Journal of Animal Feed Science and Technology Vol.2 (2014) 1-48

Effect of Supplementing Chromium on the Nutrients Intake, Digestibility and Feed Efficiency of Equines Used for Antitoxin Production

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(Received on 17.12.2013; Accepted on 24.12.2013)

Abstract

For this study, twenty-four healthy equines, were randomly divided in three equal groups viz, T_0,T_1 and T_2, each having eight animals (four mules and four ponies). Group T_0 served as control and received ration as per standard feeding practice followed on the farm. Group T_1 and T_2 were fed with same ration as used for group T_0 supplemented with chromium tripicolinate @ 210 and 420 πg/kg ration, respectively. The feed treatments had no significant effect on the average daily DM intake of the animals from different groups. The average per cent daily dry matter intake and average dry matter intake per unit metabolic body size of equines from control group was significantly (P≤0.01) higher than that of groups T_1 and T_2, however, differences between later two groups was non-significant. The average TDN intake of the equines from groups T_1 and T_2 was significantly (P≤0.01) higher than that of group T_0. However the difference between groups T_1 and T_2 was statistically non-significant. The average daily DCP intake in experimental animals from groups T_0, T_1 and T_2 were significantly (P≤0.01) different from each other. The average fortnightly body weights of the animals from the control group T_0 were significantly lower than the body weights of groups T_1 and T_2. The average body weights of animals from groups T1 and T_2 did not differ significantly from each other. The feed treatments showed no significant effect on the average gain in weights of the animals from different groups. The feed efficiency in terms of daily dry matter, TDN and DCP intake (kg) / kg gain in weight was highest in chromium supplemented treatment groups.

Keywords: Digestibility; TDN; DCP; Feed efficiency; Supplementation.

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Introduction

Chromium is essential trace element for normal carbohydrate metabolism which potentiates insulin action and stimulate glucose clearance and also aids in the conversion of thyroxin to tri-iodothyronine which results in increasing metabolic rate. Although lot of literature is available on the role of chromium on glucose metabolism in various species of animals; very scanty information is available on the effect of chromium on horses used for anti-snake venom production which remain under stress due to regular toxin antigen dosing and frequent bleeding. Considering the scope for chromium supplementation to reduce the stressed condition in the equines used in anti-venum production programme, the present experiment was planned to study the effect of different levels of chromium supplementation on nutrients intake; its utilization and feed efficiency.

Materials and Methods

For this study twenty four healthy equines (twelve mules and twelve ponies) of about 4-5 years of age used in routine hyper-immunization bleeding programme for anti-snake venum production, were selected. The animals were divided randomly in to three equal groups namely, T_0 (control), T_1 and T_2 group each having eight equine animals (four mules and four ponies) on the basis of species, breed, body weights, age and sex. Group T_0 served as control and received ration as per standard feeding practice followed on the farm. Group T_1 and T_2 were fed with same ration as used for group T_0 supplemented with chromium tripicolinate @ 210 and 420 µg/kg ration, respectively. Measured quantity of chromium tripicolinate in the form of premix was supplemented daily through the ration of individual animal. Measured amount of concentrate mixture was fed twice daily divided in two equal parts, offered individually in the manger in the stable. The animals were let loose group wise in open paddocks for roughage feeding and were fed with greens like Lucerne and maize and dry roughage like hay. Ad lib water was made available to individual equines in the stable throughout the experiment. The percent ingredient and chemical composition of the farm concentrate mixture is given in Table 1 and 2, respectively. The average chemical composition (% DMB) of hay, green maize and Lucerne is given in Table 3.

The experimental animals were housed in

Table 1: Percent Ingredient Composition of the Farm Concentrate Mixture

Name of ingredient	Per cent level
Maize	16.80
Soybean meal	17.00
Cottonseed cake	08.00
Rice polish	10.00
Deoiled rice bran	18.00
Wheat bran	17.00
Molasses	10.00
Dicalcium phosphate	01.50
Lime stone powder	00.50
Mineral mixture	00..20
Salt	01.00
Total	100.00

Table 2: Per cent Chemical Composition (%DMB) of Farm Concentrate Mixture

Nutrient	Per cent
Dry matter	90.22
Moisture	09.78
Crude protein	21.12
Ether extract	04.98
Crude fibre	10.61
Nitrogen free extract	52.91
Total ash	10.38
Acid insoluble ash	02.37
Calcium	01.32
Phosphorus	00.65

