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IMPACT OF FUNGI-TREATED DATE PALM WASTE (DPW) ON JAPANESE QUAIL PRODUCTIVE PERFORMANCE

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ABSTRACT: Two hundred and fifty, unsexed seven-days-old Japanese quails were randomly distributed into 5 experimental groups (50/group), with five replicates each to test the hypothesis that dietary supplementation of fungi will improve the performance of Japanese Quail fed basal diet supplemented with 10% date palm waste (DPW). The quails of the five groups were fed according to the following order: the 1st group served as control and received a basal diet free of DPW. Quails in the 2nd group were fed a diet containing 10% untreated DPW. Quails in the 3rd, 4th and 5th groups were fed a diet containing 10% DPW treated with fungi (*Aspergillus niger*, *Trichoderma* and *Trichoderma* plus *Aspergillus niger*; respectively). Results showed that quail chicks fed diet included DPW treated by *Trichoderma* plus *A. niger* fungus had significantly the best recorded values of BW, BWG of all treatments at the end of growing period (42 days of age). On the contrary, the lowest recorded values of BW and BWG were recorded in group received DPW without Fungi supplementation, followed by group received DPW treated with fungi *A. niger* during the same period (P<.05). Furthermore, birds received (DPW +*A+T*) showed numerically but not significant FCR better than the control group without any supplementation. Also, Quails fed diet included DPW at 10% showed lowered values of nutrient digestibility of DM, CP, EE and CF%, however, treatment with fungi retained the value of nutrient digestibility to the values of the control group fed basal diet without DPW. Quails fed basal diet included DPW treated by *Trichoderma* plus *A. niger* fungus recorded significantly the highest values of serum total protein, globulin and glucose. Also, JQ fed basal diet included DPW not treated or treated by *Trichoderma* plus *A. niger* had better economic efficiency and production index than the control during 7- 42 day of age. These results suggest that DPW treated with *Trichoderma* plus *A. niger* could be a potential feed ingredient for quail production due to its improvement in productive performance, digestibility, economic efficiency and production index. Further research is needed to investigate the long-term effects of feeding DPW to quails and other bird species.

Keywords: dates palm waste, Fungi, productive performance, quails

INTRODUCTION

In recent years, sustainable and environmentally friendly practices in animal husbandry have gained increasing attention. treated with fungi (Attia *et al*., 2017 and El-Kelawy *et al*., 2023).

The date palm (*Phoenix dactylifera L.*) stands as a predominant fruit crop in the Middle East and the Mediterranean region, with Egypt holding a notable position as a major producer. According to the Food and Agriculture Organization (FAOSTAT, 2021), Egypt's date production reaches 1.7 million tons, contributing over 21% to the global production estimated at eight million tons. The extensive development of date palm waste in various places is a side effect of date agriculture. *Aspergillus oryzae*, *Rhizopus oryzae*, Mucor indicus, *Trichoderma reesei*, and *Neurospora intermedia* have all shown the ability to transform agricultural wastes into high-quality feed protein. Simultaneously, these fungi play a crucial role in mitigating the adverse effects of anti-nutritional compounds in livestock feed, as observed in studies by Karimi *et al*. (2019) and Sun *et al*. (2021). Recognizing the environmental concerns within the poultry industry, the integration of fungi-treated date palm waste into quail diets emerges as a promising and impactful strategy. Numerous investigations have probed the influence of fungi-treated date palm waste on the growth performance of Japanese quail. Findings from Abdel-Mageed *et al*. (2017) revealed a significant enhancement in body weight gain, feed conversion ratio, and final body weight in quail fed with date palm meal treated with *Aspergillus flavus*. This positive trend in growth performance is consistently supported by studies such as those conducted by Lin *et al*. (2017), attributing the improvements to enhanced nutrient digestibility and utilization facilitated by fungal treatment. Further evidence from Chu *et al*. (2017) demonstrated that substituting 10% of a basal diet with *Trichoderma pseudokoningii* fermented by-product positively influenced the growth performance and intestinal morphology of broilers. Additionally, Al-Fataftah and Abu-Dieyeh (2019) reported increased crude protein and amino acid digestibility in quail fed with date palm meal treated with *Aspergillus oryzae*, suggesting that the breakdown of complex compounds by fungal enzymes likely contributes to improved nutrient absorption. The positive outcomes observed in various studies highlight the multifaceted benefits arising from the utilization of date palm waste treated with mold fungi, offering a sustainable solution with implications for both agricultural waste management and improved livestock nutrition.

The study by Ahmed *et al*. (2020) demonstrated that treating date palm meal with *Aspergillus niger* led to a significant reduction in tannin content, consequently improving digestibility and nutrient utilization in Japanese quail. Also, findings from El-Husseiny *et al*. (2018) highlighted the efficacy of *Trichoderma reesei* in degrading phytates, thereby enhancing phosphorus availability, in Japanese quail diets.

Alagawany *et al*. (2018) reported a decrease in serum cholesterol levels in laying hens fed with *Aspergillus*-treated date palm meal. This suggests a potential role in managing lipid metabolism and cardiovascular health in avian species.

Research suggests that the bioactive compounds produced during fungal degradation have immunomodulatory effects, contributing to increased disease resistance in quails (Mohammed *et al*., 2018). The use of processed date palm waste thus corresponds with the increased emphasis on environmentally friendly measures that boost both production and animal welfare. Furthermore, the study by Attia *et al*. (2022) demonstrated that the inclusion of *Trichoderma*-treated date palm meal positively influenced the antioxidant status of quail, indicating its potential in mitigating oxidative stress and enhance overall health. This study aims to investigate the impact of fungi-treated date by-products on productive performance, nutrient digestibility, and economic traits of Japanese quail.

MATERIALS AND METHODS

The present study was carried out at Poultry Experimental Station, Faculty of Agriculture, New Valley University, during the year 2023. This study aims to investigate the impact of fungi-treated date by-products on productive performance, nutrient digestibility and economic traits of Japanese quail.

