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EVALUATION OF NUTRITIVE VALUE OF DIFFERENT LEVELS OF CHROME SHAVING (HYDROLYSED) PARTIALLY REPLACING ANIMAL PROTEIN IN THE FEED ON THE PERFORMANCE OF QUAIL CHICKS

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ABSTRACT

The Present study was carried out to evaluate the different levels of tannery wastes (chrome shaving) on the growth performance of quail chicks. The tannery waste was partially replaced by the animal protein and 2.5% and 5% levels were prepared and given in the feed of chicks. One day old chicks were purchased from local hatchery and were studied up to 9th week. The effect of tannery waste (chrome shaving) was also observed up to 9th week. Chicken were slaughtered, dried and sent for further analysis like fat content, moisture, mineral contents, protein estimation, dressing percentage and total body weight. Both levels of chrome shavings showed significant results. However, these changes were more pronounced in 5% level of tannery waste (chrome shaving).

Keywords: quail chicks, tannery wastes, chrome shaving, animal protein, growth performance.

INTRODUCTION

The leather industry is very important, as it is the second most export carrying in Pakistan. Tanning industry uses water and some chemicals and so creates environmental problems, depending basically and the principal sources, hide and water. Tanning process produces a very obnoxious and smelly waste, which contains chromium, sulphides, ammonia, chloride and other salts, in addition to a large quantity of organic component. But these industries in Pakistan are one of the most seriously affecting pollution sources. A large amount of water being used in the tanning process produces a large volume of waste. The effluents rich in responded and dissolved impurities plus toxic chemicals have been discharged either to open lands or into waterways, polluting them to very high extent. The total installed capacity of skins and hides in Pakistan has been assessed to be 53.5 million more than 973 tonnes/year of chromium is discharged from the nearly 131 tanneries of Korangi sector 7-A only in sew sludge. It cannot be removed by simple methods. The chromium used in chrome tanning process in the trivalent form but the disposal of chromium does not take into account whether it is Cr (Vi) or Cr (III). It is total chromium content that matters. In view of the stringent chromium discharge standards chromium recovery and reuse holds a lot of importance. Therefore economic consequences in tanning industry are to be carefully looked into to have a cost effective pollution abatement measures. Wrong technology choices may affect the national economy (Chaudhry & Ahmad, 1997).

In Pakistan quail farming was introduced in 1974 and people are earning a reasonable income through this enterprise. Since then this business has created a lot of interest among the people.

Before the early 1990s, most of the poultry studies had explored the effects of inorganic chromium and were not encouraging. Then American Researchers reported the tendency for 200ppb of chromium picolinate to increase protein percentage and decrease fat %age in 3-week old broiler, chick carcass. (Feed International, 2003).

Weisman & Lewis (1998) has studied the Influence of dietary energy and nutrient concentration on the growth of body weight and of carcass components of broiler chickens. Danicke et al., (1999) showed the Effects of dietary fat type, pentosan level and xylanase supplementation on performance and carcass characteristics of male broilers. Shakurai (1979) got the greatest growth efficiency of feed conversion and egg production when used 28% to 32% protein level with 3.1 to 3.2 Kcal/g metabolizable energy in diets for Japanese quail (Conturnix coturnix japonica). They also used three lines of Japanese quail on the basis of high body weight at 5 weeks of age using 28% or 23% crude protein with or without 0.1% thiouricil. They found that 23% crude protein diet without addition of extra thiouricil was most effective in quail at 5 weeks of age.

Lee et al. (1981) performed experiment on protein requirements of breeding Japanese quail in the tropics. Shrivastav (1981) conducted a series of experiments with particular reference to protein, energy, calcium and phosphorus requirements for different stages of growth and production of quails. He reported that 27% protein upto 3 weeks age and 24% protein upto 3 weeks onward gave better growth with metabolizable energy. Baldini et al.,(1995) studied the protein requirements of bobwhite quail reared in confinement in battery brooders to eight weeks of age. In this experiment they used 20%, 25% and 28% levels of

protein and observed that 28% protein level gave the best growth and livability in quail chicks.

