Research Article

Evaluation of the Comparative Effect of Irradiated and Controlled Feed on the Body Growth of Broiler Chicken

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Abstract | This study was conducted to evaluate the influence of ionizing irradiation supplement diet with replacement of antibiotics in poultry at the level of 5KGy (1Gy= 1 joule/kg). In our study various parameters were analyzed including feed intake, FCR, dressing percentage, weight gain, mortality percentage, weight of goblet and TFT thyroid function test were performed. In this experiment total 9 hundred broiler chicks were purchased from local market and randomly divided into two groups 1 control and 1 irradiated. These groups were further distributed in two more replications with 50 birds per replication using the random treatment design. The findings our study showed that there was no significant influence of feed intake was recorded with irradiation. The results for feed intake of total chick was observed 2652.33±59.45 and 2625.78±16.31g was observed for control and irradiated group, respectively. The results for weight gain was observed significantly higher (P≥0.05) in 1st and 2nd week of study in control group, while the results for weight gain was observed significantly higher in (P≥0.05) irradiated group as compared with control group during the 3rd and 4th week of experiment. The results for overall weight gain for each broiler was recorded significantly higher (P≥0.05) in irradiated group as compared with control group 1349.00±12.59 and 1286.68±21.08g, respectively. In this study the results for feed conversion ratio was observed higher in irradiated group as compared with control group 1.95±0.02 and 2.06±0.05g, respectively. Whereas the overall results for feed conversion ratio was recorded significantly lower (P≥0.05) in irradiated group as compared with control group. The results for feed conversion ratio was observed 5.33% reduced in irradiated group as compared with control one. There was no significant difference was observed in 1st, 2nd, 3rd and 4th week of study. There was no significant difference was recorded for the results of dressing % in control and irradiated group. The findings for mortality % was observed significantly higher in (P≥0.05) in control group as compared with the irradiated group. It has also been seen that there was no any significant difference was recorded in Giblets weight and serum triiodothyronine T3, T4 and TSH of both control and irradiated groups. It has been concluded from the present study that irradiated feed can be used at the place of antibiotics with 5KGy level to decrease the mortality % for achieving maximum body weight, body growth and better FCR with less public health problems.

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Introduction

Poultry meat and eggs not only source of high quality protein, but they are major sources of minerals and vitamins through worldwide. It has been reported that poultry meat, like other meat, milk and eggs contain protein component which are considered as rich quality source of protein. The food stuff received from animal have protein digestibility corrected amino acid Score (PDCAAS) have equal values little bit less that single. Controversially food stuff derived from plant contain relevant quality of protein but have low amount of which are favorable and having reduced in the number of essential amino acid (Companyo *et al*., 2009).

Poultry birds are always on high risk of pathogenic organism through contamination with various modes of transmission. These harmful microorganisms not only reduce the FCR feed conversion ratio of broiler but also effect on the various nutritional component of poultry diet, that may cause low production performance of bird and less economic output for poultry industry. Hot and humid climate favors fungal growth and toxins production, which is the universal problem (Huwig *et al*., 2001). Poultry is very sensitive to aflatoxicosis, affecting its production (Huff *et al*., 1988). Different poultry feed companies add antibiotic in feed as antimicrobial agent at sub therapeutic level for enhancing growth and well-being, but it has been banned by European Union since 2006, because this act has been involved in transfer of harmful drugs residue to consumer (Donoghue, 2003; Companyo *et al*., 2009). The usage of antimicrobial as feed additive might produce favorable environment for resistant bacteria population by interrupting the growth of internal micro flora of bird's body, which contaminate environment and also enters to in feeding system (Diarrassouba *et al*., 2007; Sundin *et al*., 1995), which might cause antibiotic's therapy problem. In this way to reduce the growth of bacteria and contamination, various procedures have been used such as physical and chemical procedures including Gama irradiation method (Ito and Izuka, 1979: Lee *et al*., 2012; Koehler, 1991). During previous four decades different articles has been published on biological and chemical influence on the ionizing irradiation increasing its procedures (Diehl and Josephson, 1994). The Gamma irradiation is latest technology to kill the disease causing pathogen in the feed of broiler. It has been reported that irradiation is a latest technology to improve the safety, quality and trade marketing of poultry feed. It is a techniques which is utilized to expose food with gamma rays through radioactive source like Cobalt-60. It has been reported that these gamma rays can penetrate into feed and its packaging to kill the harmful parasite, bacteria and virus (Caulfield *et al*., 2008). This latest technique is known as the cold pasteurization method as it has no any increase in the level of temperature of treated feed stuff (Loaharan, 2003). This technique improves the growth of chick by decreasing the number of microbes, and nullifying the anti-nutritional factors (Donoghue, 2003; Siddhuraju *et al*., 2002; Yakhkeshi *et al*., 2013). The rapid growth of chicken broilers, the availability of its high-quality meat at low sales prices, and its rapid response to changes in ration composition have increased the researcher's attention to producing chicken meat enriched with functional ingredients (Karalik *et al*., 2018). Antibiotics have been widely used in diets of livestock for many years to control disease and improve production performance (Gaskin *et al*., 2002). However, there is a global trend to reducing their use in poultry feeds to avoid the risk of antibiotic residues in meat and minimize the development of antibiotic resistance (Abdel-Aziz *et al*., 2017; Founou *et al*., 2016; Thanner *et al*., 2016; Venter *et al*., 2017). Therefore, the addition of antibiotics as growth promoters in animal diet has been prohibited. The gamma radiation can also decrease the number of

