International Journal of Science, Environment and Technology, Vol. 5, No 6, 2016, 4622 – 4629
ISSN 2278-3687 (O)
2277-663X (P)

IMPACT OF DIETARY NUCLEOTIDES ON THE PRODUCTION TRAITS OF JAPANESE QUAILS

Prakash S.[1,*], J. Palod[2], R.K. Sharma[2], S.K. Singh[2] and Aravinth A.[3]
[1]Poultry Disease Diagnostic Laboratory, Venkateshwara Hatcheries Private Limited, Tamilnadu, India
[2]Department of Livestock Production Management, GBPUAT, Pantnagar, India
[3]Venkateshwara Hatcheries Private Limited, Tamilnadu, India
E-mail: vetvsp@gmail.com (**Corresponding Author*)

Abstract: A trial was conducted for a period of 6 weeks to evaluate the impact of yeast derived nucleotides on the production performance of Japanese quails. In the trial, 3 day old Japanese quail chicks were randomly distributed in completely randomized design into 4 treatment groups each with 3 replicates of 10 Japanese quails. The Japanese quails of treatment groups T_1 T_2, T_3 and T_4 were provided feed containing 0, 0.25, 0.5 and 0.75 per cent nucleotide respectively. Under similar housing conditions, the birds of all treatment groups were reared in two different phases i.e. starter (1-2 weeks) and finisher (3-6 weeks). During this period, individual body weight, feed spillage and feed intake (on replicate basis) were recorded at weekly intervals. Based on the collected data, average feed intake, body weight gain, feed conversion ratio (FCR) and performance index were calculated. The results of the experiment revealed that inclusion of dietary nucleotide at 0.5 percent level decreases the average feed intake and FCR and improves the body weight gain and performance index. From the results, it is concluded that nucleotide supplementation in the feed enhances the growth and production performance of Japanese quail.
Keywords: Nucleotide supplementation, 0.5 per cent, Growth, FCR.

INTRODUCTION

In the present poultry production, feed cost occupies the major portion of recurring investment. Optimal feed formulation and inclusion of unconventional feed ingredients have been practiced to reduce the feed cost. Also addition of various enzymes, probiotics and prebiotics favours proper utilization of feed at bird level and thereby reduce required nutrient density and feed cost. Strengthening the gut integrity of birds is one of the ways for better assimilation of nutrients in feed. Various non-nutrient feed additives or growth promoters have been developed to improve gut integrity and eventually increase production performance. Of these, dietary nucleotides are emerging as one of the potential feed additives because of their ability in enhancing the villous growth of intestine.

*Received Nov 24, 2016 * Published Dec 2, 2016 * www.ijset.net*

Nucleotides are the monomers and building blocks of nucleic acids and are therefore necessary for the cell replication. Although biosynthetic pathways produce nucleotides internally, they are energy expensive and inefficient to supply huge demand of additional nucleotides required for cell proliferation during the times of extraordinary stress such as growth, reproduction, environmental change or challenge, combat disease and recovery from injury. As a result the affected or compromised birds reduce their performance or slow down development. Research studies suggest that dietary nucleotide deficiency may impair liver, heart, intestine and immune functions (Grimble and Westwood, 2000) as they are inadequate to synthesis nucleotides by their own. The increased demand in combination with relatively slow supply of nucleotides by the bird itself may result in the need for extra nucleotides added directly to the poultry diet. Therefore, provision of easily available nucleotides through diet helps in the growth of these rapidly dividing cells without the expense of energy and thereby improves the productivity in birds. Looking to the role of nucleotides present investigation was undertaken to study the effects of dietary nucleotide supplementation on production performance in Japanese quails.

MATERIAL AND METHODS

The study was conducted in Instructional Poultry Farm (IPF), College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (U.S. Nagar), Uttarakhand for a period of six weeks in which one hundred and twenty, three day old unsexed and graded red plumaged Japanese quails (*Coturnix coturnix Japonica*) were divided into four treatment groups (T_1, T_2, T_3 and T_4) with 3 replicates and each replicate having 10 Japanese quails in a completely randomized design (CRD). Nucleotide in the form of yeast extract (Nucleoplus) was procured from A.A. Biotech Pvt. Ltd., Chennai. The supplement was added at graded levels through feed and given to different groups. In the experiment, the treatment T_1 served as control in which feed was offered devoid of nucleotide supplementation while T_2, T_3 and T_4 groups were given nucleotide in the form of yeast extract at the levels of 0.25, 0.5 and 0.75 per cent respectively.

In the trial period, feed was provided in two different phases to the quails i.e. starter (1-2 weeks) and finisher (3-6 weeks). The quail chicks were reared in deep litter system with similar housing and managemental conditions for different treatment groups. Feed and water were provided *ad lib* to the chicks throughout the feeding trial period of 42 days. During the entire trial period, individual body weight, feed spillage and feed intake (on replicate basis)

were recorded at weekly intervals under two phases i.e. I and II week (Starter period), III - VI week (Finisher period).

