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# Nutritional Evaluation of Potato Meal with Enzyme Supplementation on Growth Performance of Broiler Chicken

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## ABSTRACT

This study was conducted for nutritional evaluation of potato meal with and without enzyme supplementation in broilers. For the growth study, 240 chicks were distributed into 6 treatments having 40 birds per treatment (4 replicates x 10 chicks in each replicate). T1 –control diet, T2- control with cocktail of enzyme @100g/q feed, T3 - 25% crude protein of maize was replaced with potato meal without enzymes supplementation diet, T4 - T3 + cocktail of enzymes @100g/q feed, T5- 50% crude protein of maize was replaced with potato meal without enzymes supplementation and T6 - T5 + cocktail of enzyme @100g/q feed. Control diets fed chicks had better body weight gain and FCR as compared to 25% and 50% supplementation and better digestibility parameters, however, dressing percentage reduced at higher level of supplementation whereas blood parameters remained within the permissible limit. Enzymes supplementation had a positive effect on the growth parameters and digestibility of nutrients irrespective of level. It was concluded that from economic point of view potato meal can be incorporated during glut period up to 25% of maize protein in the diet of broiler chicken.

**KEYWORDS:** Digestibility. Enzymes, Potato meal

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## INTRODUCTION

Broiler industry is growing at a rapid rate in India. Meeting the nutritional requirements of increasing broiler production is a difficult task. This is primarily due to shortage and high cost of feed ingredients like maize which accounts for 55% of the feed (Adami et al., 2017). Feed cost of poultry production ranges between 65-75% of the total cost of production (Mozafari et al., 2013). Decreased availability of maize due to its exponential use in dairy industry and for direct human consumption increased the price of the feedstuffs and had direct impact on the broiler industry. Therefore, alternative economical feed ingredients of same nutritional status and non-competitive nature must be identified to produce cost-effective broiler production. The ingredient should be able to substitute maize fully or partially or which does not have any negative impact on productive parameters of poultry. Potato (*Solanum tuberosum)* is a root crop produced in many Asian countries and can be used as an alternative source. Potato is consumed as a source of starch but also has all essential amino acids especially lysine except tryptophan and methionine. Potato has 20-25% DM, 12% crude Protein, 65% starch, 0.99% EE, 6.74% ash and has an energy value of more than 2830 ME per kg (Sakib et al*.,* 2014).

Since potato has nearly the same chemical composition as that of maize presumably, its inclusion in broiler diet may be possible. There is need to assess the growth performance of broilers using potato meal. Enzymes are usually added in the diets containing alternative feed stuffs on the basis of non-starch polysaccharides contained in them (Cozannet et al*.,* 2017). So, this study was planned fornutritional evaluation of potato meal with and without enzyme supplementation in commercial broilers.

## MATERIALS AND METHODS

The potato purchased from local market were sliced into pieces, sun dried and ground. The samples

of potato meal and different feed ingredients were analysed for proximate principles (AOAC, 2007). A total of 240, day-old commercial broiler chicks were procured from GADVASU hatchery. Six experimental rations were formulated as per ICAR (2013) specifications during different phases like starter phase (Table 1), grower phase (Table 2) and finisher phase (Table 3). The maize was replaced with potato meal at 25 and 50% level without and with enzymes from diets to prepare iso-nitrogenous and iso-caloric diets. Each diet was fed to quadruplicate group of broiler chicks having 10 birds in each replicate. Standard managemental practices were followed during their entire experimental period. The chicks were divided under the treatments as: T1- control diet, T2 diet – control with enzyme @100g/q feed supplemented diet, T3 diet – 25% crude protein of maize was replaced with potato meal without enzymes supplementation diet, T4 diet – T3+ enzymes @100g/q feed, T5 diet– 50% crude protein of maize was replaced with potato meal without enzymes supplementation and T6 diet- T5 +enzyme @100g/q feed.