microorganism and improve the broiler feed, which relatively show positive effect on the production of broiler chick (Zeb *et al*., 2004). Present study was to replace the antibiotics in poultry feed with gamma radiation to reduce the risk of pathogenic microbes in the broiler feed and to investigate the biological effect on the performance of broiler chicks on irradiated containing feed.

Materials and Methods

The coccidiostats and antibiotic free feed of broiler was prepared at Saddiq Brother Feed Mill at Mandra city of Pakistan. Saddiq Brother is famous in the all over the Pakistan having its offices in all over the four provinces. This company not only have feed mills but also produces medicine, vaccinations and various other antibiotics for poultry industry.

Irradiation of feed

The free from antibiotics ration after preparation in the Saddiq brother feed mill was packed in double layer and after that transported to the (PARAS) Pakistan Radiation Services Center Lahore, where the ration was undergone with the treatment of gamma radiation with the dose of 5kG from a Cobalt-60 source installed at Pakistan Radiation Services (PARAS) Lahore Pakistan.

Feeding trail

All the experiment were performed at Nuclear Institute of Food and Agriculture, Peshawar Khyber Pakhtunkhwa, Pakistan situated at Food Division. In this experiment total nine hundred broiler chicks were purchased from local market and randomly divided into two groups 1 control and 1 irradiated. These groups were further distributed in two more replications with 50 birds per replication using the random treatment design. The findings our study showed that there was no significant influence of feed intake was recorded with irradiation. Different partitions were made to avoid mixing of different groups chicks. During the experiment feed and water was provided *ad-libitum* to all chicks. Vaccination schedule was performed according to international recommendations. Feed intake were recorded on routine bases, while the feed conversion ratio and weight gain was observed weekly.

During last stage of research project two broiler birds brought and slaughtered to determine the weight of organs, dressing % and serum level was observed by knowing the T3 triiodothyronine, T4 throxin and Thyroid Stimulating Hormone (TSH) through quantitative determination function of thyroid test concentration chemiluminescence. Present experiment was performed at Poultry shed of Nuclear Institute of Food and Agriculture, Peshawar Food Division for 5 weeks. In this experiment total (900) chicks were purchased from local market of Peshawar and distributed into 2 different group through the complete randomized design block method. These both groups were again in 9 different replications and each replicate contain total 50 chicks. To avoid mixing of bird plastic sheet were utilized for partitioning the group. Water and feed was given ad libitum. Routine wise vaccination process was carried out. Feed intake and water intake was observed daily bases and weight gain and FCR were observed weekly. For T3, andT4 and TSH serum analysis were observed using the method as described by Kozat *et al*. (2008).

Statistical analysis

The collected data was tabulated in computer for statistical analysis. This analysis was done with computer software package of (SAS, 2004).

Table 1: *The overall feed intake, weight gain, FCR feed conversion ratio in 4 weeks.*

Group	Overall feed intake/chick (g)	Overall weight gain/chick (g)	Overall FCR
	Mean ± SE	Mean ± SE	Mean ± SE
Control	2652.33±59.45	1286.68^{b}±21.08	2.06^{a} ±0.05
Irradiated	2625.78±16.31	1349.00^{a}±12.59	1.95^{b} ±0.02
P value	0.6724	0.0219	0.0233

The mean within same column having various superscripts is significantly difference at α = 0.05 level.

