DISCUSSION
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Feed consumption

The mean values of feed consumption in 100 days per bird were 13.60 ± 6.35, 13.67 ± 6.01, 13.70 ± 5.49 and 13.67 ± 3.92 kg in group I, II, III and IV, respectively. The analysis of variance showed significant (P<0.01) difference between different groups of birds. Similar observation were reported by Tomar et al. (1995) who fed feed Liv 52 as feed additives to poultry. Significantly higher feed consumption in layers fed on Livfit vet premix in the ration had also been recorded by Verma (1997) and Yadav (1997), Babu et al. (1988) also made similar findings by feeding Tefroli to the broilers.

Egg production

The egg production per bird in 100 days were 37.00 ± 0.40, 39.00 ± 0.36, 40.00 ± 0.34 and 39.00 ± 0.32 egg in group I, II, III and IV, respectively. The analysis of variance reveals that the group III was significantly superior to other groups of birds. Increased egg production in experimental groups may be due to feeding of stresroak. The present finding is in close agreement with that of Verma (1997), who fed Liv fit vet premix in diet of white plymouth rock.

Similar findings were also observed on layers by feeding Livol drugs (Mallikarjunappa, 1992) and Liv fit vet premix (Yadav, 1997).
Feed conversion efficiency

The mean value of feed conversion efficiency ranged from $344.07 \pm 3.19$ to $369.84 \pm 4.78$ g. The lowest feed conversion efficiency was observed in treatment group over control group because of more egg production due to stressroak treatment as compared to control group. Similar observations were reported by Singh et al. (1993) who fed Shatawari feed additive to the layers. Biological trials of herbal formulation used as growth promoters in broilers have established beyond doubt the improved overall performance with regard to weight gain, feed efficiency and lower mortality as reported by many investigators, (Devegowda, 1996; Ramappa et al., 1975; Rao and Reddy, 1986; Devegowda et al., 1990; Devegowda and Arvind, 1996). Similar results was reported by Verma (1997) in broiler. Better feed conversion efficiency had been noticed in broiler chicken fed an Ashwagandha root powder (Mishra, 1997) and Liv 52 powder (Prasad and Singh, 1982) in feed on the contrary, Sanchez et al. (1985) reported no significant difference between groups in feed conversion in fowl.

Age at laying of first egg

The mean age at the first egg laying were $207.72 \pm 1.77$, $209.44 \pm 1.47$, $208.28 \pm 1.43$ and $207.84 \pm 1.34$ day in group I, II, III and IV, respectively. All the groups showed non-significant differences (Table 2d). Similar observations were recorded by Verma (1997) and Yadav (1997).
Body weight at laying first egg (g)

This observations were recorded in the very beginning during the experimental period when the birds starts laying their first eggs. It was found to be no significant differences among all the groups. The minimum body weight at the first egg laid was 2016 g in group IV while the group I showed maximum of 2172 g.

Digestibility coefficient of dry matter

The digestibility coefficient of dry matter was the highest in group III (68.31 ± 0.10) and minimum in group I (67.00 ± 0.15). The analysis of variance showed significant (P <0.01) difference between different groups of birds. Similar observations were noticed by Verma (1997) who fed Livfit vet premix in broilers ration. The present finding is also substantiated by that of Yadav (1997). Contrary to these, Petukhova et al. (1992) observed that use of Gaprin in chicken diet slightly depressed digestibility of dry matter.

Digestibility coefficient of organic matter

The digestibility coefficient of organic matter was highest in group III (69.73 ± 0.10) and minimum in group I (68.63 ± 0.08). The analysis of variance indicates significant (P <0.01) difference between different groups of birds. Petukhova et al. (1992) observed that the use of Gaprin in chickens, slightly depressed the digestibility of organic matter. Verma (1997) and Yadav (1997) reported significant difference in organic matter digestibility.
Digestibility coefficient of carbohydrate

The digestibility coefficient of carbohydrate was highest in group III (72.35 ± 0.09) and minimum in group I (71.34 ± 0.07). The analysis of variance showed significant (P <0.01) difference between different groups of birds. The present findings is closely corroborated with those of Yadav (1997) and Verma (1997).