A metabolic trial was conducted at the end of experiment. Four birds from each treatment with comparable body weight were selected for conducting metabolic trial in the metabolic cages. After three days of adaptation period, birds were fed with known quantity of feed for next three days and residual feed removed on 4th day. Three days total collection method of faeces was used to determine the digestibility of nutrients. The economics of the use of potato meal in commercial broilers was calculated. The blood sample was collected at the end of experiment, i.e. on 42$^{nd}$ day to assess the impact of potato meal (PM) on ALT, AST, BUN, Creatinine, glucose, total protein and triglycerides levels in blood. Four birds from each treatment were sacrificed to evaluate the carcass parameters. The dressing percentage, liver weight, gizzard weight, heart weight, abdominal fat weight, head weight, leg weight, neck weight and giblet weight were calculated as percentage of body weight.

The collected data was analysed using software package for social sciences (SPSS Version 21.0 2012). The observed data were subjected to analysis of variance (Snedecor and Cochran 1994).

Table 1. Ingredient composition of experimental starter diets (1$^{st}$ - 14$^{th}$ day)

| Ingredients (kg/100 kg) | Treatments | | | | | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | T6 |
| Maize | 54.6 | 54.6 | 44.5 | 44.5 | 35.5 | 35.5 |
| Potato meal | 0 | 0 | 9.75 | 9.75 | 19.5 | 19.5 |
| Soybean Meal | 30 | 30 | 30 | 30 | 30 | 30 |
| Groundnut Extraction | 7 | 7 | 5.75 | 5.75 | 4.7 | 4.7 |
| De-oiled Rice Bran | 2 | 2 | 3.5 | 3.5 | 4 | 4 |
| Oil | 3.0 | 3.0 | 3.3 | 3.3 | 3.3 | 3.3 |
| Di-calcium Phosphate | 0.8 | 0.8 | 0.7 | 0.7 | 0.5 | 0.5 |
| Limestone Powder | 1.9 | 1.9 | 1.9 | 1.9 | 2 | 2 |
| Methionine (g) | 200 | 200 | 100 | 100 | 0 | 0 |
| Additives *(g) | 500 | 500 | 500 | 500 | 500 | 500 |
| Total (Kg) | 100 | 100 | 100 | 100 | 100 | 100 |

*. Additives include Vit A 8,25,000 IU, Vit $D_3$ 1,20,000 IU/, Vit K 100 mg, Riboflavin 500 mg, Thiamine 80 mg, Pyridoxine 160 mg, Vit E 800 mg, Cyanocobalamin 100 mcg, Niacin 1200 mg, Calcium pantothenate 80 mg, Manganese sulphate 25 g, Ferrous sulphate 10 g, Copper sulphate 500mg, Zinc oxide 8g Potassium Iodide 100 mg, Coccidiostat 60g.

Table 2. Ingredient composition of experimental grower diets (15th - 21st day)

| Ingredients (kg/100 kg) | Treatments | | | | | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | T6 |
| Maize | 57.3 | 57.3 | 48 | 48 | 37 | 37 |
| Potato meal | 0 | 0 | 10.2 | 10.2 | 20.4 | 20.4 |
| Soybean Meal | 22.2 | 22.2 | 14.4 | 14.4 | 4.8 | 4.8 |
| Groundnut Extraction | 14 | 14 | 21 | 21 | 30 | 30 |
| De-oiled Rice Bran | 0 | 0 | 0 | 0 | 1 | 1 |
| Vegetable Oil | 3.3 | 3.3 | 3.4 | 3.4 | 4 | 4 |
| Di-calcium Phosphate | 0.5 | 0.5 | 0.4 | 0.4 | 0.3 | 0.3 |
| Limestone Powder | 2 | 2 | 2 | 2 | 2 | 2 |
| Methionine (g) | 200 | 200 | 100 | 100 | 0 | 0 |
| Additives* (g) | 500 | 500 | 500 | 500 | 500 | 500 |
| Total (Kg) | 100 | 100 | 100 | 100 | 100 | 100 |