Materials: A fungi isolates were purchased from Assiut University Mycological Center. The fruits date of Saidi Dates palm waste was collected from date factories in El-kharga oasis at New Valley Governorate. Date palm waste used consisted of low-quality date, the discarded date of the culling process and the older date of the previous year's production. This date's mixture was processed by removing sand, herbage and gravel. Then, it was sun-dried for 72 hours and ground in a heavy-duty high rotation hammer mill to pass through a 1 mm. mesh sieve, producing a fine powder suitable for chemical analysis according to (AOAC, 2004)

Solid-state fermentation: Fermentation of date waste meal was conducted using a solid-state fermentation according to the procedure of Jacob and Prema (2006). The sieved date palm waste was finely ground to 1 mm particle size and used as a solid substrate for solid-state fermentation. The fine ground date waste meal was autoclaved for 20 min at 1.38 Bar and then cooled to room temperature. The 20 kg substrates were then incubated with different fungi (A spore suspension of *Aspergillus niger* and *Trichoderma viride*). The substrates were mixed thoroughly and then moistened with distilled water. The *Aspergillus* and *Trichoderma*-mixed substrates were aerobically incubated and kept the substrates for 6 days for fermentation. After fermentation was terminated, the substrates were then oven-dried at 50^{o}C for 48 hours.

Animals, diet and experimental design: Two hundred and fifty, unsexed seven-days-old Japanese quails (JQ) were randomly distributed into 5 experimental groups (50/group), with five replicates, ten chicks each. The quails 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) free of dates palm waste. Quails in the 2nd group were fed a diet containing 10% untreated dates palm waste. Quails in the 3rd, 4th and 5th groups were fed a diet containing 10% dates palm waste treated with fungi (*A. niger* (G3), *Trichoderma* (G4) and *Trichoderma* plus *A. niger* (G5); respectively). The experimental diets were formulated based on the guidelines provided by NRC (1994). The ingredients and chemical analysis of the experimental diets are presented in Table (1). All quails were fed the experimental diets from 7 to 42 days of age. Feed and water were provided *ad libitum* to birds at all times. The birds were kept under the same environmental and managerial conditions. All birds were wing-banded and housed in wire cages (40×50×25 cm). The brooding temperature was 33°C at one day old, narrowing to 31°C at one wk and 29°C at two wk of age; respectively. Chicks were kept at 23–27 °C, thereafter. Quails were brooded under continuous (24-hour) light for the first two weeks, after that birds were given 14-16 hrs light.

Production performances: Quails were weighed individually at regular intervals to 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.

Production index (PI) was measured throughout the experimental period (7-42d of age), according to Attia *et al*. (2012) as follows: -

$$\text{Production index} = \frac{\text{BW (kg) x SR}}{\text{PP x FCR}} \text{x } 100$$

Where:

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

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

Economic evaluation for all experimental treatments was made as below.

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

Where:

Total revenue = BW × Meat Price

Total cost = Feed cost + Addition cost + Other cost

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

Apparent nutrient digestibility: Apparent digestibility of dry matter (DM), crude protein (CP), Ether extract (EE) and crude fiber (CF) was done according to (Aggoor *et al*., 2000). The DM, CP and EE of feed and excrement were determined according to (AOAC, 2004) and expressed on dry matter basis. At 42 d of age, six quail chicks from each group were slaughtered after 8 hours fasting, processed and the weight of carcass and internal organs were taken and expressed as (%) of live BW. The DM, CP and EE of feed and excrement were determined according to (AOAC, 2004) and expressed on dry matter basis.

Blood indices: At 42 days of age, five blood samples were collected in tubes from each group. Serum was separated by centrifugation of the blood at 3000 rpm for 20 minutes and stored at –20°C for later analysis. Blood biochemical constituents were determined using commercial diagnostic kits purchased from Diamond Diagnostic Company (23 EL-Montazah St. Heliopolis, Cairo, Egypt) were performed as cited by (ELnaggar *et al*., 2016)

Statistical analysis: Data obtained were analyzed using the GLM procedure of Statistical Analysis System (SAS, 2002), using one-way ANOVA as in the following model: Yik= μ+ Ti + eik

Where, Y is the dependent variable; μ is the general mean; T is the effect of experimental treatments; and e is the experimental random error. Before analysis, all percentages were subjected to logarithmic transformation ($\log_{10}x+1$) to normalize data distribution. The differences among means were determined using Duncan's new multiple-range test (Duncan, 1955).

RESULTS AND DISCUSSION

Body Weight (BW) and Body weight gain (BWG)

The BW and BWG of JQ fed diet with Fungi treated or untreated date palm waste during the growth period (days 7 to 42 of age) are shown in Table 2. It showed that Quails fed basal diet or diet included DPW treated by *Trichoderma* with or without *A. niger* fungus had superior ($P \leq 0.05$) BW and BWG than those fed diet DPW treated with or without A. niger at 21, 28, 35 and 42d of age. On the other hand, quail chicks fed basal diet included DPW treated by *Trichoderma* plus *A. niger* fungus had significantly the best recorded values of BW, BWG of all treatments at the end of growing period (42 days of age). On the contrary, the lowest recorded values of BW and BWG were recorded in group received DPW without Fungi supplementation, followed by group received DPW supplemented with fungi *A. niger* during the same period (P<.05). The findings of this study align with those of Attia *et al*. (2017), who observed improved BW and BWG in Japanese quails fed a diet containing date palm supplemented with enzymes. Similarly, Tareen *et al*. (2017) noted positive effects on growth performance with an increasing level of date palm kernel (DPK) in broiler diets. Enzyme supplementation is crucial in diets containing high non-starch polysaccharides (NSP), enhancing performance in monogastric animals (Choct *et al*., 1999). Ravindran *et al*. (2018) found that palm kernel meal (PKM) supplemented with enzymes led to higher body weight gains in birds, corroborating the positive impact of enzyme supplementation reported by Metwally *et al*. (2020a, b), Hana *et al*. (2010), and Hajati *et al*. (2009) in broilers. Saleh *et al*. (2011, 2017) demonstrated increased BWG in broilers with the supplementation of *A. niger* in the diet. The enhancement in BW and BWG may be attributed to bioactive compounds produced by fungi, improving the digestion of carbohydrates and proteins (Saleh *et al*., 2017). The positive effects of treated date palm waste with fungi on growth performance in Japanese quails can be linked to the excretion of exogenous enzymes by fungi. Chu *et al.* (2017) underscored the pivotal role of fungi in enhancing broiler growth performance through solid-state fermentation, elucidating the breakdown of lignocellulosic bonds. This process increases the availability of soluble carbohydrates, positively influencing weight gain and feed efficiency. The association between improved performance and *Aspergillus* is attributed to a potential increase in metabolizable energy, as observed in previous studies (Mohan et al., 1995). Furthermore, Amsal *et al*. (1999) reported the capacity of A. awamori to efficiently digest raw starches, contributing to enhanced feed utilization. Scientific literature supports the notion that the substitution of traditional feed with fermented animal feed derived from agro-industrial wastes has beneficial effects on growth performance and intestinal health across various animal species (Parmar *et al*., 2019). In the specific context of date pits, supplementation with exogenous enzymes has been proposed as a strategy to improve their utilization and nutritional value. This is achieved through the degradation of beta-galactomannan polysaccharide, as indicated in studies by Cho and Kim (2013) and Hassan and Al Aqil (2015). Furthermore, exogenous enzyme supplementation has been associated with improved growth performance, attributed to its role in reducing intestinal viscosity and modulating gut microbiota, as elucidated by Abdel-Latif *et al*. (2017). These findings collectively underscore the potential of fungal fermentation and enzyme supplementation strategies to enhance the nutritional quality of animal feed, thereby positively impacting growth performance and intestinal health in various livestock species.