Based on the above collected data affected by dietary nucleotide supplementation on Japanese quails, growth parameters were studied under following heads for starter, finisher and overall period.

i. Feed intake
ii. Body weight gain
iii. Feed conversion ratio - FCR
iv. Performance index – PI (Bird, 1955).

Statistical Analysis

All the observations recorded in this study were subjected to statistical analysis using one way ANOVA technique described by Snedecor and Cochran (1994). Differences between group means were considered significant at $P < 0.05$.

RESULTS

The growth performance of experimental chicks of Japanese quails with respect to feed intake, body weight gain, feed conversion ratio and performance index was calculated at weekly interval for starter period, finisher period as well as overall basis.

Feed Intake

The average feed consumption of Japanese quails in this experiment obtained at weekly interval as well as overall basis is presented in Table 1.

During the starter period, feed intake of the birds were significantly ($P < 0.05$) reduced with increase in concentration of nucleotides in the feed. The highest and lowest feed intake were recorded in quail chicks of T_1 (92.55 ± 0.64 g) and T_4 (80.17 ± 0.64 g) groups respectively. During the finisher period, T_2 group Japanese quails consumed significantly ($P < 0.05$) lower feed (613.06 ± 2.48 g) compared to other groups. For overall period, all the supplemented groups showed significant ($P < 0.05$) reduction in the feed intake compared to the control. Feed intake of T_1 group quails was maximum (719.46 ± 5.27 g) and significantly ($P < 0.05$) higher while that of T_2 group (697 ± 2.27 g) was minimum.

Body weight gain

Effect of supplementation of yeast extract enriched with nucleotides on body weight gain of Japanese quails for a period of six weeks in this experiment is depicted in Table 1.

During the starter period, the weight gain of T_3 group quails was significantly ($P < 0.05$) higher than the quails of other groups. There was no significant difference in the weight gain

of Japanese quails among other treatment groups. During finisher period, significant ($P < 0.05$) increase in weight gain was noted in Japanese quails of supplemented groups as compared to the T_1 (control) group. Maximum (117.26 ± 0.16 g) weight gain was noted in quails of T_4 group which was statistically similar to that of T_3 group. Minimum (109.43 ± 0.60 g) and significantly ($P < 0.05$) lower weight gain compared to the supplemented groups was noted in quails of control group. For overall period, the weight gains of quails of different treatment groups were significantly different amongst each other. Maximum weight gain (166.10 ± 0.57 g) was noted in the T_3 group quails fed with 0.5 per cent of supplement, whereas minimum weight gain (157.01 ± 0.49 g) was observed in quails of control group.

Feed conversion ratio

The data on feed conversion ratio (FCR) of Japanese quails calculated at weekly intervals as well as on over all basis have been summarized in Table 1.

During starter period, minimum (1.68 ± 0.01) FCR was noted in the T_3 group quails which was statistically similar to the FCR of T_4 group. Maximum (1.95 ± 0.02) and significantly ($P < 0.05$) higher FCR was noted in the quails of T_1 group. During finisher period, FCR of nucleotide supplemented groups were significantly ($P < 0.05$) lower than the control and best result was observed in the T_4 group (5.30 ± 0.01) quails. The overall average FCR of control group quails was maximum (4.58 ± 0.04) and significantly ($P < 0.05$) higher compared to the supplemented groups. Statistically similar FCR results were noted between the T_3 and T_4 groups during this period. Minimum FCR (4.26 ± 0.02) was noted in quails of T_3 group.

Performance index

The data pertain to the performance index of Japanese quails during this experiment have been summarized in Table 1.

During starter period, Japanese quails of supplemented groups showed significantly ($P < 0.05$) better performance index compared to the control group. Significantly higher and maximum (29.24 ± 0.41) and significantly lower and minimum (24.47 ± 0.31) performance index were observed in the T_3 and T_1 group Japanese quails, respectively.

In the finisher phase, the performance indexes of supplemented groups were significantly higher than the control (19.11 ± 0.24) group. Among the supplemented groups, Japanese quails of T_4 group showed best performance index (22.12 ± 0.06) whereas lower performance index was observed in T_2 group (20.73 ± 0.16). The overall performance during the entire period was significantly ($P < 0.05$) higher in the Japanese quails provided

nucleotides compared to the control group. Maximum (38.95 ± 0.36) and significantly higher performance index was observed in T_3 group quails which was statistically similar to that of T_4 group, whereas minimum (34.27 ± 0.32) performance index was observed in the T_1 group quails.