Table 3. Ingredient composition of experimental finisher diets (22nd – 42nd day)

| Ingredients (kg/100 kg) | Treatments | | | | | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | T6 |
| Maize | 61.8 | 61.8 | 50.4 | 50.4 | 39.5 | 39.5 |
| Potato meal | 0 | 0 | 11 | 11 | 22 | 22 |
| Soybean Meal | 24 | 24 | 13 | 13 | 0 | 0 |
| Groundnut Extraction | 6 | 6 | 16.3 | 16.3 | 28.9 | 28.9 |
| De-oiled Rice Bran | 2.2 | 2.2 | 3 | 3 | 3 | 3 |
| Oil | 3.2 | 3.2 | 3.7 | 3.7 | 4.1 | 4.1 |
| Di-calcium Phosphate | 0.4 | 0.4 | 0.2 | 0.2 | 0 | 0 |
| Limestone Powder | 1.8 | 1.8 | 1.9 | 1.9 | 2 | 2 |
| Methionine (g) | 125 | 125 | 25 | 25 | 0 | 0 |
| Additives* (g) | 475 | 475 | 475 | 475 | 500 | 500 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

## RESULTS AND DISCUSSIONS

It was observed that the final body weight (FBW) decreased ($P \leq 0.05$) with the increase in the level of supplementation of crude protein from potato meal at the end of starter phase (Table 4). The highest ($P \leq 0.05$) final body weight where no potato meal was supplemented in the diet and decreased linearly with increase in potato meal inclusion. Final body weight affected similarly the gain in body weight (GIW). Maximum ($P \leq 0.05$) GIW was in un-supplemented group. Feed consumed per bird per day (FI/B/D) increased with increase in the inclusion of potato meal and was highest ($P \leq 0.05$) at highest inclusion level. FI/B/D was lowest ($P \leq 0.05$) in un-supplemented group. Lowest body weight and highest feed intake at maximum inclusion level of potato meal affected the FCR during the starter phase. Best ($P \leq 0.05$) FCR was achieved when potato meal was not supplemented in the diet. Similar results of depressed productive parameters were observed by Ojewola et al. (2006) with feeding of two different varieties of potato. The analysis of data shows that supplementation of enzyme had no ($P \leq 0.05$) impact on FBW, GIW, FI/B/D and FCR compared to un-supplemented group.

Table 4. Effect of supplementing different levels of potato and enzyme on growth performance of broilers

