RESEARCH PAPER

Effect of formaldehyde treatment and different incubation periods on *in vitro* protein degredability of soybean meal

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● ABSTRACT ●

An experiment was conducted to study the effect of formaldehyde treated soybean meal at different incubation periods on protein degradability at Department of Animal Husbandary and Dairying, College of Agriculture, Nagpur during 2008-2009. The protein degradability values of soybean meal was significantly (P<0.05) affected due to combination of HCHO treatment and incubation periods. However, values of T_5I_3 (9.38 %) was found to be non-significant to T_5I_2 (9.08 %) in reduction percentage of protein degradability. Protein solubility reduced up to 88 % with 2.5 % HCHO and 12 hours of incubation period. Combination of T_3I_3 was found to be best treatment in protection of protein. Values in per cent protein degradability were found to be significant. The reduction per cent of protein degradability increased with increasing levels of incubation period.

KEY WORDS : Incubation period, Formaldehyde, Protein, Soybean meal

● INTRODUCTION ●

Protein content of ration is the important nutritional consideration for feeding animals. However, protein supplements are more expensive ingredients in ruminant ration. Protection of natural proteins of high biological value from degradation in the rumen seems to have great potential in ruminant nutrition for better growth and production (Malik and Chopra, 1978; Tiwari and Yadav, 1989). Formaldehyde treatment has been found to be an efficient and comparatively cheaper method to protect highly degradable protein sources (Ramchandra and Sampath, 1995). Formaldehyde treatment at different incubation periods to soybean meal offers a possible means of protecting the protein from degradation by rumen microorganisms and decreases pH level. Hence, the present study was undertaken to assess the protection of protein of soybean meal by different levels of formaldehyde treatment at different incubation periods.

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● MATERIALS AND METHODS ●

The soybean meal was treated with formaldehyde (37%) solution at 0.0 (untreated), 1.0 (T_2), 1.5 (T_3), 2.0(T_4) and 2.5 (T_5) % per 100 gm cp. The crude protein content of soybean meal was 46%. Hence, amount of formaldehyde solution required was 0.0. 12.42, 18.60, 24.84 and 31.04 ml, respectively. The volume of the solution was made to 40 ml with water and formaline solution was sprayed over the samples and mixed immediately. There after, these samples were sealed airtight in polythene bags and kept for 7 days for proper reaction of formaldehyde with proteins. After 7 days, the polythene bags were opened and dried the sample at 75^0C for 24 hrs. The treated samples were ground finely after drying. These samples were used for further analysis. The well mixed samples of rumen liquor were drawn from different parts of rumen of two male animals by suction. This strained rumen liquor (SRL) was used for *in vitro* study. The samples were incubated in *in vitro* tubes at 39^0C with strained rumen liquor and Mc Dougall's buffer solution for 4,8,12 and 18 hours.

The *in vitro* protein degradation technique recommended by Lohan and Gupta (1990) was followed. The data were arranged in Factorial Completely Randomized Design (FCRD) and analyzed by standard statistical method as per Snedecor and Cochran (1989).

● RESULTS AND DISCUSSION ●

The results recorded in Table 1 showed that the protein degradability values of soybean meal were significantly (P<0.05) affected due to the HCHO treatment. The protein degradability values went on decreasing in treatment T_2, T_3, T_4 and T_5 as compare to T_1 (34.62%), in all the 4 incubation periods I_1, I_2, I_3 and I_4 hrs). The highest value (82.02%) was noticed in T_1I_4 and lowest value (7.20%) was noticed in T_5I_1. These values were found to be significant (P<0.05).

The protein degradability values of soybean meal were significantly (P<0.05) affected due to the effect of incubation. The soybean meal incubated in rumen content showed increasing in I_1, I_2, I_3 and I_4 hrs of incubation. The highest values were found in I_4 (82.02%) where as lowest value was found in I_1 (34.62%). The values in T_5I_2 and T_5I_3 was found to be non-significant to each other, (9.08 and 9.38%), respectively.