Digestibility coefficient of crude protein

The digestibility coefficient of crude protein was the highest in group III (62.29 ± 0.12) and minimum in group I (60.88 ± 0.10). Statistically, highly significant (P <0.01) difference was observed between different groups of birds. Yadav (1997) and Verma (1997) fed Livfit vet premix in layers and broilers ration they found significant (P <0.01) difference in the digestibility of crude protein in various group of birds, similar to the present findings. In contrast, Petukhova et al. (1992) observed that use of Gaprin in chicken diet slightly depressed digestibility of crude protein. However, Mudalgi et al. (1993) fed probiotic in broilers ration and found non-significant difference in the digestibility of crude protein in various group of birds.

Digestibility coefficient of crude fat (EE)

The digestibility coefficient of crude fat was the highest in group III (57.83 ± 0.14) and minimum in group I (56.28 ± 0.11). The analysis of variance showed significant (P <0.01) difference between different groups of birds. Yadav (1997) and Verma (1997) reported that highly significant (P <0.01) difference in Livfit vet premix fed group in layers and broilers. Contrary to the present findings,
Petukhova et al. (1992) observed that the use of Gaprin in chickens, slightly depressed the digestibility of ether extract.

Nitrogen balance

Nitrogen balance were $1.42 \pm 0.08$, $1.48 \pm 0.07$, $1.51 \pm 0.07$ and $1.47 \pm 0.05$ g/d in group I, II, III and IV, respectively. Analysis of variance (Table 4b) showed highly significant ($P < 0.01$) difference among various groups of birds. Similar observations were reported by Yadav (1997) in White leghorn birds fed on Livfit vet premix in ration.

Calcium balance

The calcium balance was observed maximum in group III followed by group II, IV and I. The differences were significant among various groups of birds (Table 4d). Takalikar et al. (1992) observed that the feeding of probiotic in broiler ration kept calcium balance almost similar but its retention was higher in probiotic fed group than control. Significant difference in calcium balance were observed by Yadav (1997) and Verma (1997), who fed Livfit vet premix in layers and broilers.

Phosphorus balance

The phosphorus balance of $0.11 \pm 0.01$, $0.13 \pm 0.01$, $0.14 \pm 0.02$ and $0.12 \pm 0.01$ g/d was noticed in group I, II, III and IV, respectively. Analysis of variance (Table 4f) revealed significant difference in phosphorus balance between different groups of birds. Takalikar et al. (1997) reported that feeding of probiotic in broiler ration kept phosphorus balance almost similar but its retention was higher in probiotic fed group than control group. Yadav (1997) also observed
that the significant difference in phosphorus balance between different groups of birds.

**Egg quality measurement**

**External egg quality**

**Egg weight**

The mean values of egg weight were 45.00 ± 0.43, 45.00 ± 0.63, 44.00 ± 0.63 and 44.00 ± 0.50 g in group I, II, III and IV, respectively. There was no significant differences among various groups of birds (Table 5a). Similar observation was reported by Verma (1997) in broiler ration at the different levels of Liv fit vet premix. However, Sud (1982) reported that the egg weight was significantly decreased by use of feed additive Liv 52 at different levels.

**Egg length**

The mean values of egg length for group I, II, III and IV were 55.93 ± 0.36, 55.70 ± 0.42, 53.46 ± 0.67 and 55.59 ± 0.34 mm, respectively. Egg length decreased in treated group when compared with control group. The analysis of variance showed significant difference in various groups of birds. Similar observation were reported by Yadav (1997).

**Egg width**

The mean values of egg width for group I, II, III and IV were 41.54 ± 0.25, 41.80 ± 0.26, 40.72 ± 0.24 and 41.09 ± 0.24 mm, respectively. A analysis of variance revealed that significant
difference in various groups of birds. Similar observation had been noticed by Yadav (1997) in white leghorn birds.