Table 3: The Average Chemical Composition (%DMB) of Hay, Green Maize and Lucerne

Particulars	Hay	Green maize	Lucerne
Dry matter	88.32	26.81	22.12
Moisture	11.68	73.19	77.88
Crude protein	02.25	05.54	22.68
Ether extract	02.55	01.80	01.89
Crude fibre	37.28	26.85	22.30
Nitrogen free extract	49.05	57.51	41.22
Total ash	08.87	08.30	11.91
Acid insoluble ash	05.95	03.62	00.72
Calcium	00.95	00.65	01.48
Phosphorus	00.28	00.15	00.35

Table 4: Change in Body Weight, Nutrients Intake, Feed Efficiency and Body Condition Score of the Equines from Different Experimental Groups

Parameters	T_0	T_1	T_2	treatment	Fortnight periods
Initial body weights (kg)	246.00	267.25	264.38	--	--
Final body weights (kg)	248.08	265.60	264.50	--	--
Average body weights (kg)	243.3[a]	268.98[b]	265.97[b]	**	NS
Average gain in weights (kg)	0.346	0.495	0.438	NS	NS
Average daily DM intake(kg)	04.63	04.79	04.75	NS	NS
Percent DM intake (kg)	1.90[a]	1.78[b]	1.79[b]	**	NS
DM intake g (W kg $^{0.75}$)	75.29[a]	72.03[b]	72.11[b]	*	NS
Average daily TDN intake(kg)	2.61[a]	2.95[b]	3.01[b]	**	NS
Average daily DCP intake(kg)	0.501[a]	0.573[b]	0.606[b]	**	NS
DMI kg/kg gain in weight	13.38	09.68	10.84	__	__
TDNI kg/kg gain in weight	07.54	05.96	06.87	__	__
DCPI kg/kg gain in weight	1.448	1.158	1.384	__	__
Body condition score	07.25	07.50	07.63	NS	**

Note: Figures with different superscripts differ significantly
2. * Significant at 5 % ** Significant at 1 %

ideal stables with proper ventilation and flooring. Normal methods of hygine, management, feeding practices, vaccination and deworming programmes were followed for all the experimental animals throughout the trial period. Animals were let loose daily in open paddock for roughage feeding, watering and exercise.

Parameters Studied

Following parameters were studied during the experiment of 13 weeks.

DM intake, daily total dry matter intake (kg) as obsolute percent body weight and as per kg metabolic body weight (W $kg^{0.75}$), digestibility of different nutrients, TDN and DCP content of equine rations of different rations. Body weight changes of equines under different feed treatments. The feed efficiency in terms of DM, TDN and DCP required per kg gain in body weight. Body condition score was evaluated at the beginning of the experiment and at the monthly intervals by using standard charts. At the end of experiment during last week, digestibility trial of seven days duration was conducted by total collection method.

Analytical Techniques

The proximate analysis of feed and fodder samples collected during experiment was carried out as per A.O.A.C.[1] Phosphorus estimation was carried out as per N.I.N.[2] and calcium as per Talpatra *et al*.[3] Body condition score was evaluated at the beginning of the experiment and at the monthly interval by using standard charts. A scoring system with 1 to 9 scales was used to measure body condition of experimental animals. Body condition score of equines from various was evaluated as per Henneke *et al* and recorded at monthly interval.[4] All the data collected during experimental period were subjected to statistical analysis as per Snedecor and Cochran (1998) by using randomized block design to draw the conclusions.

Results and Discussion

Change in body weight, nutrient intake, feed efficiency and body condition score of the equines from different experimental groups is given in Table 4.

The average daily DM intake during experimental period for groups T_0, T_1 and T_2 was 4.63,4.79 and 4.75 kg, respectively. It was seen that the feed treatments had no significant effect on the average daily DM intake of the animals from different groups. The average percent daily DM intake was 1.90,1.78 and 1,79 kg for groups T_0, T_1 and T_2, respectively. The average percent daily DM intake of equines from control group was significantly (P≤0.01)

Table 5: Average Percent Digestibility Coefficients, TDN and DCP Contents of Rations from Various Experimental Groups

Parameters	T_0	T_1	T_2
Digestibility Coefficients %			
Dry matter	63.22	64.67	66.82
Organic matter	64.82	67.32	67.88
Crude protein	70.18	73.22	75.23
Ether extract	75.00	77.24	78.92
Crude fibre	47.28	51.75	52.22
Nitrogen free extract	63.78	64.98	67.92
TDN %	56.52	60.82	61.78
DCP %	10.82	11.95	12.76

higher than that of groups T_1 and T_2, however, differences between later two groups was non-significant. The average daily DM intake per unit metabolic body size recorded was 75.29, 72.03 and 72.11 g for groups T_0, T_1 and T_2, respectively. The average daily DM intake per unit metabolic body size of equines from control group was significantly (PdH0.05) higher than that of groups T_1 and T_2, however, differences between later two groups was non-significant.