DISCUSSION

Feed intake

In the feeding trial, the feed intakes of groups supplemented with nucleotides were lower than the control. These findings are in agreement with Garcia *et al.* (2007) who also noted significant reduction in the feed intake of broilers supplemented with 0.5 per cent nucleotide / kg of feed during the starter period. In contrast to the results of present investigation, Domeneghini *et al.* (2004) found no significant difference in feed intake of piglets due to the supplementation of glutamine and nucleotides. Puig *et al*. (2007) and Pelicia *et al.* (2010) also noted no significant effect of nucleotide supplementation in piglets and broilers.

As nucleotides in the feed source are tremendously stable to digest, availability of nucleotide in easily digestible (free form) form and additional nutrients in the supplement may spare the energy for the metabolism in intestine and liver (Lo´pez-Navarro *et al.* 1995) and it may attribute to the reduction in feed intake of the Japanese quails of treatment group.

Body weight gain

Findings of the present investigation in both of the experiments regarding effect of nucleotide supplementation on weight gain revealed that maximum weight gain for overall period was noted in quails supplemented with 0.5 per cent nucleotide / kg of feed and weight gain was improved by all the levels of dietary nucleotide supplementation. These findings corroborated with those of Garcia *et al.* (2007) who found 1.6 per cent improvement in body weight gain of chicken supplemented 500 mg of nucleoforce / kg of feed. Shankar *et al.* (2012) reported same results in prawn. Jung and Batal (2012) found that inclusion of nucleotides increased weight gain of broilers under stress condition.

During the period of growth, nucleotides are required in larger amount for cell replication. External supplementation of the nucleotide in the present investigation helped to meet the nucleotide requirement for the fast growth. Also, enhanced growth of the intestinal villus and enterocyte maturation aided by the nucleotide supplementation (Uauy et al., 1990) increases the surface area and anabolic effect of intestinal mucosa which in turn provides the substrates

essential for the rapid growth. Probably, this may be the reason for the improved weight gain in Japanese quails of nucleotide supplemented groups.

FCR

In regard to FCR, nucleotide supplemented groups showed better results during starter, finisher and overall period on both the experiments. The capacity of dietary nucleotides to increase the intestinal surface area, villous height, mucosal protein and brush border enzyme activities (Uauy et al., 1990) resulted in the better assimilation of nutrients and therefore lowers feed to gain ratio. Similar trend for FCR were recorded by Garcia *et al.* (2007) who found 1.9% difference in feed to gain ratio of broilers supplemented with 500 mg of nucleotide / kg of feed. The results of Jung and Batal (2012) also supported the beneficial effect of nucleotide supplementation in the birds under stress condition. However, in contrast to the findings of present experiment, Pelicia *et al.* (2010) found no significant difference in the FCR of broilers supplemented with nucleotides in the feed. Similarly, Domeneghini *et al.* (2004) in their experiment found no significant difference on feed conversion ratio of piglets supplemented with glutamine and nucleotides. The reason may be the difference in level of nucleotide or species difference.

Performance Index

From the results of both experiments, it is clearly revealed that the groups fed with nucleotide supplement showed better and significantly higher performance index compared to the control. Best performance index for overall period was noted in Japanese quails of 0.5 per cent nucleotide supplemented group. Effect of nucleotide supplementation on performance index of Japanese quails and other poultry species has not been studied. Therefore, literature pertaining to this aspect is scanty, rather more experimentation on other aspects of growth have been documented in the literature. The predominant mechanism involved in the improved performance is the role of nucleotide in better intestinal growth which increases the nutrient absorption and is thus responsible for better performance.

CONCLUSION

From results of the experiment, it is concluded that the supplementation of nucleotides as yeast extract at 0.5 per cent level enhanced the production performance of Japanese quails by improving the intestinal morphology. Further studies on layer and broiler chicken, Japanese quail layers and other poultry species are recommended.

Table 1: Effect of nucleotide supplementation on production performance of Japanese quails