| Parameters | Level | | | PSE | Enzyme | | PSE | P value | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | | 1 | 2 | | L | E | L*E |
| **Starter phase** | | | | | | | | | | |
| IBW | 37.5 | 37.5 | 37.4 | 0.038 | 37.5 | 37.5 | 0.031 | 0.108 | 0.567 | 0.044 |
| FBW | 254[a] | 239[b] | 2233[c] | 2.601 | 240 | 237 | 2.124 | 0.000 | 0.296 | 0.053 |
| body weight gain (g/b) | 2165[a] | 202[b] | 185[c] | 2.59 | 203 | 199 | 2.12 | 0.001 | 0.299 | 0.053 |
| FI(g/b/d) | 29.1[c] | 30.0[b] | 31.1[a] | 0.224 | 29.8 | 30.2 | 0.183 | 0.001 | 0.128 | 0.776 |
| FCR | 1.88[c] | 2.08[b] | 2.34[a] | 0.029 | 2.07 | 2.13 | 0.024 | 0.001 | 0.065 | 0.122 |
| **Grower phase** | | | | | | | | | | |
| FBW | 369[a] | 352[b] | 331[c] | 4.06 | 351 | 351 | 3.31 | 0.000 | 0.928 | 0.976 |
| body weight gain (g/b) | 115 | 112 | 108 | 2.50 | 111 | 113 | 2.04 | 0.195 | 0.345 | 0.074 |
| FI(g/b/d) | 50.8 | 50.5 | 51.0 | 0.247 | 51.0 | 50.5 | 0.201 | 0.467 | 0.119 | 0.035 |
| FCR | 3.09[b] | 3.03[b] | 3.28[a] | 0.05 | 3.18 | 3.08 | 0.041 | 0.007 | 0.115 | 0.008 |
| **Finisher phase** | | | | | | | | | | |
| FBW | 11230[a] | 10320[b] | 913[c] | 11.44 | 1005[b] | 1041[a] | 9.34 | 0.000 | 0.014 | 0.009 |
| body weight gain (g/b) | 761[a] | 679[b] | 587[c] | 7.77 | 658[b] | 689[a] | 6.35 | 0.001 | 0.003 | 0.001 |
| FI(g/b/d) | 84.7 | 83.2 | 83.0 | 0.610 | 83.8 | 83.5 | 0.499 | 0.130 | 0.689 | 0.886 |
| FCR | 2.37[c] | 2.57[b] | 2.96[a] | 0.023 | 2.69[b] | 2.58[a] | 0.02 | 0.001 | 0.001 | 0.001 |
| **Overall Phase** | | | | | | | | | | |
| IBW | 37.5 | 37.5 | 37.4 | 0.038 | 37.55 | 37.52 | 0.031 | 0.108 | 0.567 | 0.044 |
| FBW | 1123[a] | 1032[b] | 913[c] | 11.44 | 1005[b] | 1041[a] | 9.34 | 0.000 | 0.014 | 0.009 |
| body weight gain (g/b) | 1085[a] | 994[b] | 881[c] | 8.06 | 971[b] | 1003[a] | 6.58 | 0.001 | 0.003 | 0.001 |
| FI(g/b/d) | 60.0 | 60.0 | 60.3 | 0.184 | 60.11 | 60.2 | 0.15 | 0.323 | 0.623 | 0.097 |
| FCR | 2.35[c] | 2.53[b] | 2.87[a] | 0.018 | 2.62[a] | 2.55[b] | 0.014 | 0.001 | 0.003 | 0.001 |

Means bearing different superscripts differ significantly ($p<0.05$)

During Grower phase though final body weight (FBW) decreased ($P\leq0.05$) with the increase in the level of replacement of crude protein from potato meal but gain in weight showed non-significant ($P\leq0.05$) difference. Similarly non-significant ($P\leq0.05$) trend was seen for feed intake per bird per day. FCR during this phase was better at 25% potato meal supplementation level. However, addition of enzyme had no ($P\leq0.05$) impact on the various productive parameters of broilers during grower phase. Final body weight decreased ($P\leq0.05$) with the increase in the level of supplementation of crude protein from potato meal at the end of finisher phase. The highest ($P\leq0.05$) final body weight (1123.00) was at 0% potato meal supplemented diet and decreased linearly with increase in potato meal inclusion. The highest ($P\leq0.05$) body weight gain (761.6) was witnessed at 0% potato meal supplementation and decreased ($P\leq0.05$) linearly with the increase in the level of supplementation. Adami et al., (2017) also observed decrease in body weight gain at 50% supplementationof potato meal in commercial broilers from 22-42 days of age.

The addition of enzymes had a positive effect on the final body weight of the broiler birds during finisher phase. The inclusion of the enzyme led to increase ($P\leq0.05$) in the body weight gain at the end of the finisher phase. Accordingly, the highest ($P\leq0.05$) body weight gain was in enzyme supplemented group. Feed intake per bird per day did not ($P\leq0.05$) had any impact with addition of enzyme. Higher FBW and GIW directly affected the

feed conversion ratio. Addition of enzyme showed improvement (P≤0.05) in FCR.

