



## EFFECT OF GERMINATED MAIZE AND SORGHUM BASED DIET AT DIFFERENT LEVELS ON BIOCHEMICAL PARAMETERS IN KADAKNATH

Khan, M. A., Archana Jain, \*Shakkarpude, J., Mehta, M. K., Kushwah, M.S. and Laxmi Chouhan

Department of Veterinary Physiology, College of Veterinary Science & A.H., Mhow, NDVSU (MP) 453446

\* Corresponding author email: jyots.vets@gmail.com

### ABSTRACT

Poultry industry is one of the most dynamic and rapidly expanding segments of our livestock economy. Kadaknath is an important indigenous breed of poultry inhabiting vast areas of Western Madhya Pradesh mainly the Jhabua and Dhar districts and adjoining areas of Gujarat and Rajasthan. The nutritive value of maize and sorghum seed depends on germination. One of the most important methods to increase the nutritive value of the grains, cereal and oil seeds is to germinate them. The present experiment was conducted on 240 day old Kadaknath chicks belonging to same hatch and randomly divided into six treatment groups of 40 chicks each *viz.*, GM0, GM1, GM2, GS0, GS1 and GS2. A control group (GM0) and (GS0) was given standard ration with 100% normal maize and 100% normal sorghum based diet respectively. The treatment Group GM1 and GM2 was given diet containing standard ration with 50% germinated maize and 75% germinated maize respectively. Group GS1 and GS2 were given diet containing standard ration with 50% germinated sorghum and 75% germinated sorghum respectively. The significant increase in serum calcium and phosphorus along with significant decrease in alkaline phosphatase and acid phosphatase revealed that the use of germinated maize increase of availability of calcium and phosphorus for better production. A significant decrease in serum cholesterol and significant increase in total protein was observed after 30, 60 and 90 days in all treated diets as compared to control.

**KEYWORDS:** Germination, Sorghum, Maize, Kadaknath, Biochemical.

### INTRODUCTION

Poultry industry is one of the most dynamic and rapidly expanding segments of our livestock economy. Kadaknath is an important indigenous breed of poultry inhabiting vast areas of Western Madhya Pradesh mainly the Jhabua and Dhar districts and adjoining areas of Gujarat and Rajasthan. The commonly available colours of kadaknath are jet-black, pencilled and golden. In all the three varieties of Kadaknath breed most of the internal organs exhibit intense black colouration which is due to the deposition of melanin pigment in the connective tissue of organs and in the dermis (Rao and Thomas, 1984). Sorghum is one of the staple cereals in several regions in India. It is a drought resistant cereal that is produced worldwide. Sorghum is the fifth most important crop after wheat, rice, corn, and barley (Bryden *et al.*, 2009). Maize is one of the main cereals used in feeding broiler chickens worldwide. It is free of viscous non-starch polysaccharides, the major anti-nutritive factor present in most other cereals like barley, wheat, and oats. At present the feed industry is using maize as a basic energy source in poultry diets. Sprouting has been used to improve the nutritional value of the grains. The nutritional value of sprouted grains is improved due to the conversion of complex compounds into relatively simpler compounds that are nutritionally more valuable. Sprouting of grains has resulted in increased protein quantity and quality. Sprouting also increases the concentration of certain nutrients including sugars, minerals and vitamin contents. However, sprouting has resulted in decreased starch

contents and dry matter content of grains. It also increases the plant enzyme contents.

### MATERIALS & METHODS

The present experiment was conducted on 240 day old Kadaknath chicks belonging to same hatch and randomly divided into six treatment groups of 40 chicks each *viz.*, GM0, GM1, GM2, GS0, GS1 and GS2. Each group was further divided into four replications of 10 birds each. The duration of the experiment was carried out for 90 days. Control groups (GM0) and (GS0) were given standard ration with 100% normal maize and 100% normal sorghum based diet respectively. The treatment Group GM1 was given diet containing standard ration with 50% germinated maize. The Group GM2 was given diet containing standard ration with 75% germinated maize. Group GS1 was given diet containing standard ration with 50% germinated sorghum. Group GS2 was given diet containing standard ration with 75% germinated sorghum. The experimental birds were vaccinated against Ranikhet disease and Gumboro disease/IBD at appropriate time. The birds were housed in deep litter system in the well ventilated and lighted rooms and the feed was given *ad lib.* with plenty of fresh water. The body weight of day old chicks was recorded on arrival and thereafter on weekly intervals. Blood was collected on every 30<sup>th</sup> days from each bird. About 3-4ml was collected from wing vein using 22-24 gauge needle in a clean dry vial containing 2.0 mg/ml Ethylene diamine tetra acetic acid, Sodium salt (EDTA) as an anticoagulant for biochemical analysis. The blood samples were centrifuged at 3000 rpm for 10