**Egg shell thickness**

The mean values of egg shell thickness were $0.23 \pm 0.01$, $0.25 \pm 0.02$, $0.25 \pm 0.01$ and $0.25 \pm 0.01$ mm in group I, II, III and IV, respectively. The analysis of variance (Table 5b) showed highly significant ($P < 0.01$) difference in various groups of birds. Our findings are similar with those of Verma *et al.* (1995) and Yadav (1997), who reported that the shell thickness was significantly higher in treated group than control group.

**Shell membrane thickness**

The egg shell membrane thickness was similar in all groups of birds. There was no significant difference among various groups of birds as reported by Verma (1997).

**Shell weight**

The mean values of shell weight were observed as $5.39 \pm 0.23$, $5.37 \pm 0.13$, $5.93 \pm 0.10$ and $5.76 \pm 0.14$ grams in group I, II, III and IV, respectively. Analysis of variance showed significant ($P < 0.05$) difference in various groups of birds. The present finding is comparable with that of Verma *et al.* (1995) who fed Liv 52 powder in feed of white leghorn birds. Yadav (1997) also reported significant difference in shell weight in Livfit vet premix fed group as compared to control group.
Shape index

The average shape index had been recorded as 74.32 ± 0.56, 75.08 ± 0.46, 76.36 ± 0.84 and 73.95 ± 0.57 in group I, II, III and IV, respectively. The significant differences noticed in the present study in shape indices in all groups of birds are in close agreement with the report of Yadav (1997).

Internal egg quality

Yolk weight

The mean values of yolk weight were 13.36 ± 0.33, 14.65 ± 0.32, 15.56 ± 0.39 and 15.31 ± 0.39 g in group I, II, III and IV, respectively. The analysis of variance showed significant (P <0.01) differences among different groups of birds. Perusal of Table 6 indicated that the egg yolk weight was improved by use of stresroak in broiler. The present finding was supported by the work of Mohan and Kadirval (1991) and Yadav (1997).

Yolk index

The mean values of yolk index for group I, II, III and IV were 44.84 ± 0.51, 46.75 ± 0.80, 46.91 ± 0.55 and 45.64 ± 0.50, respectively. No significant differences in Yolk indices among the groups had been observed as in the study of Verma (1997).

Albumen weight

The albumen weights were 28.78 ± 1.07, 29.73 ± 0.87, 30.39 ± 0.61 and 29.27 ± 0.52 gm in group I, II, III and IV, respectively. Analysis of variance showed no significant difference in treated and control group. Verma et al. (1995) observed that the albumen weight is free
from the effect of the treatment of Liv 52 in the ration of layers. Similar result was also found by Verma (1997) in broilers.

Albumen index

The mean values of albumen index for groups, I, II, III and IV were 11.59 ± 0.21, 11.76 ± 0.21, 11.30 ± 0.23 and 11.11 ± 0.24, respectively. The albumen index was not affected by treatment. Verma et al. (1995) reported that albumen index had not been affected by feeding of Liv 52. In the study of Verma (1997) also no significant difference in albumen indices among the groups was observed.

Haugh unit score

The mean values of haugh unit score for groups, I, II, III and IV were 88.66 ± 0.65, 89.26 ± 0.64, 86.79 ± 0.82 and 86.87 ± 0.79, respectively. Perusal of the (Table 6e) reveals that the haugh unit score differed significantly among the groups of birds. Similar results had also been noticed by Yadav (1997) in white leghorn birds fed on different levels of Livfit vet premix in the diet.

Blood metabolites

Haemoglobin

The average values of haemoglobin were 10.52 ± 0.17, 16.00 ± 0.07, 12.82 ± 0.12 and 12.12 ± 0.09 g/100 ml in group I, II, III and IV, respectively. The haemoglobin value was significantly higher in treatment groups as compared to control group. Similar findings were also reported by earlier workers (Joshi et al., 1987; Verma et al., 1995) and Yadav, 1997).
Haematocrit value

The haematocrit value was found to be significant among all the groups (Table 7b). The minimum haematocrit value was $28.62 \pm 0.17$ per cent in group I while group III showed the maximum haematocrit value of $30.66 \pm 0.14$ per cent. The highest mean haematocrit value recorded in group III may be due to 2.5 ml of stresroak. Similar results has been reported by Verma (1997).