Perusal of the data for the overall period indicated that the body weight decreased (P≤0.05) with the increase in the level of supplementation of crude protein from potato meal. The highest (P≤0.05) body weight (1123g) was in the group where no potato meal was supplemented in the diet and decreased with increase in potato meal inclusion. Overall FBW affected the gain in body weight (GIW). Maximum (P≤0.05) GIW (1085g) was in un-supplemented group. Feed consumed increased with increase in the inclusion of potato meal and was highest (P≤0.05) at highest inclusion level. Different levels of inclusion of potato meal had no-significant effect on FI/B/D. Lowest body weight and GIW at maximum inclusion level of potato meal affected the FCR during the overall phase. Best (P≤0.05) FCR was achieved when potato meal was not supplemented in the diet. However, poorest (Pd"0.05) FCR was at the highest supplementation level.

Overall phase data indicated that the addition of enzymes had a positive effect on the final body weight of the broiler birds. The inclusion of the enzyme increased (P≤0.05) the final body weight and gain in weight during overall phase. Addition of enzyme had shown no-significant (P≤0.05) effect on the FI/B/D. Higher body weight gain and non-significant difference in feed intake resulted in improved (P≤0.05) FCR with addition of enzyme.

Table 5. Effect of supplementing different levels of potato and enzyme on carcass parameters of broilers

| Parameters | Level | | | PSE | Enzyme | | P.S.E | P -value | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | | 1 | 2 | | L | E | L*E |
| Dressing % | 55.4$^{a}$ | 55.2$^{a}$ | 51.3$^{b}$ | 0.411 | 53.7 | 54.2 | 0.336 | 0.000 | 0.277 | 0.708 |
| Liver wt. | 2.44$^{b}$ | 2.43$^{b}$ | 2.62$^{a}$ | 0.058 | 2.55 | 2.44 | 0.047 | 0.043 | 0.086 | 0.409 |
| Gizzard wt. | 3.16$^{ab}$ | 3.38$^{a}$ | 3.12$^{b}$ | 0.085 | 3.14 | 3.30 | 0.070 | 0.078 | 0.111 | 0.011 |
| Heart wt. | 0.62 | 0.65 | 0.66 | 0.019 | 0.66 | 0.63 | 0.016 | 0.196 | 0.161 | 0.113 |
| Abdominal fat wt. | 2.52$^{ab}$ | 2.79$^{a}$ | 2.22$^{b}$ | 0.152 | 2.65 | 2.37 | 0.124 | 0.037 | 0.113 | 0.278 |
| Head wt. | 3.04 | 3.07 | 3.23 | 0.065 | 2.96$^{b}$ | 3.27$^{a}$ | 0.053 | 0.100 | 0.000 | 0.000 |
| Leg wt. | 4.96$^{b}$ | 4.87$^{b}$ | 5.33$^{a}$ | 0.080 | 4.81$^{b}$ | 5.29$^{a}$ | 0.066 | 0.000 | 0.000 | 0.023 |
| Neck wt. | 2.21 | 2.08 | 2.21 | 0.071 | 2.16 | 2.17 | 0.058 | 0.345 | 0.951 | 0.376 |
| Giblet wt. | 6.21 | 6.47 | 6.40 | 0.115 | 6.36 | 6.37 | 0.094 | 0.269 | 0.932 | 0.365 |

Means bearing different superscripts differ significantly (p<0.05)

**Carcass parameters of broilers**

Non-significant (P≤0.05) difference was observed on the dressing percentage of birds between 0 and 25% crude protein supplementation of maize with potato meal (Table 5). The dressing percentage decreased (P≤0.05) at highest level of supplementation of potato meal. Highest (P≤0.05) percent liver weight was observed at 50 % supplementation of potato meal in broiler ration. However, non-significant difference was seen at 0 and 25% potato supplementation. The highest (P≤0.05) percent gizzard weight was at 25% potato meal supplementation level however, it was comparable with un-supplemented group. The abdominal fat percentage followed the same trend as in gizzard weight showing maximum percent abdominal fat at 25% replacement of crude protein from potato meal with maize. Significant decrease in the abdominal fat percentage was observed at 50% replacement. No significant (P≤0.05) effect was observed in the leg percentage till 25% inclusion but it decreased (P≤0.05) significantly with the

increase in the inclusion level to 50%. Heart, Head and Neck weight showed non-significant (P≤0.05) effect of supplementation of potato meal. Though liver and gizzard weights showed significant difference individually but total giblet weight had shown non-significant (P≤0.05) difference at different levels.

