

7.3 Stress factors and mitigation strategies

Environmental, nutritional, and handling stressors interact to shape growth performance by altering behavior, physiology, and immune competence. Heat stress is often the dominant physical stressor in tropical and subtropical regions, where goats display behavioral adaptations such as shade seeking, nocturnal grazing, and reduced daytime feeding; while these responses help maintain homeothermy, they also decrease feeding efficiency and growth if not compensated by management. Under experimental hot environments, goats exhibit elevated rectal and skin temperatures, higher respiration rate, and reduced blood glucose, alongside lower dry matter intake but increased digestibility, indicating both a physiological strain and a metabolic adjustment that may not fully protect growth over longer periods (Ali et al., 2023). Reviews of climate change and goat production emphasize that high temperatures impair immune and endocrine systems, depressing growth, reproductive capacity, and product quality, which collectively lowers herd-level productivity unless mitigated by adapted management (Stavetska et al., 2025).

A variety of mitigation strategies can buffer goats against environmental and management-related stress, thereby preserving growth responses to improved feeding. Environmental strategies include providing shade, optimizing housing orientation, and installing cooling systems or misting where feasible, which have been shown to reduce heat load and lower key stress indicators such as respiratory rate and rectal temperature. Nutritional and rumen-oriented interventions, such as feeding antioxidants or specific probiotics, can also enhance resilience; for example, prophylactic supplementation with *Clostridium butyricum* and *Saccharomyces cerevisiae* before a heat-stress period improved average daily gain and feed efficiency by supporting rumen fermentation and antioxidant status under high THI (Xue et al., 2022). At the same time, good handling practices that minimize psychological and pre-slaughter stress are important, because goats are particularly susceptible to management-related stress during transport and lairage, which can depress performance and meat quality even when on-farm feeding is optimal (Kumar et al., 2022). Combining environmental control, targeted feeding strategies, and low-stress handling provides a comprehensive approach to mitigating stress and securing growth performance in modern goat systems.

8 Case Study: Analysis of Typical Feeding Strategies on Goat Growth Performance

8.1 Case of diet optimization in a large-scale farm

Diet optimization in commercial goat operations typically focuses on balancing local roughage resources with strategic concentrate supplementation to maximize average daily gain (ADG) and feed efficiency. An intensive trial with 32 Barbari male kids showed that increasing concentrate mix from 0.7% to 2.1% of body weight on a pulse-straw basal diet significantly improved weight gain, nutrient digestibility, rumen volatile fatty acid production, and nitrogen retention, providing a clear framework for intensive meat-oriented farms using crop residues as the main roughage (Dutta et al., 2025). In practice, such a strategy allows large farms to convert low-value chickpea straw and similar by-products into higher-value meat while maintaining acceptable health indicators, as reflected in improved blood glucose and hemoglobin profiles under higher concentrate inclusion.

On-farm diet optimization for replacement females illustrates how modifying existing rations can enhance future herd productivity in semi-commercial settings. In a Malaysian smallholder but fully intensive system, 4-month-old Boer-cross replacement does fed a reformulated ration based on NRC recommendations, using the same local forages and agro-industrial by-products as the farmer's original diet but at higher quantity and better nutrient balance, achieved markedly higher final body weight and ADG than goats on the routine feeding program (Ghani et al., 2017). After seven months, treated goats reached about 39 kg versus 32 kg in controls, and a higher proportion achieved a body condition score ≥ 3 , demonstrating how technically guided ration formulation within existing feed resources can lift growth performance and readiness for breeding in a quasi-large-scale scenario.

8.2 Comparative analysis of growth performance under different feeding systems

Comparisons among feeding systems consistently show that intensive or supplemented systems support higher growth rates than unsupplemented grazing, though at the cost of greater input use. A review of feeding systems in sheep and goats concluded that kids and lambs finished on pasture alone have lower ADG and carcass yield than