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EFFECT OF *Patanga succincta* ABDOMINAL PEPTIDE AS POTENTIAL IMMUNO-STIMULANTS ON LOCAL GOAT KIDS REARED IN COMMUNAL GRAZING SYSTEM

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Abstract

In traditional farming systems, particularly those utilizing communal grazing, local goats often consume fresh forage voluntarily. However, these systems are frequently associated with high mortality rates. To address this issue, the present study explores the potential of immuno-stimulant peptides derived from abdominal region of Patanga succincta to enhance immune response in goat kids. Specifically, the study aims to perform molecular characterization of a local strain of P. succincta and to evaluate the effects of these immuno-stimulant peptides (ISPs) on circulating Immunoglobulin G (IgG) levels in young goats. Sixteen two-month-old goat kids were randomly assigned to four treatment groups: T1 (0 µl ISPs), T2 (5 µl ISPs), T3 (10 µl ISPs), and T4 (15 µl ISPs), with each group consisting of four animals. The experiment followed a Completely Randomized Design (CRD) and data were analyzed using one-way ANOVA. ISPs were administered via subcutaneous injection at the superior dorsal cervical region. Serum IgG levels were quantified using the Single Radial Immunodiffusion (SRID) method. Results indicated that the T3 treatment group exhibited a statistically significant increase in IgG levels ($P<0.05$) compared to the other groups.

Key words*: abdominal peptides, immuno-stimulant, Patanga succinta, serum.*

INTRODUCTION

Traditional farming systems, particularly those based on communal grazing, play a crucial role in rural livelihoods (Masika & Mafu, 2004) across many regions of the world.

These systems allow local livestock breeds, such as goats, to graze freely on available natural forage, reducing the cost of feeding and supporting sustainable agricultural practices (Toar et al., 2019).

However, despite these advantages, traditional grazing systems often face significant challenges related to animal health and survival. One of the most pressing issues in communal grazing systems is the high mortality rate observed in young livestock, especially goat kids.

This problem can be attributed to various factors, including poor nutrition, exposure to infectious diseases, parasites, and inadequate veterinary care. The vulnerability of young animals during their early developmental stages makes it essential to explore effective strategies to strengthen their immune systems and improve survival rates.

Enhancing the immune response in livestock is a critical area of research aimed at reducing mortality and improving overall animal health. Immuno-stimulants, substances that stimulate the body's immune system, have gained considerable attention as potential tools to boost resistance against pathogens.

Among these, immuno-stimulant peptides (ISPs) have shown promise due to their ability to modulate immune functions without causing adverse effects.

Insects have recently been recognized as valuable sources of bioactive compounds, including immuno-stimulant peptides (Rumokoy & Toar, 2022). The grasshopper *Patanga succincta*, a species native to many tropical and subtropical regions, has been identified as a potential source of such peptides. These bioactive molecules, particularly those extracted from the abdominal region of the insect, may

offer new opportunities for enhancing livestock immunity naturally.

Despite the potential of ISPs, limited research has been conducted on their application in goat farming, especially within traditional systems. This gap in knowledge necessitates detailed studies focusing on the molecular characterization of these peptides and their physiological effects on target animals. Understanding the specific immune parameters influenced by ISPs is essential to validate their effectiveness and ensure safe usage.

One important indicator of immune status in goats is the level of circulating Immunoglobulin G (IgG), which plays a key role in the adaptive immune response (Rumokoy et al., 2018). Measuring IgG concentrations provides insight into the animal's ability to respond to infections and maintain health. Therefore, evaluating the impact of ISPs on IgG levels in young goats can help determine their immunomodulatory potential.

This study was designed to address these knowledge gaps by characterizing the effects of abdominal peptides of a local strain of *Patanga succincta* on IgG levels in goat kids. By conducting a controlled experiment with different ISPs dosages, the research aims to identify optimal treatment strategies for enhancing immune responses in young goats raised under traditional farming conditions.