Results and Discussion

Feed intake

The results of our study showed that overall mean values for feed intake per bird displayed in Table 1. It was observed that there was no significant impact was observed on the irradiation treatment, whereas only numerically values were found higher mean values for control group. It has been reported that irradiation has no harmful influence in the taste, odor and palatability of meat. The results for palatability of feed have some major concern, it is fact the broiler not only have rudimentary test buds hence they can taste as well as smell that is why major importance in the diet treatment results. Another experiment conducted by

Yakhkeshi *et al.* (2013), he had described that results for feed intake of broiler was not affected through treatment of irradiation at doses rates 3KGy, 5KGy and 7KGy.

Weight gain and FCR Feed conversion ratio

The results for weekly and overall weight gain and feed conversion ration per chick are described in Table 1. The results for overall weight gain and FCR showed significant affect through radiation treatment. The results for total weight gain per chick treated with irradiated group was recorded 4.2% more as compared with control group and feed conversion ratio was reduced at 5.33% in irradiated as compared with the control one. For better performance broiler feed treated on irradiated ration is more likely to used nutrient. Same report given by (Ghazy, 1990; Farag, 1998; Mani and Chandra, 2003), they stated that improve in the OM organic matter, dry matter DM, digestibility, ash and apparent metabolizable energy because of irradiation of various feed ingredients may because of decreased in the few anti nutritional factors caused by irradiation. Liener (1994), stated that various anti nutritional factors such protease inhibitors contain by some plants species which may cause low level of digestibility of protein and cause low performance and growth in animals. Haider (1981), reported that irradiation can decrease the protease inhibitor. Different other anti-nutritional factors such non phytic acid, alpha amylase and non-starch polysaccharides can positively decreased by irradiation methods, that could harm the carbohydrate and protein bioavailability with some types of minerals in animal during the metabolism process (Siddhuraju *et al.*, 2002). Ananthaswamy *et al.* (1970) and Elias and Cohen (1977), stated bear effect of irradiation on the long chain of amino acids which denature them into small pieces, which can be easily digested. It has been reported that it also helps in improving the production performance of broiler. The irradiation also helps in the starch digestion through enhancing the beta and alpha amylase activity. Another study conducted by Campbell *et al.* (1983), that irradiation showed ability to improve the absorption of protein carbohydrate and lipid. Nene *et al.* (1975), reported that irradiated diet showed better amino acid digestion in broiler. Saeman *et al.* (1952) and Sandev (1977), they reported that performance of broiler can be improved with irradiation effect on the anti-nutritional factors in feed, which may improve the digestibility and quality of poultry. It is also reported that irradiation bear the power of broken down of bond and fiber of different feed contents that may help to increase in digestibility. Number countries have different weather conditions such as hot humid which may favor the development of fungus and their toxin production. These toxins mainly influence on the production as well growth of poultry birds. The difference among the findings may be due to various environmental conditions and used of different types of antibiotics (Koehler, 1991). Simas *et al.* (2010), reported that irradiation may have positively effect to destroy myco toxins rapidly and it act as complete sterilized poultry diet supplement. Lim *et al.* (2008), described that irradiation have positive effect on the diet and it can be considered as the improved performance diet. The results of Yakhkeshi *et al.* (2013), described that irradiated poultry ration showed more weight gain and FCR in broiler chicks. Compbell reported that irradiated treated diet contain all digestible nutrient in metabolite form. Hence this diet showed better performance in the form of growth and health status. Similar results displayed by (Gaskin *et al.* 2002), reported higher growth rate with irradiated treated diet as compared with non-irradiated feed. Similar type of findings showed by (Vetern *et al.*, 2017; Thanner *et al.*, 2016) are against, they reported no significant impact of irradiated feed on the broiler performance.

Giblets weight, dressing % and mortality %

The results for gizzard, spleen, liver and heart weight was observed no significant difference among them. The details are given in Table 2. Whereas the numerical values showed slight lower values for irradiated than control one. The findings our study about various carcass parts of broiler including gizzard, spleen, liver and heart weight was observed no significant difference among them. According to results description given in the Table 2. There was slight difference among the numerical values of control and irradiated in which irradiated group showed slight better performance as compared with control group. Findings of our investigation are related with findings of Simas *et al.* (2010), he has reported not significant changes occurred in bursa, gizzard, liver and spleen weight with irradiated ration. Whereas values of present are controversial by the values of Summers *et al.* (1969), who stated that significant decreased in the weight of liver was recorded in irradiated feed including canola meal. The difference among the findings may be due to decreased in the level of glocosinolate percentage content in the canola meal. It has been reported that

