*Cibtech Journal of Zoology ISSN: 2319–3883 (Online)*
*An Open Access, Online International Journal Available at http://www.cibtech.org/cjz.htm*
*2014 Vol. 3 (3) September-December, pp.124-130/Karimi et al.*
***Research Article***

# THE EFFECT OF DRIED POTATO POWDER WITH ENZYME SUPPLEMENTATION ON PERFORMANCE OF JAPANESE QUAIL (COTURNIX JAPONICA)

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**ABSTARCT**
This study was to investigate the effects of feeding dried potato powder with or without glucanases enzyme on performance of Japanese quail. A total of 192 fifteen days old quail chicks with an average weight of 40±50g were divided into 8 treatments with 3 replicates as experimental factorial design. The treatments were divided as basal diet with no enzyme and potato powder kept as control and for others 15 % potato with (0.5g/kg) or without glucanases enzyme, 30 % potato with (0.5g/kg) or without glucanases enzyme, 15 % potato with (0.5g/kg) or without glucanases enzyme were used respectively. The live body weight gains and feed consumption of birds were measured individually feed conversion efficiency were calculated weekly. At the end of the trial for investigating the effect of using tomato powder supplementation on performance of quails, 2 birds form each replicates were slaughtered and some blood samples were taken for blood parameters determination. Data showed that using of potato powder had decreased feed intake ($p<0.05$) compared to control so that quails with increasing consumption rates of potato had the lowest feed intake. Also data showed that with using glucanases they had lesser feed intake totally. These data showed that the highest body weight gain was for control group. Although quails were fed by potato had lesser body weight gain but also quails were fed by glucanases enzyme lead to better body weight gain none significantly. Observation of this study indicated that using cumulative levels of potato with glucanases enzyme didn't significant changes on feed conversion ratio. As result was relevant from this study there were no significant differences between treatments about some carcass organs. Also using potato and glucanases lead to decrease breast meat weight. There were no significant effects about wings, drumstick, intestinal and gizzard weights between treatments. In conclusion potato powder with or without glucanases enzyme may be used as ingredient instead of corn in quail's diet without harmful effect on performance of them.

***Keywords:*** *Dried Potato Powder, Glucanases Enzyme, Performance, Carcass Traits, Japanese Quail*

## INTRODUCTION

Energy feed sources (Maize and Soybean meal) are expensive feedstuff, constituting about 50-55% of the formulated poultry diets, Maize as a major component of feed is expensive, the productivity is low which means it does not meet its demand (Agbede *et al.,* 2002). Limitation imposed by scarcity of maize and completion with human consumption have forced many farmers into employing alternative sources of energy for poultry feed formulation, such alternatives include feeding of farm by products (maize straw, potatoes, etc.) and effort had also been geared towards the utilization of relatively cheaper and available roots and tubers in recent years. There is some cheaper feed stuff such as potatoes that they can used as good source of energy and protein in poultry diets. Cooked potatoes are used as a feed for chickens in Europe, often as the principal carbohydrate source in the ration. There has been little work reported in which potatoes have been fed to turkeys. Potato is also a very valuable feed for all classes of livestock (Woolfe, 1992). Sweet potato can be used in poultry diets as a substitute for cereals, usually as dried meal. The lower protein and energy contents of sweet potato compared to cereals have consequences on feed formulation and particularly on the need of appropriate protein supplementation (Woolfe, 1992). This can explain some of the variability observed in experimental results. At higher inclusion levels, the powder texture of ground sweet potato can cause a decrease in feed intake (Ravindran *et al.,* 1996). Potato

tubers are mainly an energy source due to their high carbohydrate content, which accounts for 80-90 % of the dry weight.
These carbohydrates consist of starch, sugars and small amounts of pectins, hemicelluloses and cellulose (Lebot, 2009).

Starch is the main carbohydrate and is very resistant to amylase hydrolysis. Cooking increases the easily hydrolysable starch fraction of sweet potato from 4 % to 55 % (Dominguez, 1992). Raw potato tubers contain medium levels of trypsin inhibitors (Bradbury *et al.*, 1992) that are still sufficient to decrease protein digestibility in diets (Dominguez, 1992). Also raw potatoes contain oxalate up to 1.2g/kg DM (Ravindran *et al.*, 1995).

In recent years there has been a concerted effort to improve the nutritive worth of feedstuffs by using exogenous enzymes. On the basis of many reports it may be concluded that the nutritional values of feed stuffs can be improved by the addition of appropriate preparations of phytase, carbohydrates, glucanases and other enzyme activities.