The findings of this study could contribute to the development of innovative, cost-effective interventions for improving goat health and reducing mortality rates in communal grazing systems. Such advancements would support sustainable livestock production, enhance farmer livelihoods, and promote animal welfare in rural communities relying on traditional farming practices.

Given the high mortality rates in young goats within traditional communal grazing systems and the limited availability of effective immune-enhancing interventions (Rumokoy et al., 2018), this study seeks to explore the potential of immuno-stimulant peptides derived from *Patanga succincta* as a novel strategy to boost immune function. By investigating both the molecular characteristics of these peptides and their impact on circulating IgG levels, the research aims to provide valuable insights that could lead to practical solutions for improving goat health and reducing losses in rural farming communities (Rumokoy et al., 2019).

MATERIALS AND METHODS

A total of sixteen healthy local goat kids, approximately two months of age, were used in this study. The animals were randomly assigned to four treatment groups (T1-T4), with each group consisting of three individuals. The treatments were defined as follows: T1 control, 0 µL immunostimulatory peptides (ISPs), T2 (5 µL ISPs), T3 (10 µL ISPs), and T4 (15 µL ISPs). The study was conducted using a Completely Randomized Design (CRD) to reduce experimental bias and enhance result validity. The parameters measured included total serum immunoglobulin G (IgG) concentration, diarrhea incidence, and mortality rate.

Immunostimulatory peptides (ISPs) were extracted from the abdominal region of *Patanga succincta* specimens collected from their natural habitat. The extraction procedure involved homogenization, centrifugation, and peptide purification using standard lyophilization techniques. The purified ISPs were administered subcutaneously into the superior dorsal cervical region of each goat kid according to the respective treatment doses. All injections were performed under aseptic conditions to prevent infection and ensure animal welfare.

Blood Sampling and IgG Quantification: Blood samples were collected from the jugular vein of each goat kid at baseline (prior to ISP administration) and on day 14 post-treatment. Serum was separated by centrifugation and stored at −20°C until analysis. Immunoglobulin G (IgG) concentrations were determined using the Single Radial Immunodiffusion (SRID) assay, a reliable method for quantifying specific immunoglobulin levels.

Serum IgG concentration data were analyzed using one-way Analysis of Variance (ANOVA) to evaluate the effect of ISP dosage on the immune response. Statistical significance was set at $P < 0.05$. Mortality rate was calculated as the number of dead animals divided by the total number of observed animals, multiplied by 100%. The severity of diarrhea cases was assessed using a Likert scale ranging from 1 to 5 based on the intensity of symptoms. All

statistical analyses were performed using Microsoft Excel software.

RESULTS AND DISCUSSIONS

The results of the study on the effect of immunostimulatory peptides (ISPs) derived from the abdominal region of *Patanga succincta* on total serum IgG levels in goat kids demonstrated an increase concentrations, as illustrated in Figure 1.

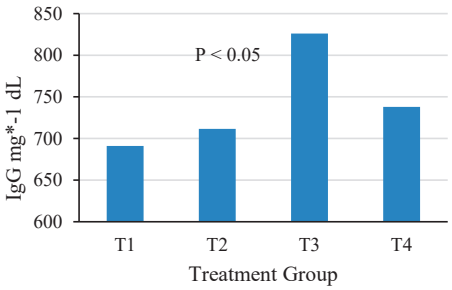

Figure 1. Treatment response on total serum IgG antibody levels

Group T3 exhibited the highest IgG concentration (~820 mg/dL), which was significantly higher than that of the control group T1 (~690 mg/dL). This difference was statistically significant ($P < 0.05$), indicating that the peptide treatment effectively stimulated the immune response in the goat kids.

The findings of this study demonstrate that administration of abdominal peptides derived from *Patanga succincta* effectively stimulates the immune response in goat kids, which is consistent with the observations reported by Iqbal et al. (2021). Their review highlights various immunotherapeutic and immunomodulatory approaches in clinical trials, emphasizing the significance of natural immunomodulators, including peptides from non-traditional sources, to enhance the host immune response against pathogens. They note that insect-derived peptides possess potential as immunostimulants by promoting antibody production, such as IgG, which plays a crucial role in the defense against parasitic and microbial infections.