Table 2: *Giblets weight, dressing percentage and percent mortality of broiler chicks in irradiated vs. Control group.*

Group	Liver weight g	Heart weight g	Spleen weight	Gizzard weight G	Dressing percentage	% mortality
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Control	51.09±1.69	10.47±0.23	2.65±0.10	31.29±0.85	65.50±1.16	8.67 [a] ±1.11
Irradiated	50.06±1.95	10.69± 0.83	2.16±0.55	30.40 ± 1.02	67.90±0.74	4.45 [b] ±0.65
P value	0.0988	0.0046	0.6929	0.7379	0.0879	0.5146

The mean within similar column have various superscripts has significantly variation at the α level of 0.05

Glocosinolate caused hypertrophy and lesion on the liver of broiler (Gharaghani *et al.*, 2008). The findings of our study showed that there was no significant effect was observed for dressing %in irradiated diet. The details are presented in the Table 2. While the numerical results showed relatively higher values for dressing % in gamma radiation treated than control group. Variation among the findings may because of positive impact of irradiation on the digestibility and nutrient digestion (Campbell *et al.*, 1986). The results of our study as in according to the results of Simas *et al.* (2010), he had observed higher values with gamma rays more than 10 KGy, has positive effect on the dressing % and carcass weight of broiler.

The results for mortality % was observed significantly decreased in irradiated feed as shown the Table 2. Which may because of complete sterilization of feed with radiation (Lim *et al.*, 2008). It has been reportedthat irradiation has removed myco-toxins from poultry feed, that is major problem for poultry farm. Another statement given by (Khan *et al.*, 1990), who had reported that Pakistan has hot and humid weather conditions which are favorable for toxin and fungal growth particularly in cereal grain. In these conditions higher mortality rate was observed in control than irradiated group. Another study was carried out by (Yakhkeshi *et al.*, 2013), he has stated that less mortality % was recorded in irradiated group than control.

Thyroid function test (TFT)

The study showed that irradiation at 5KGy level used in the poultry feed showed no any effect on the blood serum triidothyronine, thyrosin, and thyroid stimulating hormone. The details are presented in Table 3. The findings showed that there was no significant impact on the Thyroid Hormone. The findings of our investigations are in according with the results of Gharaghani *et al.* (2008), who had stated that poultry ration having canola meal irradiated at the level of 10 KGy and 20 KGy feed to broiler showed no effect on the T3 and T4 levels, respectively. The variation among the findings may because different climatic conditions and controlled as well as open yard management poultry system. In similar study the level of T4 was observed decreased at the level of 30 KGy, which may be due to radiolytic by products released by higher dose of irradiations.

Table 3: *T3 (ng/ml), T4 (ug/dl) and TSH (uiu/ml) broiler chicks in irradiated and control groups.*

Group	T3	T4	TSH
	Mean ± SE	Mean ± SE	Mean ± SE
Control	1.19±0.048	63.91±4.092	1.49±0.166
Irradiated	1.21±0.044	65.08±4.1936	1.49±0.174
P values	0.84	0.8477	0.983

Mean having various superscripts showing significant varies values of α = 0.05

Conclusions and Recommendations

According to the results of our study, it was concluded that use gamma irradiation use with the dose of 5 kGy can significantly be replaced with different antibiotics in poultry feed that showed better effect on the body growth, and immune system of broiler. Furthermore, industrial level of research-based studies are required to adopt these technological intervention for better feeding and management system in poultry husbandry.

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Novelty Statement

The study revealed that utilization of irradiations in poultry feed at the palace of antibiotics with 5KGy level to achieve reduction in the mortality percentage and getting maximum body weight as well as better FCR with less public health problems.

Author's Contribution

Midrar Ullah, Nail Chnad and Saqib Kakar: Conceived the idea.
Abdul Kabir: Wrote abstract.
Muhammad Rasheed: Wrote methodology.
Hubdar Ali Kaleri and Rameez Kaleri: Wrote results and discussion.
Mubarak Ali and Deepesh Kumar: Did SPSS analysis.
Syed Asad Ali Shah: Conclusion.
Amir Shahab, Aamir Khan, Raza Ali Mangi and Abdul Wahid Solangi: Technical input.

Conflict of interest

The authors have declared no conflict of interest.

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