Packed cell volume (PCV%)

The average PCV of $29.90 \pm 0.10$, $45.56 \pm 1.44$, $38.28 \pm 0.13$ and $37.12 \pm 0.11$ per cent had been observed in group I, II, III and IV, respectively. The PCV was significantly higher ($P <0.01$) in group II than the groups III, IV and I. Similar observations were reported by Ibrahim et al. (1992) and Baidya et al. (1994). Significant difference was observed by Yadav (1997) and Verma (1997) in PCV per cent between the treatment and control groups. However, in the study of Mandal et al. (1994) no significant differences were noticed in the PCV per cent by use of different growth promoters.

T.L.C.

The average TLC was higher in group III ($28.19 \pm 0.12$ thousand/Cu mm) while group II recorded the minimum TLC ($27.76 \pm 0.12$ thousand/Cu mm). The present findings of non-significant differences among the various groups in their TLC per cent is corroborated with that of Mandal et al. (1994).
Lymphocyte

The mean values of lymphocyte were 63.60 ± 0.50, 58.40 ± 0.50, 58.80 ± 0.48 and 58.60 ± 0.50 per cent in group I, II, III and IV, respectively. The analysis of variance (Table 7e) showed significant differences among different groups of birds. Similar results have been reported by Yadav (1997) and Verma (1997).

Neutrophils

The average neutrophils of 34.40 ± 0.50, 38.40 ± 0.50, 36.60 ± 0.50 and 40.00 ± 0.44 per cent were observed in group I, II, III and IV, respectively. The neutrophil percentage was significantly higher (P <0.01) in group IV than the groups II, III and I (Table 7f). All the treated groups had significantly higher neutrophil than control group. Verma (1997) reported significantly higher neutrophil in Livfit vet premix fed groups than the control groups. This view was also supported by Yadav (1997).

Eosinophils

The eosinophil counts was 2.01 ± 0.02, 2.02 ± 0.02, 1.91 ± 0.02 and 1.96 ± 0.02 per cent in group I, II, III and IV, respectively. The eosinophil per cent was significantly higher in group II followed by group I, IV and III (Table 7g). Similar observations were recorded by Yadav (1997) and Verma (1997).

Basophil

The average basophil was observed as 1.72 ± 0.02, 1.79 ± 0.01, 1.85 ± 0.02 and 1.81 ± 0.02 per cent in group I, II, III and IV, respectively. There was significantly higher (P <0.01) basophil per...
cent in group III than the groups IV, II and I. The present finding was supported by Yadav (1997) and Verma (1997).

Monocyte

The monocyte count of 4.66 ± 0.05, 5.04 ± 0.05, 5.28 ± 0.08 and 5.20 ± 0.07 per cent had been noticed in group I, II, III and IV, respectively. The analysis of variance indicates significant (P <0.01) differences among the different groups of birds. The view of present finding was in concordance with those of Yadav (1997) and Verma (1997).

R.B.C.

The mean values of R.B.C. were 3.30 ± 0.07, 4.08 ± 0.12, 3.60 ± 0.07 and 3.70 ± 0.07 million/Cu mm in groups I, II, III and IV, respectively. The present study indicated that an increase in the level of stress in drinking water, resulted significantly increased the R.B.C. Joshi et al. (1987) and Verma et al. (1995) revealed that the RBC content increased significantly by using the liver stimulant Liv 52. Similar observations were also reported by Ibrahim et al. (1992); Yadav (1997) and Verma (1997).

W.B.C.