minutes at room temperature and separated serum stored at 4°C till further analysis. The biochemical study was carried out using ERBA standard diagnostic kits. All observations were analyzed by using ANOVA to compare different treatment group.

**RESULT**

**(1) Calcium (mg/dl)**

The mean values of serum calcium level for groups GM0, GM1, GM2, GS0, GS1 and GS2 were 11.08 ±0.07, 12.63 ±0.28, 12.98 ±0.03, 10.96 ±0.07, 13.33 ±0.21 and 11.88 ±0.28, 11.12 ±0.06, 12.79±0.34, 13.00±0.03, 11.01±0.03, 13.18±0.17 and 11.96 ±0.15, and 11.13±0.12, 12.75±0.33, 13.05±0.33, 12.54±0.26, 13.27±0.10 and 12.89±0.10, respectively, for 30, 60 and 90 days of study period. There was significant increase (P<0.01) in the serum calcium levels as compared to control.

**(2) Phosphorus (mg/dl)**

The mean values of serum phosphorus level for groups GM0, GM1, GM2, GS0, GS1 and GS2 were 11.85±0.25, 12.28 ±0.48, 12.81±0.24, 11.78±0.23, 1.33±0.29 and 11.88 ±0.19 after 30 days, 12.60±0.23, 12.80±0.47, 13.34±0.15, 11.57±0.22, 12.88±0.10 and 11.86±0.25 after 60 days, and 11.93±0.12, 12.97±0.04, 12.87±0.22, 12.01±0.05, 13.53 ±0.23 and 112.96 ±0.06, respectively, after 90 days of study. There was significant (P<0.01) increase in the serum phosphorus concentration as compared to control group.

**(3) Alkaline phosphatase (IU/L)**

The mean values of serum alkaline phosphatase level after 30 days of GM0, GM1, GM2, GS0, GS1 and GS2 were

154.40±1.01, 152.10±1.34, 152.23±1.21, 154.59±1.16, 152.79±1.17 and 154.01±1.21, after 60 days 153.29±0.65, 150.51±0.45, 152.03±0.40, 151.30±0.81, 147.83±0.27 and 149.81±0.71, and after 90 days 154.30±0.26, 152.49±0.32, 152.69±0.24, 145.93±0.19, 148.80±0.43 and 147.96±0.06, respectively and there was significant (p<0.01) decreases in alkaline phosphatase concentration in all treated groups as compared to control group.

**(4) Acid phosphatase (IU/L)**

The mean values of serum acid phosphatase level after 30 days of GM0, GM1, GM2, GS0, GS1 and GS2 were 7.81±0.23, 7.53±0.25, 6.68±0.22, 5.77±0.23, 4.77±0.23 and 4.47±0.27, after 60 days 8.03±0.05, 7.00±0.04, 6.10±0.05, 5.78±0.21, 5.44±0.28 and 5.07±0.06, and after 90 days 8.05±0.36, 6.10±0.16, 6.66±0.29, 6.36±0.19, 5.55±0.48 and 5.67±0.22, respectively and there was significant (P<0.01) decrease in the acid phosphatase concentration in all treated groups as compared to control group.