Weber & Ried (1967) made the studies regarding protein requirement of conturnix quail and performed three experiments having increasing concentration of protein in diet from 15 % to 30%.They observed that 28.8% protein in diet gave the maximum weight gain. Vohra & Roudybush (1971) performed experiment on protein requirements of growing Japanese quail (Coturnix conturnix japanica) using matabolizable energy on different levels of dietary protein. They concluded from the experiment that 25% dietary protein gave the optimum growth.

MATERIALS AND METHODS

One day old, 500 Japanese quail specie chicks were purchased from the local hatchery and randomly divided into 3 groups of 100 birds each. These groups were randomly assigned to two experimental rations in such a way that ultimately there were two groups under each treatment. The experimental rations were fed for a period of 9 weeks. Five experimental ratios were prepared containing two levels of chrome shaving partially replaced by animal proteins i.e. 0 %, 2.5 % & 5 % and were designated as A, B and C, respectively. The composition of the experimental rations and the assumed chemical composition of the rations is given in Appendix-A. Assumed chemical composition of the feed ingredients was taken from N.R.C. USA (1969) prepared by P.C.S.I.R Laboratories.

At the start of the experiment five quails from each experimental group were taken at random and were weighed (Shimadzu BX-300, Japan). The data for total body weight gain of quails chicks were collected weekly and subjected to analysis.

Moisture content:

For moisture determination simple oven method was used. Weight the dish dried at 98-100 0C cooled in dessicator allow to cool at soon attaining room temperature. Add 2 gram sample in preweighted dish and weight it. Loosen the cover (not removed) and put in the Oven at 98-100C least to attain constant weight it. Tighten the cover and transfer to desicator and weigh soon after attaining room temperature.

Calculations:

Weight of sample before drying = A

Weight of sample after drying = B

Moisture content (%) = $\frac{A-B}{A} \times 100$

Fat content:

For fat contents, dry the thimble in oven and at attaining the room temperature in oven. Transfer the dried feed sample in the thimble and weight it again. Then the thimble with sample was placed to pored in the soxhlet chamber. At the base of the soxhlet the round bottom weighted flask is filled with N-hexane and heated. The N-hexane will evaporate and condensed at the top of the soxhlet and will drop in the chamber and go down at the creation of vacuum. This process will continue for 12-16 hours. Turn off the hot plate and evaporate the Hexane and weigh the flask.

Calculations:

Weight of empty Thimble = A

Weight of Thimble after extraction = B

Weight of Fat = B-A = C

Weight of sample = D

Weight of Fat (%) = $\frac{C}{D} \times 100$

Mineral content:

For mineral contents, weigh the porcelain crucible pre-dried and cooled in dessicator. Add 2gm sample in the porcelain crucible and weight it. Ignite the sample in the muffle furnace preheated at 50^{o}C. Maintain this temperature for 2 hours. After ignition transfer crucible directly to dessicator, cool and weigh immediately.

Calculations:

Weight of sample = A

Weight of Ash = B

Ash content (%) = $\frac{B}{A} \times 100$

Protein content:

For protein estimation, take dried and ground feed sample 1gm in a filter paper and transfer it to 250ml kjeldhal flask. Add equal amount of catalyst digestion mixture. Add 10ml Conc. H_2SO_4 to the flask. Place on digestion rack and start heating slowly that material should not come out by frothing. The flask should be planed at the angle of 45^{o}. Continue heating until all the carbon converted to ammonium sulphate and no blackish material. It will turn to light green or clear. If the acid dried the add more Conc. H_2SO_4 to the flask. Turn off the heater and cool it to room temperature. Then make volume to 50ml in a volumetric flask with distilled water. Take 10ml boric acid solution in a conical flask and attach to the condenser lower end to collect distillate. Add 10ml volumetric solution of digested sample in round bottle of markham apparatus and them add 10ml 40% NAOH solution from the upper end of markham apparatus and start collecting the distillate. After attaining 25ml distillate Titrate it with N/70 HCL note the end point. (Pink color) and note down the Hcl/N/70 used.