The combined effect of HCHO treatment and incubation had significant effect on protein degradability (P<0.05). T_3I_3 (23.28%) was found to be more significant as it protected 70% of protein, which is enough for optimum protection. Higher level of HCHO treatment resulted in over protection. It indicated that protein degradation was decreased with increasing level of HCHO. This seems that HCHO treatment adequately protected the protein from microbial attack.

This result was in accordance to Singh *et al.* (1977) that treatment to groundnut cake decreased the rate of digestibility when treated with HCHO. They also observed that HCHO treatment at 12 hrs of incubation was most effective.

Table 1 : Combined effect of HCHO treatment and incubation periods on protein degradability of soybean meal (%)

Treatments	Incubation period (hrs)				Treatment mean
	I_1	I_2	I_3	I_4	
T_1	34.62	63.06	79.58	82.02	64.82
T_2	23.24	36.92	44.19	46.08	37.60
T_3	14.15	19.03	23.38	26.03	20.64
T_4	8.98	10.97	12.93	13.98	11.71
T_5	7.20	9.08	9.38	10.82	9.12

Reduction per cent of protein degradation:

The results depicted in Table 2 reveals that reduction per cent of protein degradability was significantly (P<0.05) affected due to the effect of HCHO treatment. The highest values were noticed in T_5I_3 (88.20%) where as lowest

Table 2 : Combined effect of HCHO treatment and incubation periods on Reduction percentage of protein degradability of soybean meal (%)

Treatments	Incubation period (hrs)				Treatment mean
	I_1	I_2	I_3	I_4	
T_1	-	-	-	-	-
T_2	32.87	41.45	44.44	43.65	40.60
T_3	59.12	69.81	70.60	68.25	66.94
T_4	74.14	82.58	83.74	82.89	80.83
T_5	79.20	85.58	88.20	86.79	84.94

value was noticed in T_2I_1 (32.87%). It showed that the reduction per cent of protein degradation was increased with increasing level of formaldehyde solution. These values were significant to each other. Treatment T_3 was found to be most superior as it protected 70% protein.

The reduction per cent of protein degradability of soybean meal was also affected due to incubation. The soybean meal incubated in rumen content showed increasing in I_1, I_2, and I_3 but values decreased in I_4. The highest value was found in I_3 (44.44, 70.60, 83.74 and 88.20%). Incubation period (I_3) h was found to be most effective in protecting protein with treatment T_3 (70.60%).

The combined effect of HCHO and incubation periods had significant effect on protein degradability (P<0.05). Most effective value was found in T_3I_3 (70.60%) for protection of protein. Observations showed that protein solubility decreased up to 88% with 2.5% formalin. The results are in agreement with that of Bhargava and Ranjhan (1973) who reported N production reduced to 86% with 5% formaline treated groundnut cake in comparison with untreated cake. The results are in accordance to Sinha *et al.* (1976) who observed that protein solubility decreased up to 87% by formaldehyde treatment in groundnut cake and linseed cake.

Conclusion:

The protein degradability values of soybean meal was significantly (P<0.05) affected due to combination of HCHO treatment and incubation periods. Highest values were found in I_4 (82.02, 46.08, 26.03, 13.98 and 10.82%) where as lowest values were found in I_1 (34.62, 23.24, 14.15, 8.98 and 7.20%). However, highest values were noticed in T_1 (untreated) (34.62, 63.06, 79.58 and 82.02%) and lowest values were noticed in T_5 (7.20, 9.08, 9.38 and 10.82%). Values of T_5I_3 (9.38%) was found to be non-significant to T_5I_2 (9.08%).

In reduction percentage of protein degradability protein solubility reduced up to 88% with 2.5% HCHO and 12 hr of incubation period. Combination of T_3I_3 was

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found to be best treatment in protection of protein. Values in per cent protein degradability were found to be significant (P<0.05). The reduction percentage of protein degradability increased with increasing levels of incubation period.

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