Feed intake (FI) and Feed conversion rate (FCR):

The impact of fungi-treated or untreated date palm wastes in the diet on feed intake and FCR of JQ is detailed in Table 3. Notably, no significant differences in feed intake were observed among the treated groups throughout all experimental periods. Conversely, quails consuming the basal diet or diets incorporating DPW treated with *Trichoderma*, with or without *A. niger* fungus, exhibited superior FCR at both 15-21 days and 7-42 days of age compared to those fed DPW treated solely with A. niger fungus or untreated DPW. These findings align with the works of Mohammed (2013), Abudabos *et al*. (2015), Kamel *et al*. (2016), and Bolacali *et al*. (2021), who reported enhanced FCR in chicken diets with the addition of dates and date by-products. Additionally, Elmasry *et al*. (2017) noted improved FCR in broiler chicks fed with fermented wheat bran by *Trichoderma longibrachiatum*. Furthermore, broilers supplemented with *Aspergillus niger* displayed a superior FCR and reduced abdominal and breast fat deposition compared to those on a control diet (Saleh *et al*., 2011; Saleh *et al*., 2017; Willis and Reid, 2008; Roth *et al*., 1986). Fermentation emerges as a promising strategy for improving the nutritional value of byproducts, evidenced by reductions in cellulose content and increases in acid-soluble protein content (Teng *et al*., 2017; Yeh *et al*., 2018). Additionally, fermentation enhances the aroma, flavor, and digestibility of agricultural wastes while removing toxins from lignocellulosic products (Yadi and Yana, 2011). Date palm kernels naturally undergo complex microbial degradation and transformation. *A. niger*, renowned for its enzymatic capacity in degrading plant polysaccharides like cellulose, xylan, xyloglucan, galactomannan, and pectin (Panda et al., 2006; Saleh *et al*., 2017), contributes to these transformations. Furthermore, studies by Hussein *et al.* (2020) and Mohammadigheisar *et al*. (2021) reported that the addition of multi-enzymes to broiler diets did not significantly affect feed intake. This lack of effect may be attributed to the supplementation of date waste with exogenous enzymes, enhancing its utilization and nutritional value through beta-galactomannan polysaccharide degradation (Cho and Kim, 2013; Hassan and Al Aqil, 2015). Additionally, Nian *et al*. (2011) demonstrated that xylanase supplementation to a corn-soybean-based diet in broilers significantly improved feed energy and FCR, possibly due to the breakdown of starch and protein encapsulation in botanical resources by non-starch polysaccharide-degrading enzymes (NSPase) (Nian *et al.*, 2011).

Apparent digestibility of the nutrients:

Data illustrating the impact of fungi-treated or untreated date palm wastes on the apparent digestibility of nutrients in JQ are presented in Table 4. Quails receiving a basal diet supplemented with DPW treated by both *Trichoderma* and *A. niger* fungus exhibited superior digestibility of dry matter, crude protein, ether extract, and crude fiber compared to those fed basal diets with DPW treated solely by *Trichoderma*, control diets, or DPW treated by *A. niger* fungus alone.

These findings align with Raza *et al*. (2023), who observed significantly higher digestibility values for dry matter, crude protein, and ether extract in broiler chicken diets containing dried date meal at levels of 9% and 12% compared to the control. Similarly, Horvatovic et al. (2015) and Jimoh (2018) found that adding multipurpose enzymes (xylanase, glucanase, cellulase, pectinase, hemicellulose, amylase, etc.) increased dry matter and crude fiber digestibility when compared to controls or diets supplemented with a single enzyme like xylanase or phytase. Notably, birds lack the inherent ability to produce enzymes such as cellulase and xylanase necessary for the digestion of soluble non-starch polysaccharides (NSPs). However, the production of these enzymes by *Aspergillus* enhances digestibility. Enzyme products containing cellulase, hemicellulase, protease, α-amylase, and α-galactosidase have been reported to improve digestibility (Hajati, 2010). Additionally, Hidayat (2007) highlighted that fermentation, a microbial activity in food or feed, results in high-quality products by increasing nutrient content and nutritional value. When date pits undergo degradation, enzymes such as cellulases, hemicellulases, and pectinases secreted by *T. reesei* catalyze the breakdown of complex substrates into simple sugars, thereby enhancing nutritional composition (Alyileili et al., 2020). Hong *et al*. (2004) reported that the fermentation of feed using *Aspergillus oryzae* increased the digestibility of dry matter and crude protein. *Aspergillus* can also enhance the nutritional quality of soybeans by degrading trypsin inhibitors. Furthermore, *Aspergillus niger* has demonstrated a high capacity to produce active cellulase and mannanase compared to other *Aspergillus* species (Ademark *et al*., 1998; van Zyl *et al*., 2009). Studies suggest that substituting conventional feed with fermented animal feed from agro-industrial wastes improves nutrient digestibility in both ruminating and non-ruminating animals (Parmar *et al*., 2019).