Calculations:

1ml of N/14 = 1mg of N2

N/70 HCL used = A ml

Divide by 5 to convert it to N14 = A

= Bmg N2

Bmg N2 is in the 10ml sample

10 ml contains = Bmg N2

01 ml contains = B/10

50 ml contains = $\frac{B}{10} \times 50 = 5 \times B$

1000mg contains = $\frac{5 \times B}{1000}$

100 mg contains = $\frac{5 \times B}{1000} \times 100$

$= \frac{B}{2} N$

To convert it into N2, multiply by 6.25

$N2 = \frac{B}{2} \times 6.25$

RESULTS

Total body weight:

Initial weight of the quail at the start of experiment was 32.33g ± 0.16. It was control group of quails. In group B, containing 2.5% of chrome shaving replaced by animal protein, the weight of quails of 2nd week was 34.84g ± 0.2. In group C, 5% level of chrome shaving given to quails (partially replaced by animal protein), the weight was 36.5g ± 0.22. The value of total weight gain at the end of 9th week was highly significant as ***128.35g ± 0.03 (P>0.001) in group A. While in group B, there was **114.9g ± 0.28 and in group C was ***134.12g ± 0.29 (P>0.001). Total weight gain increased highly significantly in group A and group C while in group B Weight was moderate significantly increased (see, Table-1).

Dressing Percentage:

Initial dressing percentage of quails at the start of experiment was 51.14% ± 0.15. It was "A" group (control) interacting; giving normal fed. In group "B", 2.5% level of chrome shaving, dressing %age was 49%±0.23 and in group "C" 5% level, it was 54.5% ± 0.16.

The value of total dressing %age at the end of experiment, 9th week it was significantly decreased as *44.41% ± 0.17 in group A. In group "B" it was **56.57% ± 0.19 and in group "C" it was **48.43% ± 0.14. Overall results showed that in 4th, 5th, 6th, 7th and 8th weeks the dressing percentage as decreased significantly. In last week it was increased in group B only (Table-2).

Fat contents:

The amount of fat was determined at the start of experiment was found out to be 20% ± 0.01 in control group. In group B it was 25 ± 0.12 and 31 ± 0.01 in group C. The amount of fat was decreased highly significantly after 9th week. The control group had 7.5 ± 0.01 and group B had **5.5 ± 0.12 (P>0.01) amount of fat. While ***4.8 ± 0.07 in group C (P>0.001) was determined. The 2nd and 3rd weeks showed high amount of fat. Amount of fat was decreased significantly in 5% level of chrome shavings in feed of quails (Table-3).

Mineral contents:

The amount of mineral was determined at the start of experiment. The initial value was found out to be 17.3% ± 0.03 in group A. In group B, value was 14.67 ± 0.01 and 10.6 ± 0.01 in group C. After 9th week, at end of experiment value was decreased significantly in ($P < 0.01$) different weeks like 3rd, 5th, 6th, 7th and 9th weeks. After 9th week value of mineral contents in group A was 12.5 ± 0.01, **12 ± 0.01 in group B (P>0.01) and ***11.75 ± 0.01 in Group C (P>0.001) (Table-4).

Moisture contents:

The amount of moisture was determined initially at the start of the experiment and was found to be 88.85% ± 0.90 in control group. The group B showed 85.59 ± 0.2 and group C showed 87.6 ± 0.098 of moisture contents. At the end, control group showed 80.5 ± 0.07, in group B it was *80.23±0.07 (P>0.05) and group C it was **82.75 ± 0.21 (P>0.01). Moisture content was significantly decreased upto last 9th weeks. However the amount of moisture content was decreased in 2.5% level significantly ($P < 0.01$) (Table-5).

Protein contents:

The protein content of quail was estimated at the start of the experiment. The initial value was found out to be 30±0.01 in group A, 32±0.02 in group B and 32.5±0.02 in group C. The amount of protein was increased highly significantly after 9th week. This was 50± 0.07 in group B and 52.75± 0.01 in group C (Table-6).

Simple ANOVA was applied to the data. The result was found out to be significant as the value of F was more than 0.5. While *P > 0.05, **P > 0.01, ***P> 0.001, a = Mean ± SEM. (Bishop, 1966).

Table-1. Total average body weight (g) of Quails after exposure of different levels (2.5 % & 5 %) of chrome shaving (hydrolyzed) partially replacing animal protein in feed.