**(5) Total protein (g/dl)**

The mean values of total protein level for groups GM0, GM1, GM2, GS0, GS1 and GS2 were 7.95±0.05, 8.26±0.15, 8.97±0.08, 7.52±0.20, 8.01±0.52 and 8.98±0.02, after 30 days, 7.96±0.04, 8.98±0.07, 9.03±0.07, 7.99±0.03, 8.47±0.27 and 9.04±0.05, after 60 days and 7.99±0.04, 8.25±0.39, 9.03±0.05, 8.05±0.05, 9.08±0.05 and 9.24±0.23, respectively, after 90 days. There was significant (P<0.01) increase in the total protein concentration in treated groups as compared to control.

**TABLE 01:** Effect of germinated maize on biochemical parameters in Kadaknath after 30, 60 and 90 days of study (Mean ± SE)

Parameters	GM0 (control) 30 Days	GM1	GM2		GM0 (control) 60 Days	GM1	GM2		GM0 (control) 90 Days	GM1	GM2	
Calcium (mg/dl)	11.08 <sup>a</sup> ±0.07	12.63 <sup>b</sup> ±0.28	12.98 <sup>b</sup> ±0.03	**	11.12 <sup>a</sup> ±0.06	12.79 <sup>b</sup> ±0.34	13.00 <sup>b</sup> ±0.03	*	11.13 <sup>a</sup> ±0.12	12.75 <sup>b</sup> ±0.33	13.05 <sup>b</sup> ±0.33	**
Phosphorus (mg/dl)	11.85 <sup>a</sup> ±0.25	12.28 <sup>a</sup> ±0.48	12.81 <sup>b</sup> ±0.24	*	12.60 <sup>a</sup> ±0.23	12.80 <sup>a</sup> ±0.47	13.34 <sup>b</sup> ±0.15	*	11.93 <sup>a</sup> ±0.12	12.97 <sup>b</sup> ±0.04	12.87 <sup>b</sup> ±0.22	**
Alkaline phosphatase (IU/l)	154.40 <sup>a</sup> ±1.01	152.10 <sup>b</sup> ±1.34	152.23 <sup>b</sup> ±1.21	*	153.29 <sup>a</sup> ±0.65	150.51 <sup>b</sup> ±0.45	152.03 <sup>ab</sup> ±0.40	*	154.30 <sup>a</sup> ±0.26	152.49 <sup>b</sup> ±0.32	152.69 <sup>b</sup> ±0.24	*
Acid phosphatase (IU/l)	7.81 <sup>a</sup> ±0.23	7.53 <sup>a</sup> ±0.25	6.68 <sup>b</sup> ±0.22	*	8.03 <sup>a</sup> ±0.05	7.00 <sup>b</sup> ±0.04	6.10 <sup>c</sup> ±0.05	*	8.05 <sup>a</sup> ±0.36	6.10 <sup>b</sup> ±0.16	6.66 <sup>b</sup> ±0.29	**
Total protein (g/dl)	7.95 <sup>a</sup> ±0.05	8.26 <sup>a</sup> ±0.15	8.97 <sup>b</sup> ±0.08	**	7.96 <sup>a</sup> ±0.04	8.98 <sup>b</sup> ±0.07	9.03 <sup>b</sup> ±0.07	*	7.99 <sup>a</sup> ±0.04	8.25 <sup>a</sup> ±0.39	9.03 <sup>b</sup> ±0.05	*
Total cholesterol (mg/dl)	113.54 <sup>a</sup> ±0.63	116.04 <sup>b</sup> ±0.58	113.58 <sup>a</sup> ±0.81	*	110.86 <sup>a</sup> ±0.23	113.16 <sup>b</sup> ±0.21	113.98 <sup>c</sup> ±0.06	*	111.64 <sup>a</sup> ±0.29	112.73 <sup>b</sup> ±0.23	114.99 <sup>c</sup> ±0.08	**
Glucose (mg/dl)	182.85 <sup>a</sup> ±0.82	185.31 <sup>b</sup> ±1.10	184.78 <sup>b</sup> ±0.22	*	187.96 <sup>a</sup> ±0.51	190.01 <sup>b</sup> ±0.40	188.58 <sup>a</sup> ±0.23	*	190.44 <sup>a</sup> ±0.30	191.98 <sup>b</sup> ±0.51	188.96 <sup>a</sup> ±0.54	**

\*\*Shows Significance at 1% level as compared to control group (P < 0.01)

\*Shows Significance at 5% level as compared to control group (P < 0.05)

- The value with the different superscripts in a row are different significantly between groups
- The value with the no superscripts in a row is having no significant relationship.