The mean values of W.B.C. were 24.20 ± 0.37, 25.00 ± 0.31, 27.20 ± 0.37 and 26.80 ± 0.37 thousand/cubic mm in group I, II, III and IV, respectively. The present study indicated that an increase in the stress in drinking water, resulted in increase of W.B.C. The present finding was supported by that of Verma (1997).
Total serum protein

The average values of total serum protein were $4.21 \pm 0.05$, $3.98 \pm 0.04$, $4.52 \pm 0.01$ and $4.24 \pm 0.02$ g/100 ml in groups I, II, III and IV respectively. Total serum protein was significantly higher ($P < 0.01$) in group III than the groups IV, I and II. Joshi et al. (1987) and Verma et al. (1995) observed an increase in total serum protein concentration in blood by feeding liver stimulant Liv 52. Similar observations were reported by Yadav (1997) and Verma (1997).

Glucose

The mean values of glucose for groups I, II, III and IV were 260.18 + 0.73, 182.08 + 0.43, 203.18 + 0.94 and 139.52 + 0.40 mg/100 ml, respectively. The total glucose content was significantly higher ($P < 0.01$) in group I than the group III, II and IV (Table 7m). The present findings were supported by Prasad et al. (1994); Yadav (1997) and Verma (1997).

Cholesterol

The mean values of cholesterol for groups I, II, III and IV were 152.5 + 0.79, 166.26 + 0.46, 181.64 + 0.84 and 170.3 + 0.62 mg/100 ml, respectively. The cholesterol value was significantly higher in control group than treatment groups (Table 7n). Joshi et al. (1987); Yadav (1997) and Verma (1997) reported significantly decrease cholesterol level in treated groups as compared to corresponding control groups.

Serum calcium

The mean values of serum calcium were observed as $22.26 \pm 0.09$, $23.27 \pm 0.15$, $23.80 \pm 0.08$ and $23.55 \pm 0.22$ mg/100 ml in groups I,
II, III and IV, respectively. All the treated groups were significantly higher than the control group (Table 70). The present findings were supported by those of Yadav (1997) and Verma (1997).

Serum phosphorus

The perusal of the (Table 7) reveals that serum phosphorus was maximum in treated group III (10.08 ± 0.10 mg/100 ml) while the lowest was found in control group I (8.68 ± 0.05 mg/100 ml). Serum phosphorus value of blood sample increased with the treatment levels with significant differences. Similar observations were reported by Yadav (1997) and Verma (1997).

Enzyme activity of blood

SGPT

The activity of SGPT was higher in group IV (27.26 ± 1.00 unit) whereas, significantly minimum SGPT was observed in control group I (22.62 ± 0.41 units). Similar to the present findings, significantly higher SGPT in treated group was observed by Yadav (1997) and Verma (1997). However, Shridharan et al. (1984); Ibrahim et al. (1992) and Baidya et al. (1994) reported that the SGPT did not different significantly among different treatments by feeding on Antibiotic and probiotic.

SGOT

The average SGOT levels were 21.96 ± 0.26, 20.12 ± 0.78, 25.94 ± 0.80 and 23.72 ± 0.61 units in groups I, II, III and IV, respectively. There was significantly higher (P <0.01) SGOT in group III followed by group IV, I and II. Ibrahim et al. (1992) worked out SGOT and
noted increased content in treatment groups by use of *Azadirachta indica* leaves in chicken diet. Our findings is also in close agreement with those of Yadav (1997), and Verma (1997) who observed significantly higher SGOT in Livfit vet premix groups. On the contrary, no significant difference, in SGOT levels between the group fed with antibiotic in broiler diet and control group had been noticed (Baidya *et al.*, 1994).

**Alkaline phosphatase**

The mean values of alkaline phosphatase groups I, II, III and IV were $6.30 \pm 0.07$, $6.15 \pm 0.06$, $8.06 \pm 0.23$ and $6.82 \pm 0.17$ I.U./L, respectively. Alkaline phosphatase activity was numerically higher in group III than the groups IV, I and II. Similar to the present findings, Ibrahim *et al.* (1992) observed that the alkaline phosphatase for increased by use of *Azadirachta indica* leaf in chicks diet. Similar result was also reported by Yadav (1997) and Verma (1997). However, Shridharan *et al.*, 1984) observed low level of alkaline phosphatase in the treated dogs with herb and Liv- 52 after experimentally induced liver damage with carbon tetrachloride.