Insect-derived peptides may function as immunostimulants by activating B cells and promoting the production of IgG antibodies. This increase in IgG is crucial for protecting goat kids from pathogenic infections during the early stages of life when the immune system is still developing (Megha & Mohanan, 2021).

The results of this study also demonstrate a strong stimulation of the immune response, as illustrated in Figure 1, where group T3 exhibited the highest IgG levels with a significant difference compared to the control group. The increase in IgG concentration is a key indicator of adaptive immune system activation, particularly reflecting the effector functions of immunoglobulin G (IgG) in antigen neutralization, complement activation, and pathogen opsonization.

Furthermore, Megha & Mohanan (2021) explain that immunoglobulins not only serve as essential components of the body's defense system but also act as important biomarkers for assessing immune status and the efficacy of immunomodulatory therapies. In this context, the observed increase in IgG levels in goat kids reinforces the potential of insect-derived peptides as natural immunostimulants that can be applied to enhance livestock resistance against pathogenic infections. This study aligns with the concept that natural peptides can modulate the immune system through B cell activation and the production of specific antibodies.

Thus, the findings of this study support peptide-based immunization strategies as a promising approach in livestock health management, aligning with current understandings of the role of immunoglobulins in disease prevention and therapeutic interventions.

The increased IgG levels observed in group T3 confirm the effectiveness of the 10 µL ISP dose in enhancing the immune system. Groups T2 and T4 also demonstrated elevated IgG concentrations compared to the control, but not to the same extent as T3, suggesting that the 10 µL dosage elicits the most optimal immunostimulatory effect. However, long-term evaluations regarding safety and potential side effects are necessary prior to broader application.

The following figure presents the observed mortality rate of the goat kids (Figure 2).

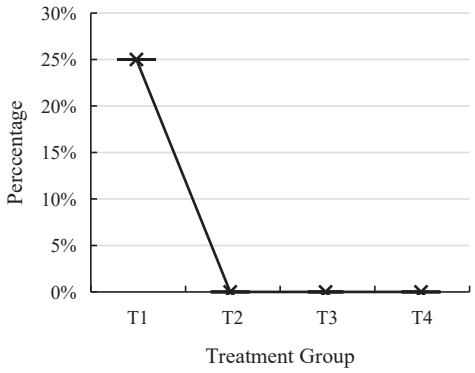

Figure 2. Mortality rate of observed goat kids

Observations indicated that the control group (T1), which did not receive abdominal peptides from *Patanga succincta* (0 µL ISPs), exhibited a mortality rate of 25%, whereas all treatment groups (T2, T3, and T4) that received the abdominal peptides showed no mortality (0%). Considering that the test animals were two-month-old local goat kids raised under communal grazing systems, these results are both significant and warrant further analysis.

The high mortality observed in the control group indicates that young goats raised under open communal grazing systems are vulnerable to environmental stressors, pathogen exposure, and potentially suboptimal baseline immunity. Several studies have reported elevated kid mortality rates in communal grazing systems due to infectious diseases, parasitic infestations, adverse climatic conditions, and inadequate management practices. For instance, a community-based intervention in the Eastern Cape, South Africa, successfully reduced kid mortality from approximately 56% to 22% through improvements in veterinary services, sanitation, and disease control (Slayi et al., 2022). Furthermore, herders in communal grazing areas have identified disease and parasitism as the primary causes of kid mortality (Slayi et al., 2014).

Conversely, the absence of mortality in the treatment groups indicates the potential protective effects of *P. succincta* abdominal peptides as immunostimulants. Bioactive insect peptides have increasingly attracted research interest due to their promising antimicrobial, antioxidant, and immunomodulatory activities. A recent review highlights the application of insect peptides in livestock health, emphasizing their antimicrobial and antioxidant capacities (Tarahi et al., 2025). Additionally, other studies have proposed insect antimicrobial peptides as alternatives to antibiotics and growth promoters in livestock, demonstrating positive impacts on health and disease resistance (Patyra & Kwiatek, 2023).