It is our understanding, that an increase in the productive value with enzyme supplementation can be achieved by elimination of the nutrient encapsulating effect of the cell walls and therefore improved energy and amino acid availability, solubilization of cell wall, non-starch polysaccharides for more effective hindgut fermentation and improved overall energy utilization, hydrolysis of certain types of carbohydrate-protein linkages and therefore improved availability of amino acids, and elimination of the anti-nutritive properties of certain dietary components, by their enzymatic hydrolysis to the prebiotic type components which, in turn, may facilitate gut development and health in young chickens. Glucanases cannot be synthesized by the birds and it digests high molecular weight â-glucanas in grain and cereal based feeds.

Research on influence of exogenous enzymes on the performance of turkey and quail appears to be scanty. Therefore, the objective of this study is to find out the effect of using potato and glucanas supplementation on performance and some carcass traits of Japanese quails.

## MATERIALS AND METHODS

This experiment was carried out at the Aviculture farm of Shahrekord, Iran. A total of 180 fifteen day old quail chicks with an average weight of 40±50g were divided into 8 treatments and were further subdivided into 3 replicates with 12 birds on each. Potatoes were purchased from local market then they were boiled and dried with sun light and also glucanases enzyme was purchased from veterinary drug store.

Corn, soybean meal and barely samples were analyzed in the lab for determine amount of crude protein, calcium and its phosphorus with Association of Official Analytical Chemists (AOAC, 2000) methods. The basal diet was balanced on the basis of corn, soybean meal and barely as recommended by National Research council (NRC, 1994).

The treatments were divided as basal diet with no glucanases enzyme and potato kept as control and for others 15 % potato with (0.5g/kg) or without glucanases enzyme (T1), 30 % potato with (0.5g/kg) or without glucanases enzyme, 15 % potato with (0.5g/kg) or without glucanases enzyme were used respectively. Diets and fresh water were provided adlibitum during this experiment.

The live body weight gains and feed consumption of quails were measured individually, feed conversion efficiency were calculated weekly.

At the end of experimental period, 2 birds form each replicates were slaughtered for determination of other parameters.

Also dressing percentage was calculated free from giblets and some organs were weighed separately as percentage of carcass weight.

**Table 2: Composition of the experimental diets for quails**

| Ingredients % | Control | 15 % Potato T1 | 30 % Potato T2 | 45 % Potato T3 |
|---|---|---|---|---|
| Corn | 45.4 | 29 | 17 | 2.20 |
| Soybean meal | 33.65 | 38 | 31.26 | 33 |
| Oil | 1.95 | 2.50 | 1.85 | 1.80 |
| Fish meal | 6.7 | 3.4 | 7.6 | 5.9 |
| DCP | 0.10 | 0.23 | 0.05 | 0.10 |
| Calcium carbonate | 0.86 | 1.12 | 0.60 | 0.70 |
| Barely | 10 | 10 | 10 | 10 |
| Nacl | 0.20 | 0.20 | 0.20 | 0.20 |
| Vitamin Premix* | 0.25 | 0.25 | 0.25 | 0.25 |
| Mineral Premix* | 0.25 | 0.25 | 0.25 | 0.25 |
| Potato powder | 0 | 15 | 30 | 45 |
| Glucanases enzyme | 0 / 0.5 | 0 / 0.5 | 0 / 0.5 | 0 / 0.5 |
| Pebbles | 0.55 | 0 | 0.89 | 0.55 |
| **Calculated nutrient content** | | | | |
| ME (Kcal/Kg) | 2900 | 2900 | 2900 | 2900 |
| CP (%) | 24.06 | 24.01 | 24.04 | 24.00 |
| Ca (%) | 0.84 | 0.81 | 0.81 | 0.82 |
| Available Phosphorus (%) | 0.55 | 0.51 | 0.52 | 0.45 |
| Lysine (%) | 1.23 | 1.29 | 1.30 | 1.22 |
| Methionine (%) | 0.30 | 0.37 | 0.38 | 0.33 |
| Methionine+ Cystine (%) | 0.62 | 0.71 | 0.68 | 0.60 |

*Control with no tomato pulp powder, and 2 kg/100 kg (T1), 4kg/100 kg (T2) and 6 kg/100 kg (T3) and 8 kg/100 kg (T4) of tomato pulp powder were used respectively. *Supplied Per Kilogram Of Feed: 9000 IU of vitamin A, 20000IU vitamin D3, 18000IU vitamin E, 2000IU vitamin K3, 3000IU Vitamin B3, 3000IU Vitamin B5, 1000IU Vitamin B9, 3000IU Vitamin B6. 200Mg Se,8000 Mg Fe,100000 Mg Mn,100µg Se,100000Mg Zn, 10000 Mg Cu.*

***Data Analysis***

The statically model was : $Yijk = \mu + \acute{\alpha} i + ßj + (\acute{\alpha} + ß)ij + eijk$

Where : Yijk = average effect observed, µ = total average, άi= effect of coneflower, ßj = effect of protexin, (ά +ß) ij = interactions (coneflower × protexin), eijk = effect of errors.