WEEKS	EXPERIMENTAL		CONTROL
	2.5 %	5 %	
II	34.84 ± 0.21	36.5 ± 0.22	32.33 ± 0.16
III	62.805 ±0.25	51 ± 0.21	55.07 ± 0.17
IV	98.34 ±0.238	83.53 ± 0.81	78.54 ± 0.15
V	96.14 ±0.179	91.8 ± 0.07	110.29±0.14
VI	*116.6 ±0.031	*114.35 ±0.016	113.55±0.16
VII	**135.79 ±0.13	*121.07 ± 0.002	134.86±0.12
VIII	*118.26 ±0.16	**130.128 ± 0.31	132.94±0.17
IX	*114.9 ± 0.28	**134.12 ± 0.29	128.55±0.16

Table-2. Dressing percentage of Quails after exposure of different levels (2.5 % & 5 %) of chrome shaving (hydrolyzed) partially replacing animal protein in feed.

WEEKS	EXPERIMENTAL		CONTROL
	2.5 %	5 %	
II	49.00 ± 0.23	54.5 ± 0.16	51.14 ± 0.15
III	56.02 ± 0.52	56.85 ± 0.18	53.86 ± 0.14
IV	45.59 ± 0.32	48.85 ± 0.19	51.31 ± 0.12
V	45.78 ± 0.41	42.15 ± 0.02	49.47 ± 0.19
VI	42.79 ± 0.52	43.515 ± 0.17	44.39 ± 0.17
VII	48.905 ±0.21	48.73 ± 0.19	46.76 ± 0.16
VIII	39.24 ± 0.17	45.63 ± 0.13	44.49 ± 0.15
IX	56.57 ± 0.19	48.43 ± 0.14	44.41 ± 0.17

Table-3. Total Fat contents (%) of Quails after exposure of different levels (2.5 % & 5 %) of chrome shaving (hydrolyzed) partially replacing animal protein in feed.

WEEKS	EXPERIMENTAL		CONTROL
	2.5 %	5 %	
II	25±0.12	31±0.01	20±0.01
III	25±0.11	30±0.21	20±0.01
IV	20±0.12	11±0.79	9.9±0.01
V	11±0.11	9.2±0.28	8.2±0.07
VI	16.4±0.23	15.5±0.11	8.2±0.09
VII	*6±0.21	*5±0.21	8.2±0.01
VIII	**5.9±0.11	***4.9±0.25	7.9±0.21
IX	**5.5±0.12	***4.8±0.07	7.5±0.01

Table-4. Total Mineral contents (%) of Quails after exposure of different levels (2.5 % & 5 %) of chrome shaving (hydrolyzed) partially replacing animal protein in feed.

WEEKS	EXPERIMENTAL		CONTROL
	2.5 %	5 %	
II	14.67±0.01	10.6±0.01	17.3±0.03
III	17±0.09	8.4±0.166	14±0.09
IV	9.2±0.027	8.16±0.01	11±0.63
V	15±0.01	16.15±0.34	15±0.89
VI	12±0.07	11.26±0.56	14±0.63
VII	*12.6±0.56	11.35±0.01	12.29±0.89
VIII	*2.2±0.1667	***11.8±0.07	12.5±0.23
IX	**12±0.01	***11.75±0.01	12.5±0.01

Table-5. Total Moisture contents (%) of Quails after exposure of different levels (2.5 % & 5 %) of chrome shaving (hydrolyzed) partially replacing animal protein in feed.

WEEKS	EXPERIMENTAL		CONTROL
	2.5 %	5 %	
II	85.59±0.2	87.6±0.098	88.85±0.90
III	84.8±0.21	86.35±0.34	87.79±0.89
IV	84.21±0.17	85.97±0.16	85.85±0.90
V	83.98±0.16	85.75±0.20	84.67±0.90
VI	82.89±0.43	83.90±0.289	83.5±0.89
VII	*82.47±0.75	*83.6±0.17	79.02±0.89
VIII	*81.32±0.25	**83.22±0.01	80.45±0.90
IX	*80.23±0.16	**82.75±0.21	80.5±0.07

Table-6. Total Protein (%) of Quails after exposure of different levels (2.5 % & 5 %) of chrome shaving (hydrolyzed) partially replacing animal protein in feed.