The protective mechanism conferred by *P. succincta* peptides likely involves the stimulation of non-specific immune responses, such as enhanced phagocytic activity, cytokine production, and activation of oxidative defense systems. Other insect-derived peptides have been shown to upregulate immune-related gene expression; for instance, the paralytic peptide from *Bombyx mori* stimulates nitric oxide production to combat bacterial infections (Ishii et al., 2013).

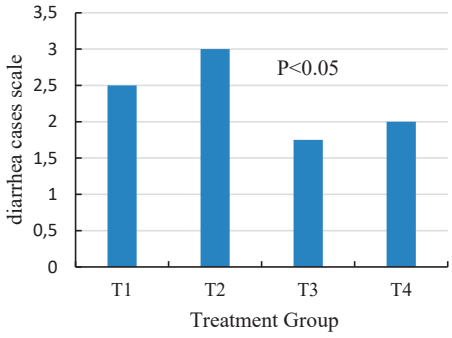

Figure 3. Treatment response to diarrhea cases in observed goat kids

Figure 3 illustrates the treatment response to diarrhea cases in the observed goat kids, with the highest diarrhea score observed in group T2 (~3.0) and the lowest in group T3 (~1.7). The significant difference ($P < 0.05$) indicates that the treatments had varying effects on the incidence of diarrhea. Group T3 exhibited the best response, showing a lower diarrhea score compared to other groups, including the control. Diarrhea in goat kids is a significant health issue that can reduce growth performance and increase mortality rates (Srivastava et al., 2025). The reduction in diarrhea cases observed in groups treated with *Patanga succincta* abdominal peptides can be attributed to immunomodulatory mechanisms that enhance

the immune system, thereby increasing resistance to diarrhea-causing pathogens (Datt et al., 2023). Natural peptides are known for their antimicrobial and immunostimulatory activities, which can also reduce inflammation (Gupta, 2025; Rumokoy et al., 2017). Studies by Munang'andu et al. (2024) and Toar et al. (2017) further demonstrate that natural immunomodulators can lower the incidence of infectious diseases in livestock by boosting both local and systemic immunity. The significant decrease in diarrhea cases in the T3 treatment group (10 µL ISPs) aligns with this concept, indicating that the dosage or peptide formulation in T3 is more effective in preventing diarrhea.

Thus, these findings demonstrate that the use of insect abdominal peptides as potential immunostimulatory agents plays a positive role in controlling diarrhea in goat kids, while simultaneously enhancing livestock health and productivity.

CONCLUSIONS

Based on the results and discussion presented above, we conclude that administration of abdominal peptides from *Patanga succincta* significantly enhances immune response and reduces the incidence of diarrhea in goat kids. The treatment group T3, which received 10 µL of ISPs, exhibited the highest serum IgG levels and the lowest diarrhea scores, indicating the peptide's potential as a natural immunomodulatory agent. This effectiveness is attributed to the peptide's ability to stimulate antibody production, strengthen host defenses against pathogens, and improve gastrointestinal health. Therefore, *Patanga succincta* abdominal peptides hold promise as an alternative functional additive in sustainable and healthier management systems for young goats.

Based on the promising immunostimulatory effects of *Patanga succincta* abdominal peptides demonstrated in this study, it is recommended to further explore their application as a natural immunomodulatory additive in goat farming practices. The optimal dose of 10 µL ISPs (T3 group) showed significant benefits in enhancing immune function, reducing diarrhea incidence, and lowering mortality, suggesting its potential for improving animal health and productivity. Future research should focus on long-term safety evaluations, dose optimization, and the mechanisms underlying the immunomodulatory actions of these peptides. Additionally, field trials under diverse environmental and management conditions are warranted to validate their efficacy and feasibility in commercial livestock production. Incorporating such bioactive peptides could contribute to reducing reliance on antibiotics and chemical additives, aligning with sustainable and eco-friendly animal husbandry goals.

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REPRODUCTION, PHYSIOLOGY, ANATOMY