At last the GLM procedure of SAS software (SAS, 2001) was used for data analysis of variance as completely randomized design. In addition the significant difference among the mean were calculated by Duncan's multiple range tests (Duncan, 1995).

## RESULTS AND DISCUSSION

***Result***

Data showed that use of potato and glucanases had decreased feed intake (FI) significantly ($p<0.05$) in comparison to control (Table 2). We found that body weight BW (kg) was higher none significantly when the birds fed by potato and glucanases compared to control. Although feed conversion ratio (FCR) were lesser in control but also that was higher with using potato and enzyme. Data showed that using cumulative levels of potato and glucanases hadn't significant changes on FCR.

**Table 2: The effects of coneflower and protexin on performance of Japanese quails**

| **Treatments*** **(Potato)** | **FI (Kg)**** | **BW(Kg)** | **FCR (kg/kg)** |
|---|---|---|---|
| Control | 17.25[a***] | 6.29[a] | 2.76 |
| P (1) | 17.26[a] | 5.68[b] | 3.03 |
| P (2) | 17.11[a] | 5.88[ab] | 2.90 |
| P (3) | 14.77[b] | 5.15[c] | 2.95 |
| P Value | 0.002 | 0.005 | 0.797 |
| **(Glucanases)** | | | |
| G (0) | 16.91 | 5.86 | 2.92 |
| G (1) | 16.27 | 5.65 | 2.90 |
| P Value | 0.17 | 0.56 | 0.91 |
| SEM | 0.58 | 0.225 | 0.152 |

**Potato 15% diet P (1), Potato 30% diet P (2),), Potato 45% diet P (3), Glucanases 0g/kg diet G (0), Glucanases 50g/kg diet G (1). **Feed intake (FI), body weight (BW), feed coefficient (FCR)*
****Means within row with no common on letter are significantly different (p<0.05).*

According to Table 3, the carcass percentage had increased by using potato and glucanases enzyme. The breast weights were changed no significantly by using experimental diets. Drumstick weights also were tended to increase by using potato and glucanases enzyme and they were at the lowest on control and at the highest on G (1). As result was relevant from Table 3 there were no significant differences between treatments about intestine, liver and wings weight.

**Table 3: The effects of coneflower and protexin on some carcass characteristics**

| **Treatments*** **(Potato)** | **Carcass (%)** | **Breast (g)** | **Drumstick (g)** | **Wings (g)** | **Liver (g)** | **Intestine (g)** |
|---|---|---|---|---|---|---|
| Control | 65.81 | 32.90 | 19.02 | 5.59 | 4.13 | 6.29 |
| P (1) | 69.39 | 33.87 | 19.62 | 5.62 | 3.33 | 6.66 |
| P (2) | 66.28 | 33.09 | 19.32 | 5.80 | 3.99 | 6.33 |
| P (3) | 67.69 | 32.85 | 19.73 | 5.79 | 4.49 | 7.35 |
| P Value | 0.993 | 0.385 | 0.89 | 0.479 | 0.291 | 0.620 |
| **(Glucanases)** | | | | | | |
| G (0) | 67.06 | 33.76[a] | 19.23 | 5.61 | 3.50 | 6.64 |
| G (1) | 67.35 | 32.55[b] | 19.64 | 5.80 | 4.02 | 6.72 |
| P Value | 0.98 | 0.73 | 0.90 | 0.18 | 0.75 | 1.00 |
| SEM | 4.38 | 0.797 | 0.620 | 0.314 | 0.431 | 0.498 |

**Potato 15% diet P (1), Potato 30% diet P (2),), Potato 45% diet P (3), Glucanases 0g/kg diet G (0), Glucanases 50g/kg diet G (1). **Feed intake (FI), body weight (BW), feed coefficient (FCR).*
****Means within row with no common on letter are significantly different (p<0.05).*

***Discussion***

In the present study, potato and glucanases enzyme supplementation had some significant effects (P<0.05) on the measured values in growing Japanese quails. The usage of the potato and glucanases weren't significant influences on body weight gains in Japanese quails.