Period	Parameter	Treatment			
		T_1	T_2	T_3	T_4
Starter (I –II Weeks)	**Avg. feed intake (gm)**	$92.55^{a} \pm 0.64$	$84.59^{b} \pm 0.36$	$82.24^{c} \pm 0.47$	$80.17^{d} \pm 0.64$
	Body weight gain (gm)	$47.58^{b} \pm 0.14$	$47.28^{b} \pm 0.16$	$49.04^{a} \pm 0.33$	$47.06^{b} \pm 0.49$
	FCR	$1.95^{a} \pm 0.02$	$1.79^{b} \pm 0.01$	$1.68^{c} \pm 0.01$	$1.70^{c} \pm 0.02$
	Performance Index	$24.47^{c} \pm 0.31$	$26.43^{b} \pm 0.21$	$29.24^{a} \pm 0.41$	$27.63^{b} \pm 0.55$
Finisher (III-VI Weeks)	**Avg. feed intake (gm)**	$626.91^{a} \pm 4.70$	$613.06^{b} \pm 2.48$	$626.09^{a} \pm 1.41$	$621.66^{ab} \pm 0.58$
	Body weight gain (gm)	$109.43^{c} \pm 0.60$	$112.72^{b} \pm 0.23$	$117.06^{a} \pm 0.35$	$117.26^{a} \pm 0.16$
	FCR	$5.73^{a} \pm 0.05$	$5.44^{b} \pm 0.03$	$5.35^{bc} \pm 0.03$	$5.30^{c} \pm 0.01$
	Performance Index	$19.11^{c} \pm 0.24$	$20.73^{b} \pm 0.16$	$21.89^{a} \pm 0.18$	$22.12^{a} \pm 0.06$
Overall (I–VI Weeks)	**Avg. feed intake (gm)**	$719.46^{a} \pm 5.27$	$697.65^{c} \pm 2.27$	$708.34^{b} \pm 1.68$	$701.83^{bc} \pm 1.17$
	Body weight gain (gm)	$157.01^{d} \pm 0.49$	$160.00^{c} \pm 0.08$	$166.10^{a} \pm 0.57$	$164.32^{b} \pm 0.41$
	FCR	$4.58^{a} \pm 0.04$	$4.36^{b} \pm 0.02$	$4.26^{c} \pm 0.02$	$4.27^{c} \pm 0.01$
	Performance Index	$34.27^{c} \pm 0.32$	$36.70^{b} \pm 0.16$	$38.95^{a} \pm 0.36$	$38.47^{a} \pm 0.15$

* $P < 0.05$

REFERENCES

[1] Bird, J.M. 1955. 'Performance Index' of growing chicken. Poultry Science 34: 1163-1164.

[2] Domeneghini, A.; Giancamillo, A.D.; Savoini, G.; Paratte, R.; Bontempo, V. and Dell'Orto, V. 2004. Structural patterns of swine ileal mucosa following L-glutamine and nucleotide administration during the weaning period. A histochemical and histometrical study. Histology and Histopathology 19: 49-58.

[3] Garcia, E.E.; Puig, M.; Borda, E. and Chetrit, C. 2007. Efficacy of a nucleotide preparation in broiler chickens. *In*: Proceedings of the 16th European Symposium on Poultry Nutrition, Strasbourg, France, 26-30 August, 2007. pp. 511-514.

[4] Grimble, G.K. and Westwood, O.M.R. 2000. Nucleotides. In: German, J.B. and Keen, C.L. (Eds.), Nutrition and Immunology: Principles and Practice. Humana Press Inc., Totowa, NJ, USA, pp. 135– 144.

[5] Jung, B. and Batal, A.B. 2012. Effect of dietary nucleotide supplementation on performance and development of the gastrointestinal tract of broilers. British Poultry Science 53(1): 98-105.

[6] Lo´pez-Navarro, A.T., Gil, A., Sa´nchez-Pozo, A., 1995. Deprivation of dietary nucleotides results in a transient decrease in acidsoluble nucleotides and RNA concentration in rat liver. Journal of Nutrition 125, 2090–2095.

[7] Pelícia, V.C.; Sartori, J.R.; Zavarize, K.C.; Pezzato, A.C.; Stradiotti, A.C.; Araujo, P.C.; Mituo, M.A. O. and Madeira, L.A. 2010. Effect of nucleotides on broiler performance and carcass yield. Brazilian Journal of Poultry Science 12 (1): 31 – 34.

[8] Puig, M.; Manzanilla, E. G.; Morales, J.; Borda, E.; Pérez, J. F.; Piñeiro, C. and Chetrit, C. 2007. Dietary nucleotide supplementation reduces occurrence of diarrhoea in early weaned pigs. Livestock Science 108: 276-279.

[9] Shankar, R.; Murthy, H.S.; Sujatha, H.R.; Jayaraj, E. G.; Tejpal, C.S. and Chinthamani, V.S. 2012. Effect of nucleotide on growth, immune responses and resistance of *Macrobrachium rosenbergii* (De Man) to *Macrobrachium rosenbergii* nodavirus (MrNV) and extra small virus (XSV) and Aeromonas hydrophila infection. Aquaculture International 20:1–12.

[10] Snedecor, G. W. and Cochran, W. B. 1994. *Statistical Methods.* 8th Edn. The Iowa State University Press, Ames, IOWA, USA.

[11] Uauy, R., Stringel, G., Thomas, R. and Quan, R. 1990. Effect of dietary nucleosides on growth and maturation of the developing gut in the rat. Journal of Pediatric Gastroenterology and Nutrition 10: 497–503.