6. SUMMARY

Two experiments, one on growing lambs and another on lactating cows were conducted to evaluate the diets differing in microbial biomass synthesis on productive performance.

In Experiment-I, twelve Bannur growing ram lambs were divided into four groups of three each based on comparable body weight and age. The feeding trial was carried out with four periods of four weeks each in a switch over design. The ram lambs in all the four groups received rhodes hay (RH) as the sole roughage and a concentrate supplement (CS). The CS were formulated using the data on ME and PF obtained from the RIVGPT (Kiran and Krishnamoorthy, 2007) in addition to the CP, in a way that all the four CS were comparable in CP and ME but differ in PF. The diets were formulated to be similar in k but differ in PF. The PF and k for D-1, D-2, D-3 and D-4 were 3.07 and 0.0496; 3.16 and 0.0514; 3.18 and 0.0525; 3.59 and 0.0497, respectively. The k was kept similar for the four diets in order to exclude the effect of k on microbial efficiency. The RH and CS were fed at the rate of 1.5% of body weight so as to provide energy and protein required for maintenance and a weight gain of 50g per day as specified by the ARC (1984). During the feeding trial, daily DMI and weekly body weight change were recorded. The metabolism trial was conducted for seven days at the end of each period.

The total DMI (g/day) in D-1, D-2, D-3 and D-4 groups were 519.8, 527.9, 527.1 and 528.8, respectively. There was no significant difference in DMI among the groups. The significant difference in nutrients intake and digestibility among the groups was due to variation in the CS allowance among the groups to provide similar ME to support weight gain of 50g/day. Body weight gain was similar among groups. Since the lambs in four groups had similar DMI and OMI and were supplied with adequate rumen degraded nitrogen, any difference in microbial nitrogen (MN) flow to the duodenum was regarded as a reflection of the differences in rumen fermentation characteristics (k and PF) of the diets. Since k was similar across the four diets, any difference in MN supply to the duodenum or the efficiency of
microbial N synthesis can be attributed to the differences in PF of the diets. The MN supply to the duodenum (g/day) for D-1, D-2, D-3 and D-4 were 3.49, 3.13, 3.48, 3.21, respectively and the difference was not significant. Similarly the efficiency of MN synthesis (g N/kg ADOM) for the corresponding diets were 10.90, 10.01, 11.14, 11.46, respectively. Therefore, differing PF of the diets had no significant influence on the microbial efficiency in vivo. The N retention in D-2 was higher (P ≤ 0.001) than in D-4, D-1 and D-3 which was attributed to higher N intake of dietary origin since MN supplied to the duodenum was similar in all diets.

The diets with higher PF had no influence on total DMI, nutrient intake, digestibility, body weight gain and nitrogen retention. This indicates that the variation in PF with similar k between the diets failed to supply expected amount of MN to the lower tract. Hence it is necessary to formulate diets with sufficient difference in k to influence higher microbial biomass synthesis in the rumen.

In Experiment-II (lactation trial) six crossbred cows in mid lactation were divided into three groups of two each based on comparable milk yield, body weight, number of lactations completed and days in lactation. The trial was carried out in three periods of four weeks each in a switch over design. The cows in all three groups received finger millet straw (FMS) as the sole roughage and a concentrate supplement (CS). The CS were formulated using the data on ME and PF obtained from the RIVGPT (Kiran and Krishnamoorthy, 2007). The CP and ME content of concentrate supplements were similar. The diets were formulated to be similar in k but differ in PF. The PF and k for D-1, D-2 and D-3 were 3.23 and 0.0581; 3.33 and 0.0609; 3.31 and 0.0620, respectively. The cows were offered adequate FMS. The daily allowance of concentrate supplement for individual cows for maintenance and milk yield was calculated based on the previous weeks’ milk yield, milk fat, body weight and FMS intake. During the feeding trial, daily DMI, milk yield and weekly body weight in cows were recorded. The metabolism trial was conducted for seven days at the end of each period.
Higher DMI in D-1 and D-2 groups was not in response to PF of diets as all the three diets were similar in biomass synthesis efficiency. Significant difference in OM and NDF intake in lactating cows was also attributable to similar variations in DM intake. The digestibility of nutrients for the three diets were similar except for CP. No significant difference was observed among the groups in weight gain since all the cows were fed for maintenance and milk production and without any allowance for body weight change. The 4% FCM yield (kg/day) for D-1, D-2 and D-3 were 10.8 ± 0.86, 12.0 ± 0.87 and 11.2 ± 0.86, respectively and the differences were not statistically significant. There was a significant difference (P≤0.05) in total solids content but not in total solids yield among the groups. The fat content (g/kg) of milk in D-1, D-2 and D-3 were 40.7±1.9, 42.5±1.9 and 45.2±1.9, respectively and the difference was statistically significant (P≤0.002). The milk protein content were similar for the three diets. The higher fat yield in D-2 group was due to higher milk yield in the same group compared to the D-1 and D-3 groups. No significant difference was observed between the groups in nitrogen retention in lactating cows, although there was a negative nitrogen balance in D-2 group. The microbial N supply (g/kg ADOM) to the duodenum, as determined by total urinary PD excretion in D-1, D-2 and D-3 were 19.1±0.9, 18.3±0.9 and 18.2±0.9, respectively with no significant difference observed among the groups.

Further, the body weight gain predicted from ME intake calculated from ME content of the diet obtained from RIVGPT was 98 % of the observed gain in lambs whereas in lactating cows, the observed performance (maintenance+4% FCM yield +weight gain) was accountable to the extent of 95.6% of the energy intake obtained from energy estimates derived from RIVGPT.

Conclusions

The results of the two experiments conducted in this study differing PF of the diets had no influence on in vivo microbial efficiency and nitrogen utilization. A lack of effect of differing PF of the diets was attributable to the lack of difference among
the diets in rate of fermentation (k). Therefore, in order to identify the effect of differing PF on microbial efficiency in vivo, the k should be allowed to vary along with PF.

A good agreement (within ±2% in Expt.-I and ±4.4% in Expt.-II) between the observed energy output (maintenance+4% FCM yield +weight gain) and the energy input calculated from ME value determined from the RIVGPT indicates the reliability of using RIVGPT to determine ME content of ruminant feedstuffs, and their application in practical diet formulation to achieve targeted performance.

Although the RIVGPT can also be applied to differentiate feedstuffs for the microbial biomass synthesis efficiency (PF) in vitro, the application of such data to manipulate microbial biomass synthesis in vivo is inconclusive. However, in the context of simplicity of RIVGPT to determine microbial efficiency in vitro, and the necessity to evaluate ruminant feedstuffs for microbial biomass synthesis, further studies to assess the reliability of PF data for application in practical diet formulation deserves attention.