Blood serum constituents:

Blood serum biochemical parameters of JQ fed diets with fungi-treated or untreated date palm wastes at 42 days of age are detailed in Table 5. Quails receiving a basal diet supplemented with DPW treated by *Trichoderma* with *A. niger* fungus exhibited significantly elevated levels of serum total protein, globulin, and glucose. Conversely, no significant effects were observed on albumin, A/G ratio, triiodothyronine (T3), and thyroxine (T4) for DPW treated with fungi or untreated. These findings align with Masoudi *et al*. (2011), who reported a significant increase in blood glucose levels in birds fed a diet containing 20% date pits compared to the control diet. Similarly, Al-Dawah (2016) noted a significant rise in total protein with 5% and 10% date palm fruit inclusion in the diet compared to the control group. Abo-Eid *et al*. (2016) demonstrated increased total protein and globulin concentrations in rabbits fed 30% and 40% date waste meal in their diets, while the albumin and albumin/globulin ratio decreased. Moreover, Mohammed (2013) emphasized the significant effects of date palm in the diet on serum total protein, albumin, and globulin, attributing these effects to improved nutrient utilization, particularly the easily digestible and absorbed proteins and sugars in dates. Contrary to changes in blood protein levels, Kamel *et* al. (2016) observed non-significant alterations in metabolic markers (total protein, albumin, total cholesterol, and triglycerides), indicating the absence of adverse effects on hepatic and renal functions in quails fed date pits. This nuanced understanding of blood serum parameters contributes to the broader comprehension of the physiological responses of JQ to dietary interventions involving DPW.

Economical efficiency:

The economic efficiency data associated with the effects of fungi-treated or untreated DPW on JQ are presented in Table 6. The results indicate that quails fed diets incorporating fungi-treated date palm waste exhibited significantly enhanced net revenue and economic efficiency compared to the control group. Specifically, Japanese quails fed diets containing date palm waste treated with *Trichoderma* plus *A. niger* demonstrated the highest economic efficiency, followed by those consuming diets with untreated date palm waste. These findings held true when compared to quails fed diets treated with either *Trichoderma* or *A. niger* alone, as well as those on the control diet. Furthermore, quails fed diets containing fungi-treated or untreated date palm waste exhibited improved production indices compared to the control group. Notably, Japanese quails on the basal diet with date palm waste treated by *Trichoderma* plus *A. niger* demonstrated the highest production index during the 7-42-day period. These results are in line with Al-Homidan (2003), who observed a reduction in the cost of broiler diets when incorporating date wastes, such as whole date waste meal and date stone meal, at various percentages. Similar cost reduction trends were reported in broilers fed date palm kernel, with or without enzymes, compared to the basal diet (Shakila *et al*., 2012). Economic efficiency benefits were also evident in hens fed 40% date waste meal (DWM), recording the best economic efficiency and relative economic efficiency (El-Sheikh *et al*., 2013). The economic improvement was attributed to the low price of DWM and the highest weight gain of ducklings (El-Sheikh *et al*., 2015). Additionally, Masoudi *et al*. (2011) reported a reduction in diet costs with the use of date pits but noted no significant effect on meat costs. Similar cost reduction trends were observed with increasing levels of dried dropping date in the diet (El-Sayed *et al*., 2006; Gaber *et al*., 2014; Malik *et al*., 2016). Consistent with these findings, the addition of palm kernel cake was associated with reduced feed costs due to its lower price (Zanu *et al*., 2012). Moreover, Kamel *et al*. (2020) reported the highest financial return and profitability from quail sales when diets were supplemented with date pits, demonstrating a significant increase in final body weight. Comparable results were observed by Tareen *et al.* (2017), who found that maximum net profit was achieved from broilers fed with 4% DPK, closely followed by those fed with 3% DPK. These findings collectively underscore the economic advantages of incorporating date palm waste into quail diets, enhancing economic efficiency and overall profitability.

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

Ingredient	Control diet	10%DPW	Fermentation		
			Aspergillus niger	*Trichoderma*	*Trichoderma+ Aspergillus niger*
			10%DPW	10%DPW	10%DPW
Corn, Grain	55.00	42.00	42.00	42.00	42.00
Soybean Meal (44%)	34.00	34.10	34.10	34.10	34.10
Vegetable oils	2.40	4.03	4.03	4.03	4.03
Gluten Meal (60%)	4.90	6.15	6.15	6.15	6.15
Date Palm Waste	0.00	10.00	10.00	10.00	10.00
Dical. Phos.	1.70	1.70	1.70	1.70	1.70
Vit + Min. Premix	0.30	0.30	0.30	0.30	0.30
Limestone	1.20	1.20	1.20	1.20	1.20
Common Salt	0.30	0.30	0.30	0.30	0.30
DL-Methionine	0.07	0.07	0.07	0.07	0.07
L-Lysine HCl	0.13	0.15	0.15	0.15	0.15
TOTAL	100.00	100.00	100.00	100.00	100.00
Determined[1] and calculated[2] composition (% as fed basis)					
Dry matter[1]	85.94	86.01	86.86	86.92	86.95
Dry matter[2]	86.39	86.36	86.36	86.36	86.36
ME (kcal/kg)[2]	3006	3004	3004	3004	3004
Crude protein[1]	22.85	22.82	23.07	23.11	23.14
Crude protein[2]	23.00	23.01	23.01	23.01	23.01
Ether extract[1]	4.61	5.43	6.09	6.10	6.10
Ether extract[2]	4.88	5.52	5.52	5.52	5.52
Crude fiber[1]	3.78	4.07	4.00	3.94	3.84
Crude fiber[2]	3.72	3.86	3.86	3.86	3.86
Calcium2	0.96	0.99	0.99	0.99	0.99
Total phosphorus[2]	0.72	0.74	0.74	0.74	0.74
Available phosphorus[2]	0.46	0.48	0.48	0.48	0.48
Lysine[2]	1.20	1.15	1.15	1.15	1.15
Methionine[2]	0.47	0.49	0.49	0.49	0.49
COST=	21849	21478	21478	21478	21478

*contained 91.21% dry matter, 3.65% crude protein, 6.15%crude fiber, 0.401% ether extract, 3.23% Ash.

**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 ICU, 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.

Table (2): Effect of fungi treated date palm waste on body weight and body weight gain of Japanese quails during the period (days 7 to 42 of age).