Enzymes supplementation had shown non-significant (P≤0.05) impact on various carcass parameters except on head and leg weight where enzyme supplementation shown increase (P≤0.05) in their percent weight. Though, statistically there was no significant difference in the abdominal fat but numerically abdominal fat reduced where enzyme was supplemented. Overall, it can be concluded that addition of enzyme responded positively w.r.t. carcass parameters with addition of potato meal.

Table 6. Effect of supplementing different levels of potato and enzyme on blood parameters of broilers

| Parameters | Level | | | PSE | Enzyme | | PSE | P-value | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | | 1 | 2 | | L | E | L*E |
| AST (IU/L) | 254.7 | 240.2 | 246.5 | 8.763 | 247.3 | 246.9 | 7.155 | 0.510 | 0.968 | 0.860 |
| ALT (IU/L) | 5.37 | 5.25 | 5.75 | 0.447 | 5.33 | 5.58 | 0.365 | 0.717 | 0.634 | 0.588 |
| BUN (mg/dl) | 6.37 | 6.37 | 6.36 | 0.005 | 6.36 | 6.37 | 0.004 | 0.774 | 0.174 | 0.097 |
| Creatinine (mg/dl) | 0.47 | 0.48 | 0.47 | 0.006 | 0.47 | 0.47 | 0.005 | 0.742 | 1.00 | 0.157 |
| Glucose (mg/dl) | 255.8$^{a}$ | 236.0$^{b}$ | 268.3$^{a}$ | 5.94 | 254.3 | 252.5 | 4.85 | 0.004 | 0.792 | 0.326 |
| Total Protein (g/dl) | 3.85$^{a}$ | 3.48$^{b}$ | 3.88$^{a}$ | 0.11 | 3.67 | 3.80 | 0.089 | 0.034 | 0.304 | 0.750 |
| Triglycerides (mg/dl) | 44.7$^{b}$ | 49.8$^{a}$ | 48.5$^{ab}$ | 1.56 | 47.0 | 48.3 | 1.27 | 0.082 | 0.498 | 0.569 |

Means bearing different superscripts differ significantly (p<0.05)

**Blood parameters of broilers**

Non-significant differences (P>0.05) were observed among the treatments for serum concentrations of AST, ALT, BUN andcreatinine (Table 6). Similar trends were also found in study conducted by Adami et al (2017) . Glucose concentration reduced (P>0.05) in birds fed 25% potato meal. Unexplained (P>0.05) reduction in total protein serum concentration of birds at 25% was observed however, non-significant (P>0.05) difference was observed in un-supplemented and 50% potato supplemented group. Serum triglyceride level was found to be maximum (P>0.05) at 25% supplementation which was comparable (P>0.05) with the birds fed diet supplemented with 50% potato meal. The un-supplemented group showed lowest (P>0.05) triglyceride level. Supplementation of enzyme showed non-significant (P>0.05) deviation in the levels of blood parameters.

Table 7. Effect of supplementing different levels of potato and enzyme on percent digestibility parameters of broilers