**(6) Total cholesterol (mg/dl)**

The mean values of total cholesterol level for groups GM0, GM1, GM2, GS0, GS1 and GS2 were 113.54±0.63, 116.04±0.58, 113.58±0.81, 115.99±0.04, 115.06±0.39 and 113.99±0.07, after 30 days, 110.86±0.23, 113.16±0.21, 113.98±0.06, 116.74±0.22, 115.19±0.24 and 115.29±0.47, after 60 days, and 111.64±0.29, 112.73±0.23, 114.99±0.08, 117.35±0.45, 115.28±0.48 and 115.67±0.31, respectively, after 90 days. There was significant (P<0.01) decrease in total cholesterol concentration in all treated groups as compared to control group.

**(7) Glucose (mg/dl)**

The mean values of serum glucose level for groups GM0, GM1, GM2, GS0, GS1 and GS2 were 182.85±0.82, 185.31±1.10, 184.78±0.22, 189.86±0.84, 190.06±0.74 and 189.16±0.41, after 30 days, 187.96±0.51, 190.01±0.40, 188.58±0.23, 188.71±0.57, 190.68±0.20 and 190.07±0.37, after 60 days and 190.44±0.30, 191.98±0.51, 188.96±0.54, 190.29±0.25, 193.21±0.44 and 190.60±0.51, respectively, after 90 days. There was non significant difference in glucose concentration in treated groups after 30 days but it was highly significant after 60 and 90 days as compared to control.

**TABLE 02:** Effect of germinated sorghum on biochemical parameters in Kadaknath after 30, 60 and 90 days of study (Mean ± SE)

Parameters	GS0 (control) 30 Days	GS1	GS2		GS0 (control) 60 Days	GS1	GS2		GS0 (control) 90 Days	GS1	GS2	
Calcium (mg/dl)	10.96 <sup>a</sup> ±0.07	13.33 <sup>c</sup> ±0.21	11.88 <sup>b</sup> ±0.28	**	11.01 <sup>a</sup> ±0.03	13.18 <sup>c</sup> ±0.17	11.96 <sup>b</sup> ±0.15	**	12.54 <sup>a</sup> ±0.26	13.27 <sup>b</sup> ±0.10	12.89 <sup>a</sup> ±0.10	*
Phosphorus (mg/dl)	11.78 <sup>a</sup> ±0.23	12.33 <sup>b</sup> ±0.29	11.88 <sup>a</sup> ±0.19	*	11.57 <sup>a</sup> ±0.22	12.88 <sup>b</sup> ±0.10	11.86 <sup>a</sup> ±0.25	*	12.01 <sup>a</sup> ±0.05	13.53 <sup>c</sup> ±0.23	12.96 <sup>b</sup> ±0.06	**
Alkaline phosphatase (IU/l)	154.59 <sup>a</sup> ±1.16	152.79 <sup>b</sup> ±1.17	154.01 <sup>a</sup> ±1.21	*	151.30 <sup>a</sup> ±0.81	147.83 <sup>b</sup> ±0.27	149.81 <sup>ab</sup> ±0.71	*	145.93 <sup>a</sup> ±0.19	148.80 <sup>b</sup> ±0.43	147.96 <sup>b</sup> ±0.06	*
Acid phosphatase (IU/l)	5.77 <sup>a</sup> ±0.23	4.77 <sup>b</sup> ±0.23	4.47 <sup>b</sup> ±0.27	*	5.78 <sup>a</sup> ±0.21	5.44 <sup>a</sup> ±0.28	5.07 <sup>b</sup> ±0.06	*	6.36 <sup>a</sup> ±0.19	5.55 <sup>b</sup> ±0.48	5.67 <sup>b</sup> ±0.22	*
Total protein (g/dl)	7.52 <sup>a</sup> ±0.20	8.01 <sup>a</sup> ±0.52	8.98 <sup>b</sup> ±0.02	**	7.99 <sup>a</sup> ±0.03	8.47 <sup>b</sup> ±0.27	9.04 <sup>c</sup> ±0.05	**	8.05 <sup>a</sup> ±0.05	9.08 <sup>b</sup> ±0.05	9.24 <sup>b</sup> ±0.23	*
Total cholesterol (mg/dl)	115.99 <sup>a</sup> ±0.04	115.06 <sup>a</sup> ±0.39	113.99 <sup>b</sup> ±0.07	**	116.74 <sup>a</sup> ±0.22	115.19 <sup>b</sup> ±0.24	115.29 <sup>b</sup> ±0.47	*	117.35 <sup>a</sup> ±0.45	115.28 <sup>b</sup> ±0.48	115.67 <sup>b</sup> ±0.31	*
Glucose (mg/dl)	189.16 ±0.41	190.06 ±0.74	189.86 ±0.84	NS	188.71 <sup>a</sup> ±0.57	190.68 <sup>b</sup> ±0.20	190.07 <sup>b</sup> ±0.37	*	190.29 <sup>a</sup> ±0.25	190.60 <sup>a</sup> ±0.51	193.21 <sup>b</sup> ±0.44	**