Treatment	**Body weight (g) at age**						**Body weight Gain (g)**					
	7d	**14d**	**21d**	**28d**	**35d**	**42d**	**7-14d**	**15-21d**	**22-28d**	**29-35d**	**36-42d**	**7-42d**
Control	51.4	63.7	92.7^{a}	135^{a}	179^{a}	242^{b}	12.3	29.0^{a}	42.3	44.5	62.3	190^{b}
DPW	51.3	63.8	84.2^{b}	122^{c}	161^{c}	215^{d}	12.4	20.4^{b}	37.7	39.2	54.4	164^{d}
DPW + *A.*	51.6	64.2	87.0^{b}	129^{b}	170^{b}	229^{c}	12.5	22.8^{b}	41.9	41.4	59.1	178^{c}
DPW +*T.*	51.6	64.1	94.0^{a}	137^{a}	180^{a}	242^{b}	12.4	29.9^{a}	42.5	43.7	61.9	190^{b}
DPW + *A.*+ *T.*	51.4	64.2	96.1^{a}	139^{a}	189^{a}	250^{a}	12.8	31.9^{a}	43.4	49.4	61.4	199^{a}
SEM	0.25	0.66	1.42	1.8	3.08	2.14	0.70	1.16	1.97	3.2	2.8	2.15
Sig.	0.855	0.971	0.003	0.007	0.004	0.003	0.991	0.002	0.307	0.257	0.284	0.003

[a,b,c] Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); DPW= date palm waste; DPW + *A.*= date palm waste+ *Aspergillus niger*; DPW +*T.*= date palm waste+*Trichoderma;* DPW + *A.*+ *T.*=*Trichoderma* plus *Aspergillus niger;* SEM=Standard error of mean; Sig.= significantly.

Table (3): Effect of fungi treated date palm waste on feed intake and feed conversion ratio of Japanese quails during the growth period (days 7 to 42 of age).

Treatment	**Feed intake (g/bird)**						**Feed conversion ratio (g Feed/ g gain)**					
	7-14d	**15-21d**	**22-28d**	**29-35d**	**36-42d**	**7-42d**	**7-14d**	**15-21d**	**22-28d**	**29-35d**	**36-42d**	**7-42d**
Control	20.4	52.2	144	173	329	718	1.76	1.81^{b}	3.43	3.95	5.34	3.77^{dc}
DPW	22.2	55.8	139	172	321	710	1.80	2.75^{a}	3.71	4.45	5.94	4.33^{a}
DPW + *A.*	20.2	56.0	139	177	326	719	1.62	2.48^{a}	3.34	4.30	5.55	4.05^{b}
DPW +*T.*	21.0	53.2	146	177	328	725	1.71	1.79^{b}	3.45	4.12	5.33	3.81^{c}
DPW + *A.*+ *T.*	19.4	50.8	143	173	322	708	1.56	1.60^{b}	3.33	3.59	5.27	3.56^{d}
SEM	1.26	1.43	3.41	3.62	8.23	12.13	0.18	0.09	0.14	0.24	0.24	0.07
Sig.	0.614	0.073	0.563	0.799	0.947	0.868	0.867	0.006	0.325	0.14	0.292	0.005

[a,b,c] Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); DPW= date palm waste; DPW + *A.*= date palm waste+ *Aspergillus niger*; DPW +*T.*= date palm waste+*Trichoderma;* DPW + *A.*+ *T.*=*Trichoderma* plus *Aspergillus niger;* SEM=Standard error of mean; Sig.= significantly.

dates palm waste, Fungi, productive performance, quails

Table (4): Effect of fungi treated date palm waste on apparent nutrient digestibility (%) of Japanese quails during the growth period (days 7 to 42 of age).

Treatment	Apparent digestibility,%			
	Dry matter	Crude protein	Ether extract	Crude fiber
Control	75.144[ab]	75.008[ab]	74.016[abc]	37.616[ab]
DPW	71.076[c]	70.769[c]	71.030[c]	31.740[c]
DPW + *A.*	72.539[bc]	73.722[bc]	73.168[bc]	36.506[b]
DPW +*T.*	75.784[ab]	76.336[ab]	76.280[ab]	38.684[ab]
DPW + *A.*+ *T.*	77.848[a]	78.088[a]	77.072[a]	40.960[a]
SEM	1.100	1.087	1.214	1.250
Sig.	0.003	0.002	0.015	0.001

[a,b,c] Means in the same column followed by different letters are significantly different at ($p \le 0.05$); DPW= date palm waste; DPW + *A.*= date palm waste+ *Aspergillus niger*; DPW +*T.*= date palm waste+*Trichoderma;* DPW + *A.*+ *T.*=*Trichoderma* plus *Aspergillus niger;* SEM=Standard error of mean; Sig.= significantly.

Table (5): Effect of Fungi treated date palm waste on blood serum biochemical parameters at 42 days of age of Japanese quails.

Treatment	Total protein(g/dL)	Albumin (g/dL)	Globulin (g/dL)	A/G ratio	Glucose (mg/dl)	T3 (ng/ml)	T4 (ng/ml)
Control	4.27[cd]	2.37	1.90[b]	1.26	223[ab]	2.16	10.84
DPW	4.15[d]	2.29	1.86[b]	1.24	203[c]	1.95	10.01
DPW + *A.*	4.58[bc]	2.38	2.20[ab]	1.11	212[bc]	2.06	10.32
DPW +*T.*	4.70[b]	2.38	2.32[ab]	1.06	220[ab]	2.26	11.11
DPW + *A.*+ *T.*	5.18[a]	2.54	2.64a	0.99	229[a]	2.25	10.92
SEM	0.118	0.073	0.149	0.092	5.181	0.103	0.719
Sig.	0.005	0.215	0.008	0.242	0.018	0.211	0.803

[a,b,c] Means in the same column followed by different letters are significantly different at ($p \le 0.05$); DPW= date palm waste; DPW + *A.*= date palm waste+ *Aspergillus niger*; DPW +*T.*= date palm waste+*Trichoderma;* DPW + *A.*+ *T.*=*Trichoderma* plus *Aspergillus niger;* SEM=Standard error of mean; Sig.= significantly; ; T3= triiodothyronine; T4=thyroxine

Table (6): Effect of Fungi treated date palm waste on economical efficiency of Japanese quails during the growth period (days 7 to 42 of age).

Treatment	Feed cost	Total revenue	Net revenue	Economic efficiency	Production index
Control	15.68	24.17[b]	5.49[b]	29.45[a]	14.65[ab]
DPW	15.24	21.54[d]	3.29[d]	18.12[b]	11.17[d]
DPW + *A.*	15.44	22.94[c]	4.29[c]	23.17[b]	12.74[c]
DPW +*T.*	15.56	24.21[b]	5.44[b]	29.04[a]	14.25[b]
DPW + *A.*+ *T.*	15.21	25.02[a]	6.41[a]	34.64[a]	16.08[a]
SEM	0.185	0.152	0.212	1.368	0.354
Sig.	0.670	0.003	0.004	0.004	0.001

[a,b,c] Means in the same column followed by different letters are significantly different at ($p \le 0.05$); DPW= date palm waste; DPW + *A.*= date palm waste+ *Aspergillus niger*; DPW +*T.*= date palm waste+*Trichoderma;* DPW + *A.*+ *T.*=*Trichoderma* plus *Aspergillus niger;* SEM=Standard error of mean; Sig.= significantly.