Asmara *et al.*, (2007) use of sweet potato leaves meal up to 5% had similar live weight, carcass weight and pigmentation of carcass skin to those of control. Thyagarajan *et al.*, (2010) showed that the influence of glucanase inclusion in feed was highly significant (P=0.01) on eighth week performance of turkeys. Onyekwere *et al.*, (2008) studied that sweet potato root meal, improved its value to the extent that 20%

dietary inclusion of the meal produce no adverse effect on broiler starter. Agwunobi (1999) showed that the use of potato lead to reduce in body weight and feed conversion efficiency in broilers. Also he considered that the optimum levels of inclusion of sweet potato in the diets were to be 27% and 30% for starting and finishing broiler chickens, respectively. The carbohydrate of sweet potato is highly digestible and soluble. It is low in fiber and consists predominantly of starch between 4-7% which occurs as sugar. Also, high reducing sugar in sweet potato tuber and flour causes diarrhea at high levels. Thus limiting inclusion rate in livestock rations. The use of no-sweet clone is therefore recommended (Tewe *et al.*, 2001). Exogenous enzymes are added to poultry diets to manipulate conditions in the digestive tract and improve the nutrient value of feed stuffs (Classen, 1996; Meng *et al.*, 2005). Khattak *et al.*, (2006) suggested that benefits of using feed enzymes to poultry diets include reduction in digesta viscosity, enhanced digestion and absorption of nutrients especially fat and protein, increased feed intake, weight gain, and feed gain ratio, decreased size of gastrointestinal tract. This result is in accordance with the report that the body weight gain of broilers, fed diets containing different combinations of carbohydrates with glucanases, was greater (P=0.05) with improved (P=0.05) ileal digestibilities of starch and protein than that of birds fed control diet (Meng *et al.*, 2005). Ribeiro *et al.*, (2010) suggest that levels of endogenous β-glucanases may affect the efficacy of exogenous enzymes used to improve the nutritive value of barley-based diets for broilers. The development of a quick β-glucanase assay that could be applied for cereal-based feeds may help identify those barley-based diets that are more responsive to the action of feed enzymes. High values for starch digestibility (97.4%) have been recorded for older animals (Szylit *et al.*, 1978) and it was found that the low digestibility of raw sweet potato starch in young birds (74%) increases with animal age (Yoshida *et al.*, 1962).

The lower energy value of sweet potato compared to maize in young animals has been noted by several authors (Panigrahi *et al.*, 1996, Yoshida *et al.*, 1962). It is well known that diets presenting high levels of soluble NSP induce considerable enlargement of some portions of the gastro intestinal tract (Brenes *et al.*, 1993) and stimulate an increase in protein turnover rates (Danicke *et al.*, 2000). Enzyme supplementation decreases digesta viscosity and therefore improves the feed passage rate and nutrient absorption. In addition, the relative weight of the digestive tract decreases, leading to an increase in carcass yield (Petterson and Aman, 1989). Ahaotu *et al.*, (2011) showed that use 25% of sweet potato had significantly ($p<0.05$) improved body weight, shank length, wing length, body height, body length, thigh length, leg length, daily feed intake, heart weight and crop weight. Ravindran and Sivakanesan (1996) showed that sweet potato meal can replace up to 400 g/kg maize in broiler diets without adverse effects in performance. The depression in weight gains observed in birds fed on a diet containing 600 g sweet potato meal/kg was related largely to lowered food intake arising from the powdery texture of sweet potato meal.

Agwunobi (1999) showed that the carcass quality was significantly improved and the birds on the sweet potato diet continually passed wet droppings, resulting in a significant ($p < 0.05$). Mmereole (2009) investigated that the birds fed with diets containing 20% enzyme treated sweet potato leaf meals proved superior in all parameters evaluated. That study recommended that body weight gains as well as other growth traits such as feed intake and feed efficiency ratio were all improved by enzyme treatment of the sweet potato leave meals diets even at 20% inclusion level.

***Conclusion***

It can be concluded that the supplementation of quail diets with the potatoes hadn't significant beneficial effect on growth performance. Also the use of potato and glucanases enzyme in quail rations during the period from 15 to end may manipulate weight gain and feed conversion ratio. As mentioned above it has become clear that there is a quite bite of benefits potato and glucanases enzyme as source of a valuable nutritional resource to be used for quails. Furthermore feature studies are needed for more explanations.

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