\*\*Shows Significance at 1% level as compared to control group (P < 0.01)

\*Shows Significance at 5% level as compared to control group (P < 0.05)

- The value with the different superscripts in a row are different significantly between groups
- The value with the no superscripts in a row is having no significant relationship.

**DISCUSSION****(1) Calcium and phosphorus**

The present study revealed that there was a significant (p<0.01) increase in the serum calcium and phosphorus level in the all the treated groups after 30, 60 and 90 days of the study as compared to control groups for both maize and sorghum. This indicates that use of germinated maize and sorghum in feed may be capable of release of calcium and inorganic phosphorus by the action of phytase enzyme released from the germinated grains. So this inorganic phosphorus readily available for utilization by the body along with increased availability of bivalent ions and trivalent ions like calcium, magnesium, iron and zinc *etc.* for the growth and other metabolic activities of the body. Similar observations were also reported by Singh and Khatta (2003), Jain (2008), Osman (2009), Prajapati (2010), Kwari *et al.* (2012), Jamre (2015), and Gautam *et al.* (2017).

**(2) Glucose, total cholesterol and total protein**

The present study revealed a significant (p<0.01) effect in the level of serum glucose, after 60 and 90 days of growth period but the level was non significant after 30 days of study period in germinated sorghum supplemented group. A significant decrease (p<0.01) in serum cholesterol and significant increase in total protein was observed after 30,60 and 90 days in all treated diets as compared to

control. These observations were in accordance with the findings of El-Deek *et al.* (2009), Osman (2009), and Gautam *et al.* (2017). On the contrary, Jain (2008), Manwar and mandal (2009) and Prajapati (2010) found no significant effect on the above parameters in treated groups as compare to control.

**(3) Acid phosphatase and alkaline phosphatase**

The present study showed significant (p<0.05) decrease in plasma alkaline phosphatase and acid phosphatase after 30, 60 and 90 days in all the treated groups as compare to control group. This decrease in acid and alkaline phosphatase enzymes may indicated that sprouted grain given to Kadaknath chicks may increase the activity of some enzymes like phytase, resulted in increased plasma concentration of phosphorus and calcium through liberation of phosphorus, bivalent and trivalent ions, which are readily available to the chicks. All the results reported in the present study were in agreement with the observations reported by Viveros *et al.* (2002), Famino and Akinola (2006), Jain (2008), Prajapati (2010), Jamre (2015), and Gautam *et al.* (2017). In contrast non significant effect was noted by Onifade *et al.* (1999).

**CONCLUSION**

The significant increase in serum calcium and phosphorus, along with significant decreases in alkaline phosphatase

and acid phosphatase revealed that the use of germinated maize and sorghum increase the availability of calcium and phosphorus for better production. The present study revealed a significant effect in the level of serum glucose, after 60 and 90 days of growth period. A significant decrease in serum cholesterol and significant increase in total protein was observed after 30, 60 and 90 days in all treated diets as compared to control.

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