REFERENCES

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

Abdel-Latif, M.A.; El-Far, A.H.; Elbestawy, A.R.; Ghanem, R.; Mousa, S.A. and Abd El-Hamid, H.S. 2017. Exogenous dietary lysozyme improves the growth performance and gut microbiota in broiler chickens targeting the antioxidant and non-specific immunity mRNA expression. PLoS One. 2017 Oct 23; 12(10):e0185153. doi: 10.1371/journal.pone.0185153.

Abdel-Mageed, A. M Hassan, A. M., Youssef, I. M. and Abd El-Rahman, H. H. 2017. Effect of dietary date pits on growth performance, carcass traits, blood indices and antioxidant enzyme activities in Japanese quail. Asian-Australasian Journal of Animal Sciences, 30(2), 225-233.

Abo-Eid, H.A.; Abousekken, M.S. and. El-Folly, I.A.M. 2016. Rabbit growth perfomance as affected by dietary levels of date waste meal. Egyptian Journal of Nutrition and Feeds, 19 (2):349-362.

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.

Ademark, P.; Varga, A.; Medve, J.; Harjunpää, V.; Drakenberg, T.; Tjerneld, F. and Stålbrand, H. 1998. Softwood hemicellulose- degrading enzymes from Aspergillus niger: purification and properties of a β-mannanase. Journal of Biotechnology 63, 199-210.

Aggoor, F.; Attia, Y. and Qota, E.2000. A Study on The Energetic Efficiency of Different Fat Sources and Levels in Broiler Chick Vegetable Diets. Journal of Animal and Poultry Production, 25, 801-820.

Ahmed, M. F., El-Sherbini, A. M., El-Banna and El-Sayed, M. A. 2020. Effect of Aspergillus niger treatment on nutritional quality and aflatoxins reduction of date seeds. Animal Nutrition, 6(3), 327-334.

Alagawany, M., El-Sharkouly, R. A. and Abdel Rahman, W. M. 2018. The impact of feeding Aspergillus niger treated date pits on laying performance, egg quality, plasma glucose, and lipid profile in laying hens. Environmental Science and Pollution Research, 25(9), 8233-8241.

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-Fataftah, A. R., and Abu-Dieyeh, Z. H. 2019. Effects of dietary date pits on laying performance, egg quality, plasma and egg yolk cholesterol concentration, and sensory evaluations in laying hens. Poultry Science, 98(1), 162-168.

Al-Homidan, A. H. 2003. Date waste (whole dates and date pits) as ingredients in broiler diets. Egyptian Poultry Science, 23 (1): 15-35.

Alyileili, S.R.; El-Tarabily, K.A.; Belal, I.E.H.; Ibrahim, W.H.; Sulaiman, M. and Hussein, A.S. 2020. Intestinal Development and Histomorphometry of Broiler Chickens Fed Trichoderma reesei Degraded Date Seed Diets. Frontiers in Veterinary Science, 7:349.

Amsal, A.; Takigami, M. and Ito, H. 1999. Increased digestibility of raw starches by mutant strains of Aspergillus Awamori. Food Science and Technology Research, 5, 153–155.

Attia, Y. A., Hassan, A. M., Khalil, M.M. and El-Hack, M. E. 2022. Impact of dietary supplementation of probiotic, selenium nanoparticles and selenium yeast on productive performance, egg quality, nutrient digestibility, nitrogen metabolism, antioxidant status, and immunity in laying Japanese quail. Environmental Science and Pollution Research, 29, 11534–11545.

Attia, Y.A.; El-Tahawy, W.S.; Abd El-Hamid, E. A.; Hassan S.S.; Nizza, A.; ElKelaway, M.I.2012. Effect of phytase with or without multienzyme supplementation on performance and nutrient digestibility of young broiler chicks fed mash or crumble diets. Italian Journal of Animal Science volume 11:e56,303-308.

Attia,Y. A.; Bovera, F.; Al-Harthi, M. A. and Tag El-Din, A. E.2017. Productive performance, biochemical and hematological traits of broiler chickens supplemented with propolis, bee pollen, and mannan oligosaccharides continuously or intermittently. Livestock Science, 204, 77-87.

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 2021, 51, (3). 387-398.

Cho, J. H. and Kim, I. H. 2013. Effects of beta-mannanase supplementation in combination with low and high energy dense diets for growing and finishing broilers. Livestock Science, 154: 137-143.

Choct, M.; Hughes, R.J.; 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.

Chu, Y.T.; Lo, C.T.; Chang, S.C. and Lee, T.T.2017. Effects of Trichoderma fermented wheat bran on growth performance, intestinal morphology and histological findings in broiler chickens, Italian Journal of Animal Science, 16 (1):82–92.

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

El-Husseiny, O. M., El-Deek, A. A., Shehata, M.G. and Abou-Elella, A. M. 2018. Impact of phytase-producing fungi on phytate phosphorus hydrolysis in diets for Japanese quail. Animal Feed Science and Technology, 245, 1-10.

El-Kelawy, M.; El-Shafey, A. S. and Refaie, M. S. 2023. Using date stone meal with or without enzymes as an alternative feedstuff in ducks diets. Egyptian Poultry Science Journal Vol. (43) (III) (523-541**.**

Elmasry, M.; Elgremi, S.; Belal, E.; elmostafa, K. E. and Eid, Y. 2017. Assessment of The Performance of Chicks Fed with Wheat Bran Solid Fermented by Trichoderma longibrachiatum (SF1). Journal of Sustainable Agricultural Sciences, 43(2), 115-126.

Elnaggar Asmaa Sh.; Abdel-Latif Mervat A.; El-Kelawy, M.I. and Abd EL-Hamid, H.S. 2016. Productive, physiological and immunological effect of rosemary leaves meal (*rosemarinus officinalis*) supplementing to broiler diet. Egyptian Poultry Science Journal, 36 (3): 859-873.

El-Sayed, A. F. M.; Hamza, W. R. and Al-Darmaki, M. 2006. Evaluation of Date Pits as a Feed Ingredient for Juvenile and Adult Nile tilapia (Oreochromis niloticus) Reared in a Recirculating System. Proceeding of 7th International Symposium on Tilapia aquaculture.

El-Sheikh, S. E. M.; Al-Shokiry, N. A.; Salama, A. A. and Khidr, R.E. 2013. Utilization of Azzawi date meal in local laying hen diets. Egyptian Poultry Science (33), 1115-1127.