| Parameters | Level | | | P.S.E | Enzyme | | P.S.E | P-value | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | | 1 | 2 | | L | E | L*E |
| CP | 72.6[a] | 54.2[b] | 40.9[c] | 0.594 | 50.0[b] | 56.8[a] | 0.485 | 0.000 | 0.042 | 0.674 |
| CF | 35.7[a] | 31.4[b] | 29.5[c] | 0.372 | 32.0 | 32.5 | 0.304 | 0.000 | 0.299 | 0.832 |
| EE | 86.1[a] | 79.9[b] | 69.5[c] | 0.750 | 76.8[b] | 80.2[a] | 0.613 | 0.000 | 0.008 | 0.308 |
| OM | 82.6[a] | 73.7[b] | 62.4[c] | 0.630 | 71.5[b] | 74.4[a] | 0.514 | 0.000 | 0.007 | 0.039 |
| Ca | 47.6[a] | 33.4[b] | 33.6[b] | 0.690 | 38.2 | 38.2 | 0.563 | 0.000 | 0.981 | 0.299 |
| P | 73.7[a] | 51.1[b] | 44.7[c] | 1.109 | 52.5[b] | 60.4[a] | 0.906 | 0.000 | 0.001 | 0.001 |

Means bearing different superscripts differ significantly ($p<0.05$)

**Digestibility parameters of broilers**

The highest ($P\leq0.05$) crude protein digestibility (72.65) was found in the un-supplemented group (Table 7). There was a significant decrease ($P\leq0.05$) in the crude protein digestibility as the levels of supplementation of potato meal increased and lowest (40.93) being at 50% supplementation. A similar trend of linear decrease ($P\leq0.05$) in crude fibre digestibility, ether extract digestibility and organic matter digestibility was observed with increasing potato meal supplementation. The calcium absorption was highest ($P\leq0.05$) in the un-supplemented group whereas both the treatment showed reduced ($P\leq0.05$) absorption and there was no significant ($P\leq0.05$) difference in calcium absorption at both the levels of inclusion. Thephosphorus absorption was found to be ($P\leq0.05$) highest in the un-supplemented group and showed a decreasing ($P\leq0.05$) absorption pattern as the supplementation increased.

Enzymes supplementation had a positive ($P\leq0.05$) impact on the crude protein, ether extract and organic matter digestibility. Asa et al. (2020) observed similar response of increase in digestibility of different nutrients (crude protein, ether extract and organic matter) with inclusion of enzymes in broilers. Addition of enzyme improved ($P\leq0.05$) the digestibility of these nutrients. Crude fibre digestibility did not get affected ($P\leq0.05$) by supplementation of enzymes. Similarly non-significant ($P\leq0.05$) effect was observed in calcium absorption however, phosphorus absorption improved ($P\leq0.05$) with addition of enzyme in the diets.

Table 8. Effect of supplementing different levels of potato and enzyme on economics of broilers.

| | Cost economics | | | | | |
|---|---|---|---|---|---|---|
| Variables | T1 | T2 | T3 | T4 | T5 | T6 |
| Total feed cost (Rs. / b) | 59.2 | 59.5 | 58.5 | 58.2 | 58.8 | 58.8 |
| Chick cost (Rs. / b) | 18 | 18 | 18 | 18 | 18 | 18 |
| Total cost (Rs. / b) | 77.2 | 77.5 | 76.5 | 76.2 | 76.8 | 76.8 |
| Finisher body weight(kg/b) | 1071.5 | 1174.5 | 1036.9 | 1028.0 | 906.2 | 921.1 |
| Selling price(@75/kg/b) | 80.3 | 88.1 | 77.8 | 77.1 | 67.9 | 69.1 |
| Profit(Rs) | 3.12 | 10.50 | 1.3 | 0.90 | -8.91 | -7.78 |

The highest profit of margin was observed in T2 treatment where enzyme was supplemented in control diet (Table 8). This group had highest final body weight. Least profit of margin was observed in T5 treatment where 50% crude protein of maize was replaced with potato meal without enzymes. The inclusion of potato meal in the diets resulted in decrease in final body weight and also reduced the profit margins as compared to the control diets. Profitability was seen in the 25% potato meal

supplementation but was reduced as compared to control diets.

## CONCLUSION

It was concluded that from economic point of view potato meal can be incorporated during glut period or when maize price is too high up to 25% of maize protein in the diet of broiler chicken.

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