**Acid phosphatase**

The mean values of acid phosphatase were observed as $1.37 \pm 0.02$, $1.25 \pm 0.01$, $1.59 \pm 0.05$ and $1.76 \pm 0.03$ (K.A.) in groups I, II, III and IV, respectively. Acid phosphatase was significantly more in groups IV followed by group III, I and II. This view were also supported by Ibrahim *et al.* (1992); Yadav (1997) and Verma (1997).
Per cent hatchability

The maximum hatchability per cent was found in group III (72%) followed by group IV (68%), II (68%) and I (66%). The results indicates, better hatchabilities in the treated groups as compared to control group, but it was not significant statistically. The hatchability was significantly increased in the study of Babu and Gajendran (1993) in Japanese quails by use of probiotic and various other growth promoter such as antibiotic and livol. Yadav (1997) and Verma (1997) also observed higher hatchabilities in the birds treated with Liv fit vet premix than that of untreated group.

Body weight

The body weights in group I, II, III and IV were 2366 ± 13.75, 2514 ± 14.90, 2620 ± 18.20 and 2430 ± 12.00 g, respectively. Significantly higher body weight was observed in treated groups as compared to control group. The present finding was supported by those of Damele and Deshpande (1966); Ramappa et al. (1975); Rao and Sreemannoyana (1980); Prasad and Singh (1982); Mujeer et al. (1988); Reddy and Rao (1988); Choudhary (1991); Panda (1991); Pradhan and Basu (1993); Sreenivas and Devegowda (1994); Prajapati (1997), Mujeeb (1996) and Mishra (1997).

Heart weight

The perusal of the (Table 10) reveals that the heart weight was maximum in group III (14.2 ± 0.24 g) while group I showed the minimum of 10.0 ± 0.41 g. There were significant differences among all the groups(Table 10b). This view was in agreement with those of Yadav (1997) and Verma (1997).
Liver weight

The liver weights were recorded as 45.74 ± 1.15, 36.32 ± 0.67, 47.22 ± 0.96 and 41.28 ± 0.42 g in groups I, II, III and IV, respectively. The higher liver weight was observed in group III followed by I, IV and II. There were significant difference among different groups of birds. Yadav (1997) also observed the similar findings in his study.

Lung weight

The mean values of lung weight for group I, II, III and IV were 10.01 ± 0.07, 10.08 ± 0.09, 10.21 ± 0.11 and 10.07 ± 0.08 g respectively. There was no significant difference in different groups of birds. Baidya et al. (1994) reported that the lung weight did not differ significantly by feeding of antibiotic and probiotic in the ration of broilers.

Kidney weight

The mean values of kidney weight were 8.84 ± 0.29, 8.14 ± 0.25, 9.84 ± 0.26 and 8.32 ± 0.19 grams in groups I, II, III and IV, respectively. The highest (P<0.01) kidney weight was noticed in group III followed by groups I, IV, and II. The present finding was in concordance with those of Yadav (1997) and Verma (1997).

Number of mature ova in ovary

The number of mature ova in group I, II, III and IV were 3.0 ± 0.45, 4.0 ± 0.32, 5.0 ± 0.32 and 4.0 ± 0.32, respectively. Significantly more mature ova was observed in treatment groups than the control group indicating the beneficial effect of stresroak in the development of ova.
Mortality rate

The mortality rates in group I, II, III and IV had been observed is 16, 12, 8 and 12 per cent, respectively. The results reveals highest mortality rate in control group as compared to treatment groups. Similar observations was reported by Mohan et al. (1978); Roiter (1979); Sanchez et al. (1985) reported that non-significant difference in mortality in fowls. Lowered mortality was observed by Ramappa et al. (1975); Rao and Reddy (1986); Devegowda et al. (1990), Devegowda and Arvind (1996). They reported that herbal formulations used as growth promoters have established beyond doubt improved overall performance with lowered mortality. Similar results reduced mortality was reported by Mishra (1997) in broiler chicken fed Withania somnifera root powder groups.