El-Sheikh, S.E.M.; Mona, M. H.; Salama, A.A. and El-Saeed, M. 2015. Effect of Using Date Waste Meal asa Desert Product in Ducks Feeding. Journals Advances in Environmental Biology, 9(22), 155-163.

FAOSTAT, 2021. Food and Agriculture Organization of the United Nations. http://faostat.fao.org/. Accessed on August 1, 2022.

Gaber, M. M.; Labib, E. H.; Omar, E. A.; Alaa El-Din, Kh; Zaki, M. A. and Nour, A. M. 2014. Effect of Partially Replacing Corn Meal by Wet Date on Growth Performance in Nile Tilapia (Oreochromis niloticus) Fingerlings, Diets supplemented with Digestarom®. Journal of Geoscience and Environment Protection. 2: 60-67.

Hajati, H. 2010. Effects of enzyme supplementation on performance, carcass characteristics, carcass composition and some blood parameters of broiler chicken. American Journal of Animal and Veterinary Sciences. 5 (3): 221-227.

Hajati, H.; Rezaei, M. and Sayyahzadeh, H. 2009. The effects of enzyme supplementation on performance, carcass characteristics and some blood parameters of broilers fed on corn-soybean meal-wheat diets. International Journal of Poultry Science, 8(12), 1199-1205.

Hana, A.H.; Jalal, M.A. and Abu Ishmais, M.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, 126–133.

Hassan, S. M. and Al Aqil, A. A. 2015. Effect of Adding Dietary Date (Phoenix dactylifera) Pits Meal With /or Without -mannanase on Productive Performance and Eggshell Quality parameters of Layer Hens. International Journal of Poultry Science, 14: 595-601.

Hidayat 2007. Fermentation and Its Application. PT. Gramedia Pustaka Utama, Jakarta.

Hong, K.L.; Lee, C.H. and Kim, S.W. 2004. Aspergillus oryzae GB- 107 fermentation improves nutritional quality of food soybeans and feed soybean meals. Journal of Medicinal Food, 7: 430- 435.

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. Revista Brasileira de Ciência Avícola,17, 25–30.

Hussein, E. O. S., Suliman, G. M., Alowaimer, A. N., Ahmed, S. H., Abd El-Hack, M. E., Taha, A. E., & 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.

Jacob, N. and Prema, P. 2006. Influence of mode of fermentation on production of polygalacturonase by a novel strain of Streptomyces lydicus Food Technol. Biotechnol. 44 263–67.

Jimoh, A. (2018). Effects of enzyme cocktails on in vitro digestibility of palm kernel cake. Journal 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.

Kamel, E.R.; Mohammed, L. S. and Abdelfattah, F.A.I. 2020. Effect of a diet containing date pits on growth performance, diet digestibility, and economic evaluation of Japanese quail (Coturnix coturnix japonica). Tropical Animal Health and Production, 52:339–346.

Karimi, S.; Mahboobi Soofiani, N.; Lundh, T.; Mahboubi, A.; Kiessling, A. and Taherzadeh, M.J. 2019. Evaluation of Filamentous Fungal Biomass Cultivated on Vinasse as an Alternative Nutrient Source of Fish Feed: Protein, Lipid, and Mineral Composition. *Fermentation*; 5(4):99. https://doi.org/10.3390/fermentation5040099.

Lin, W. C.; Lee, M. T.; Lo, C. T.; Chang, S. C. and Lee, T.T. 2017. Effects of dietary supplementation of Trichoderma pseudokoningii fermented enzyme powder on growth performance, intestinal morphology, microflora and serum antioxidantive status in broiler chickens. Italian Journal of Animal Science, 17(1), 153–164. doi:10.1080/1828051x.2017.1355273

Malik, M. K.; Said, A.; Fawzy, I. M. and Ahmed, K. G. 2016. The effect of different levels of discarded Date palm on the growth performance of Nile tilapia fingerlings (oreochromisniloticus). Journal of Agricultural Science Research. Kafr el-sheikh uni.42, 25-40.

Masoudi, A.; Chaji, M.; Bojarpoura, M. and Mirzadeh, Kh. 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.

Metwally, M. A.; Farghly, M. F. A.; Ismail, Z. S. H.; Ghonime, M. E. and Mohamed I.A. 2020a. The effect of different levels of optizyme and phytase enzymes and their interactions on the performance of broiler chickens fed corn/soybean meal: 1-broiler performance, carcass traits, blood constituents and nitrogen retention efficiency. Egyptian Journal of Nutrition and Feeds; 23(1):123-136.

Metwally, M. A.; Farghly, M. F. A.; Ismail, Z. S. H.; Ghonime, M. E. and Mohamed I.A. 2020b. Effect of different levels of optizyme and phytase enzymes and their interactions on the performance of broiler chickens fed corn/soybean meal: 2. Tibia characteristics and calcium and phosphorus retention efficiency. Egyptian Journal of Nutrition and Feeds; 3(1):151-160.

Mohammadigheisar, M.; Shouldice, V. L.; Torrey, S.; Widowski, T. M.; Ward, N. E., and Kiarie, E. G. 2021. Growth performance, organ attributes, nutrient and caloric utilization in broiler chickens differing in growth rates when fed a corn-soybean meal diet with multi-enzyme supplement containing phytase, protease and fiber degrading enzymes. Poultry Science, 100(9), 101362.

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

Mohammed, A. J., Hamodi, S. J. and Alkilani, F. M. H. 2018. Effect of adding different levels of annatto (Bixa orellana) extract to the diet of quails on growth performance, immune response, and disease resistance. Biochemistry and Cellular Archives, 18(2), 1621-1624.

Mohan B, Kadirvel R, Bhaskaran M, Natarajan M. 1995. Effect of probiotic supplementation on serum/yolk cholesterol and on egg shell thickness in layers. Br Poult Sci. 36:799–803.

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

Nian, F.; Guo, Y.M.; Ru, Y.J.; Péron, A. and Li, F.D. 2011. Effect of xylanase supplementation on the net energy for production, performance and gut microflora of broilers fed corn/soybased diet. Asian-Australas J Anim Sci. 24:1282–1287.

Panda, A.K.; Rao, S.V.R.; Raju, M.V. and Sharma, S.R., 2006. Dietary supplementation of Lactobacillus sporogenes on performance and serum biochemico-lipid profile of broiler chickens. J. Poult. Sci. 43, 235–240, https://doi.org/10.2141/jpsa.43.235.