WEEKS	EXPERIMENTAL		CONTROL
	2.5 %	5 %	
II	32±0.02	32.5±0.02	30±0.01
III	32.5±0.01	33.35±0.04	30±0.02
IV	33.9±0.01	34.8±0.016	30.5±0.05
V	35±0.05	35.75±0.020	30.5±0.01
VI	39±0.03	37.90±0.009	31±0.01
VII	*45±0.05	*47±0.017	32.6±0.02
VIII	*49.5±0.02	**50.22±0.01	31±0.02
IX	*50±0.07	**52.75±0.01	31.5±0.01

DISCUSSION

The human population of Pakistan at present is estimated as 135.28 million and is increasing at a rate of 2.77% per year which is highest in the region which seeks a rapid intensification of food resources. According to protein committee of Pakistan, per capita daily consumption should be 68.65% grams, out of which 27.40 grams should be of animals' origin. Majority of population is deficient in protein especially in animal protein. Health consultants advise the use of poultry meat for its low cholesterol contents and high quality protein So the shortage of animal protein could be overcome by augmenting poultry meat production. (WHO, 2003)

Protein level in the ration of quails is considered as an important factor for the efficient growth. But recent studies have shown that besides the protein level, the amino acid profile of feed is more important. The total protein actually based upon the requirement for the dietary essential amino acids and the amount of nitrogen necessary for the biosynthesis of dietary non essential amino acids in the body, needed for growth. A balanced ration should possess adequate

amount of all dietary essential amino acids and sufficient amount of nitrogen for the synthesis of dietary non essential amino acids .Generally it is not necessary to consider all the essential amino acids at the time of formulation but only the most limiting amino acids are Critical amino acids Of the dietary essential amino acids are known as the most critical amino acids. These are usually short in conventional feedstuffs. (ATSDR, 2002).

In the present research work, different levels of chrome shavings as 2.5% and 5% in feed were increased the body weight of the quail chicks. Weight was increased in 2.5% and 5% levels of chrome shaving in feed in almost all weeks but stable in 8th and 9th weeks. Similar results have been shown by Fisher et al; (1972). He reported in 1973 the significant increase in body weight up to 250mg/kg of copper sulphate in broilers. They showed the increase effects of diets with different levels of protein on the performance of Japanese quail. Japanese quails were fed on the diets containing 16,22 or 28% CP. At 35 days old the average live weight was 134.7, 173.4 and 168.6 g, mean live weight gain 105.9, 141.7 and 139.4 g and feed conversion 5.44, 3.81 and 3.94 kcal/ kg gain, respectively.

In our Experiment, there was a general increase in the value of body weight due to high level of chrome shaving (5%) given to quail chicks up to **134.12 ± 0.29. It is high than above mentioned experiments. The increase in weight gain was because chromium (tannery wastes) is required for hemoglobin synthesis and normal bone formation. It might be reason of weight gain in present study.

The dressing percentage was decreased up to 9th week old chicks of quails. The fat contents of quails also decreased till the 9th week of sampling fat content were decreased while increasing body weight showing the amount of fat was reduced and meat amount was increased. It was due to chromium given in the feed of quail chicks. The moisture contents were decreasing till 9th week of sampling. There was a significant decrease in the moisture contents of quails as the diet (chrome shaving, 5 %level) given to quails. Similarly the value of mineral contents was decreased significantly (5 % level of chrome shaving). It is a significant change in quail body it is due to chromium, which was given in diet in for of chrome shaving. The protein is the main building block of the body as well so as the quail was increasing in size. The protein content of quail also showed an increase in value as protein content increasing up to 55%. There was a significant increase in the protein content of quail as the diet given to quail was high in protein content; quails were increasing in size as its protein content was also increasing.

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Appendix-A: Composition of experimental feeds (Fish Meal VS H.T.S).

Maize	25	25	25	25	25
Wheat	20	20	20	20	20
Rice broken	5	5	5	5	5
Rice polish	8	8	8	8	8
Cotton seed meal	3	3	3	3	3
Rapeseed meal	7	7	7	7	7
Soyabean meal	10	10	10	10	10
Fish meal	16	12	8	4	--
Hydrolysed tannery shaving	--	2.5	5.0	7.5	10
Limestone	1	1	1	1	1
Molasses	3	3	3	3	3
D.C.P	1	1	1	1	1
Vitamin minerals	1	1	1	1	1
Total	**100**	**100**	**100**	**100**	**100**