The average daily TDN intake of the animals was 2.61, 2.95 and 3.01 kg for groups T_0, T_1 and T_2, respectively. The average daily TDN intake of the equines from groups T_1 and T_2 was significantly (P≤0.01) higher than that of group T_0. The differences in the values for daily TDN intake of groups T_1 and T_2 was statistically non-significant.

The average daily DCP intake of the animals was 0.501, 0.573 and 0.606 kg for groups T_0, T_1 and T_2, respectively. The average daily DCP intake in experimental animals from groups T_0, T_1 and T_2 were significantly (P≤0.01) different from each other.

The average initial body weights of the animals in groups T_0, T_1 and T_2, were 246.00, 267.25 and 264.38 kg, respectively. Corresponding body weights at the end of three months of experimental period were 248.08, 265.60 and 264.50 kg for groups T_0, T_1 and T_2, respectively. The average fortnightly body weights of the animals in groups T_0, T_1 and T_2 were 243.30, 268.98 and 265.97 kg, respectively. The average fortnightly body weights of the animals from the control group (T_0) were significantly lower than the body weights of the groups T_1 and T_2. The The average body weights of the animals from groups T_1 and T_2 did not differ significantly from each other. The average fortnightly gains of the animals in groups T_0, T_1 and T_2 were 0.346, 0.495 and 0.438 kg, respectively for groups T_0, T_1 and T_2. The statistical analysis revealed that the average gain in weights of the animals from different groups were non-significant..as no such work is reported in literature, the findings of the present research work could not be compared. Further it appears that there is no adverse effect of bleeding on body weights of equines from different feeding regimes speculated on considerations in fortnightly gain in weights were observed.

Feed efficiency was calculated in terms of DM, TDN and DCP (kg) required per kg gain jn weight. The average daily DM intake kg/kg gain in weight during experimental period for groups T_0, T_1 and T_2 was 13.38, 9.68 and 10.84 kg, respectively. The average daily TDN intake and DCP intake kg/kg gain in weight during experimental period for groups T_0, T_1 and T_2. Was 7.54 and 1.448, 5.96 and 1.158 and 6.87 and 1.384 kg, respectively. It was observed that the feed efficiency in terms of daily DM, TDN and DCP intake kg/kg gain in weight was highest in chromium supplemented treatment groups when compared with that of control suggestive of positive effect of chromium supplementation on feed efficiency, although data was not analyzed and tested statistically.

The average body condition score for groups T_0, T_1 and T_2. Were 7.25, 7.50 and 7.63, respectively. It was seen that chromium supplementation had no significant effect on the average body condition score of the equines from different groups, indicative of no adverse effect of such supplementation on the well being of animal.

Results of digestibility are given in Table 5. The digestibility of DM was 63.22, 64.67 and 66.82 % for groups T_0, T_1 and T_2, respectively. The digestibility of OM for groups T_0, T_1 and T_2. Was 64.82, 67.32 and 67.88 %, respectively. The digestibility of CP for groups T_0, T_1 and T_2. Was 70.18, 73.22 and 75.23 %, respectively. The digestibility of EE for groups T_0, T_1 and T_2. Was

75.00, 77.24 and 78.92 %, respectively. The digestibility of CF for groups T_0, T_1 and T_2 Was 47.28, 51.75 and 52.22 %, respectively. The digestibility of NFEfor groups T_0, T_1 and T_2 Was 63.78, 64.98 and 67.92 %, respectively. It was noticed from digestibility coefficient data that the overall digestibility of all the nutrients was higher for group T_2 followed by group T_1 and T_0.

TDN content for groups T_0, T_1 and T_2 Was56.52, 60.82 and 61.78 %, respectively.DCP content for groups T_0, T_1 and T_2 Was 10.82, 11.95 and 12.76 %, respectively.

Conclusion

From the overall performance of equines from the present study, it is summerised that chromium supplementation to ration fed to equines for anti-sera production programme resulted higher TDN and DCP intake, higher nutrient digestibility, better feed efficiency in terms of DM, DCP and TDN required/kg gain in weight, without affecting DM intake and gain in body weight. Supplementation of chromium in the form chromium tripicolinate @ 420 µg/ kg ration, to the equines give numerically superior performance when compared with the performance that of @ 210 µg/kg ration, although the differences were not statistically significant. Thus it is concluded from the overall results of the present study that chromium tripicolinate can be supplemented @ 210 µg/ kg ration of equines for better anti-sera production programme without affecting plane of nutrition and animal wellbeing. For steady performance the supplementation of chromium tripicolinate @ 420 µg/kg ration of equines can be done.

Acknowledgement

Facilities provided by the director, Premium serum and vaccines Pvt. Ltd., Narayangaon Dist. Pune Maharashtra (India) for undertaking this research work is greately acknowledged.

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