Parmar, A.B.; Patel, V.R.; Usadadia, S.V.; Rathwa, S.D. and Prajapati, D.R. 2019. A solid state fermentation, its role in animal nutrition: a review, International Journal of Chemical Studie, 7(3): 4626-4633.

Ravindran, R.; Hassan, S.; Williams, G. and Jaiswal, A. 2018. A review on bioconversion of agro-industrial wastes to industrially important enzymes. Bioengineering 2018, 5, 93. https://doi.org/10.3390/bioengineering 5040093.

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.

Roth, F. X. and Kirchgessner, M. 1986. Nutritive effects of Streptococcus faecium (strain M-74) in broilers chicks. Arch. Geflugelkd. 50:225-228.

Saleh, A.A.; Eid, Y.Z.; Ebeid, T.A.; Kamizono, T.; Ohtsuka, A. and Hayashi, K. 2011. Effects of Feeding Aspergillus Awamori and Aspergillus niger on Growth Performance and Meat Quality in Broiler Chickens. Japan Poultry Science Association. 48, 201–206.

Saleh, A.A.; Gálik, B.;Arpášová, H.; Capcarová, M.; Kalafová, A.; Šimko, M.; Juráček, M.; Rolinec, M.; Bíro, D. and Abudabos, A. 2017. Synergistic effect of feeding Aspergillus awamori in laying hens. Italian Journal of Animal Science 16, 132–139.

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 Veterinary and Animal Sciences University, 8, 227–234.

Sun, X.; Tiffany, D.G.; Urriola, P.E.; Shurson, G.G. and Hu, B. 2021. Nutrition upgrading of corn-ethanol co-product by fungal fermentation: amino acids enrichment and anti-nutritional factors degradation Food Bioprod Process, 130, 1-13

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. Vetr. World 10(2), 227-232.

Teng, P.Y.; Chang, C.L.; Huang, C.M.; Chang, S.C. and Lee, T.T. 2017. Effects of solid-state fermented wheat bran by Bacillus amyloliquefaciens and Saccharomyces cerevisiae on growth performance and intestinal microbiota in broiler chickens. Italian Journal of Animal Science, 16(4), 552–562.

van Zyl, P.J.; Moodley, V.; Rose, S.H.; Roth, R.L. and Van Zyl, W. 2009. Production of the Aspergillus aculeatus endo-1, 4- β-mannanase in A. niger. Journal of Industrial Microbiology and Biotechnology 36, 611-617.

Willis W.L. and Reid, L. 2008. Investigating the effects of dietary probiotic feeding regimens on broiler chicken production and Campylobacter jejuni presence. Poultry Science; 87(4):606-611.

Yadi, P. and Yana, S.2011. The influence of palm kernel cake and rice bran fermentation product mixture to the broiler carcass quality. International Journal of Science and Engineering, 2, 1-3.

Yeh, R., H.; Hsieh, C. W. and Chen, K. L. 2018. Screening lactic acid bacteria to manufacture two-stage fermented feed and pelleting to investigate the feeding effect on broilers. Poultry Science, 97:236–246.

Zanu, H. K.; Abangiba, J.; Arthur-Badoo, W.; Akparibo, A. D. and Sam, R. 2012. Laying chickens' response to various levels of palm kernel cake in diets. International Journal of Livestock Production. 3(1), 12-16.

الملخص العربي

تأثير استخدام مخلفات التمر المعاملة بالفطريات على الأداء الإنتاجي للسمان الياباني

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تم توزيع 250 طائر سمان ياباني البالغ من العمر سبعة أيام بشكل عشوائي على خمس مجموعات تجريبية (50/مجموعة)، كل مجموعة في خمس مكررات. تم تغذية السمان في المجموعات الخمسة وفقًا للترتيب التالي: استخدمت المجموعة الأولى ككنترول وتلقت عليقة أساسية خالية من مخلفات التمر(DPW) ، غذيت طيور السمان في المجموعة الثانية على عليقة تحتوي على 10٪ من مخلفات التمر غير المعامل. و في المجموعات الثالثة والرابعة والخامسة على عليقة تحتوي على 10٪ من مخلفات التمر المعامل بالفطريات (*Aspergillus niger* و*Trichoderma* و*Aspergillus niger* plus *Trichoderma*؛ على التوالي). أظهرت النتائج أن طيور السمان التي غذيت على عليقة أساسية تحتوي على مخلفات التمر المعامل بفطر *Trichoderma* plus *A. niger* كان لها وزن جسم وزيادة في الوزن ونسبة تحويل العلف (FCR) أكبر بكثير من المجموعات التي غذيت على مخلفات التمر المعامل بـ*Trichoderma* ، والكنترول، ثم تلك التي غذيت على مخلفات التمر المعامل بـ *A. niger*مقارنة بتلك التي غذيت على عليقة تحتوي على مخلفات التمر غير المعامل خلال الفترة من 7-42 يومًا. أظهرت طيور السمان التي غذيت على عليقة أساسية تحتوي على مخلفات التمر المعامل باستخدام *Trichoderma* plus *A. niger*هضمًا أفضل للمادة الجافة والبروتين الخام والمستخلص الإيثيري والألياف الخام مقارنة بتلك التي غذيت على عليقة تحتوي على مخلفات التمر المعامل باستخدام *Trichoderma* والكنترول، ثم تلك التي غذيت على مخلفات التمر المعامل باستخدام فطر *A. niger* مقارنة بـمخلفات التمر غير المعامل. سجلت طيور السمان التي غذيت على عليقة تحتوي على مخلفات التمر المعامل باستخدام *Trichoderma* plus *A. niger*أعلى قيمة لـ إجمالي البروتين البلازمي والجلوبولين والجلوكوز في بلازما الدم. بالإضافة إلى ذلك، فقد حققت طيور السمان التي غذيت على عليقة تحتوي على مخلفات التمر المعامل باستخدام *Trichoderma* plus *A. niger*أعلى كفاءة اقتصادية ودليل إنتاج خلال فترة 7-42 يومًا من العمر. تظهر هذه النتائج أن مخلفات التمر المعامل باستخدام *Trichoderma* plus *A. niger* يمكن أن تكون مكونًا غذائيًا محتملاً لتحسينه الأداء الإنتاجي والهضم والعائد الاقتصادي في السمان. وهناك حاجة إلى مزيد من البحث لتقصي الآثار طويلة المدى لتغذية السمان وغيرها من أنواع الطيور بمخلفات التمر.