

those finished in stalls or on pasture plus concentrate, while supplemented grazing animals often achieve performance comparable to, or better than, fully stall-fed counterparts (Ke et al., 2023). These patterns reflect both increased energy and protein density and more stable nutrient supply, underscoring why semi-intensive systems with targeted supplementation are often recommended for improving growth while retaining some grazing-based advantages (Huang et al., 2023).

Field comparisons confirm these general trends under smallholder conditions. In Assam local goats, kids reared intensively with ad libitum concentrate and fodder exhibited significantly higher final body weights and superior feed conversion efficiency compared with contemporaries managed extensively with traditional grazing and browsing, with divergence in body weight becoming highly significant from the third week onward (Hoque et al., 2020). Similarly, work on Osmanabadi goats comparing traditional grazing with various stall-feeding plus supplementation methods found that systems combining grazing with stall feeding achieved the best overall body growth and chest girth development, suggesting that integrating controlled feeding with natural browsing can yield both biological and economic benefits over purely extensive methods (Da et al., 2021).

### **8.3 Evaluation of technical interventions (Additives/Management Measures)**

Feed additives and formulation technologies offer additional leverage to enhance growth performance beyond basal ration design. A meta-analysis of *Saccharomyces cerevisiae* supplementation in growing goats found that dietary yeast consistently increased ADG while only modestly affecting dry-matter intake and feed conversion ratio, and also elevated blood glucose, white blood cell counts, and ruminal propionate and total volatile fatty acids, indicating improved rumen fermentation and health status (Ogbuewu and Mbajiorgu, 2023). Similarly, a factorial trial with neem leaf and polyethylene glycol showed that adding 6% neem leaf plus 15% PEG to the concentrate raised feed intake, nutrient digestibility, ADG, and propionic acid concentration while reducing ruminal methanogens and protozoa, suggesting that certain plant-based additives can simultaneously enhance growth and modulate the rumen microbiome in a favorable direction (Taethaisong et al., 2023).

Management-type technical interventions, such as pelleting and optimizing concentrate level, can also markedly improve growth efficiency in commercial settings. A comparative on-farm study in Bangladesh demonstrated that a complete pelleted feed (40% roughage, 60% concentrate) under stall feeding produced substantially higher daily weight gain and lower feed conversion ratio and cost per kilogram gain than conventional semi-intensive feeding without pellets, implying strong economic incentives for pelleting where infrastructure allows (Ahmed et al., 2020). Likewise, trials in India and Iraq indicate that intermediate concentrate levels around 2%-3% of body weight, whether in mash or pelleted form, often yield superior growth and feed efficiency compared with lower or higher levels, helping define practical targets for intensive fattening systems (Al-Ani, 2024; Dutta et al., 2025). Together, these technical interventions—microbial and plant additives, precision in concentrate level, and physical processing of feeds—provide a toolkit for fine-tuning feeding strategies to maximize growth performance in goats under diverse production environments.

## **9 Conclusion and Prospects**

Research on feeding strategies for goats consistently demonstrates that growth performance is highly responsive to both nutrient density and ration structure. Optimally balanced diets that match energy and protein to physiological stage, breed, and production objectives improve average daily gain, feed conversion ratio, and carcass traits. Appropriate use of high-quality forages, combined with concentrates formulated to support rumen health, underpins efficient growth while reducing digestive upsets. Strategic supplementation with minerals and vitamins further supports skeletal development, immune competence, and overall robustness, especially in intensive or semi-intensive systems. Studies comparing different management systems indicate that integrating good nutrition with appropriate housing, health programs, and environmental control yields additive benefits for growth. Intensive and semi-intensive systems, when properly managed, enable more precise feed allocation and better control of environmental stressors, leading to more uniform growth rates. Genetic improvement and targeted breeding add another layer of enhancement by improving feed efficiency, growth potential, and resilience, particularly when combined with modern tools such as marker-assisted selection. Overall, the literature converges