

# ARTIFICIAL INTELLIGENCE AND KETOSIS: EXPERIMENTAL AND ANALYTICAL PERSPECTIVES

Gurbanova Nailya Tofiq<sup>1</sup>, Mehtiyev Agil Gazanfar<sup>2</sup>, Khalilova Gunel Rafail<sup>2</sup>, Babayeva Turkan Mirsakhavat<sup>2</sup>, Meyfaliyeva Aynur Jumshud<sup>2</sup>

<sup>1</sup>Senior Lecturer, Azerbaijan State Agricultural University, Ganja, Azerbaijan

<sup>2</sup>Teacher, Azerbaijan State Agricultural University, Ganja, Azerbaijan.

## Abstract

The rapid development of digital technologies has significantly influenced modern healthcare systems. In this context, the interaction between Ketosis and Artificial Intelligence represents an important area of interdisciplinary research. This study explores the physiological mechanisms of ketosis, the role of artificial intelligence in metabolic monitoring, and incorporates experimental animal-based analytical results to provide a comprehensive perspective.

## 1. Introduction

Metabolic processes are essential for maintaining energy balance in biological systems. Ketosis is one such process that reflects a shift in energy utilization from carbohydrates to fats. While this state can be beneficial under controlled conditions, it may also lead to serious complications if not properly managed [1]. With the emergence of artificial intelligence, new opportunities have arisen for real-time monitoring, predictive diagnostics and personalized treatment. This paper aims to examine both the theoretical and practical integration of ketosis and AI technologies. Ketosis is defined as a metabolic condition in which ketone bodies are produced in the liver due to reduced carbohydrate availability. These ketones serve as an alternative energy source, particularly for the brain and muscles [2].

There are two main forms:

Nutritional ketosis – controlled and generally safe

Pathological ketosis – associated with metabolic disorders

A severe pathological condition, Diabetic Ketoacidosis, occurs when ketone accumulation leads to metabolic acidosis and requires urgent medical intervention [2].

## **Artificial Intelligence in Healthcare Systems**

Artificial Intelligence involves computational models capable of learning from data and making predictions. In healthcare, AI is used for:

- Disease prediction

- Clinical decision support

- Real-time patient monitoring

AI has the potential to transform medicine by improving accuracy and efficiency in diagnosis and treatment [3].

### **Applications of AI in Ketosis and Metabolic Regulation**

AI models analyze patient data (glucose, ketones, lifestyle) to predict metabolic imbalance and prevent complications. AI enables individualized diet and insulin strategies, improving metabolic control. Continuous glucose monitoring systems combined with AI provide real-time alerts and trend analysis. AI assists clinicians in making evidence-based decisions, reducing diagnostic errors.

## **2. Experimental part**

### **Experimental Analysis (Large Ruminants – Dairy Cattle Model)**

To better understand the dynamics of Ketosis in livestock, an experimental study was conducted on dairy cattle (large ruminants), in which ketosis is a common metabolic disorder, particularly during early lactation [3].

#### **Study Design**

**Subjects:** 30 dairy cows

#### **Groups:**

- Healthy control group (n = 15)

- Ketosis-affected group (n = 15)

**Observation period:** First 6 weeks postpartum

#### **Measured parameters:**

- Blood glucose (mg/dL)

- Blood ketone levels ( $\beta$ -hydroxybutyrate, mmol/L)

- Milk yield (L/day)

- Body condition score (BCS)

Artificial Intelligence-based models were applied to analyze metabolic patterns and predict ketosis risk.

## Results

**Table 1.** Biochemical and physiological indicators in healthy and ketosis-affected dairy COWS.

| Parameter            | Healthy Cows     | Ketosis-Affected Cows |
|----------------------|------------------|-----------------------|
| Blood Glucose        | 60 ± 4 mg/dL     | 42 ± 5 mg/dL          |
| Ketone Levels (BHB)  | 0.8 ± 0.2 mmol/L | 3.2 ± 0.6 mmol/L      |
| Milk Yield           | 28 ± 3 L/day     | 20 ± 4 L/day          |
| Body Condition Score | 3.2 ± 0.3        | 2.5 ± 0.4             |

### AI-Based Analytical Findings

The AI model identified:

A **rapid increase in ketone levels** during the first two weeks postpartum

A strong negative correlation between milk yield and ketone levels ( $r \approx -0.76$ )

Early metabolic imbalance detected 3–4 days prior to clinical manifestation [4,5]

### Interpretation of Results

The findings indicate significant metabolic stress in ketosis-affected cattle:

Reduced glucose levels indicate a negative energy balance

Elevated ketone concentrations confirm subclinical or clinical ketosis

Decreased milk yield reflects substantial economic impact

Lower body condition scores suggest increased fat mobilization

From an analytical perspective:

AI models successfully predicted ketosis before the onset of observable clinical signs

Early detection enables timely nutritional and veterinary interventions

This approach significantly reduces productivity losses

### Practical Implications

AI systems can be integrated into precision livestock farming

Sensor-based monitoring combined with AI enables real-time analysis

Automated alerts can be generated (e.g., “*High ketosis risk detected*”)

This approach improves:

Animal health and welfare

Farm productivity

Economic efficiency

### 3. Conclusion

The integration of Ketosis and Artificial Intelligence represents a major advancement in modern medicine. While ketosis is a complex metabolic condition with both beneficial and harmful aspects, artificial intelligence provides powerful tools for its monitoring and management.

The inclusion of experimental animal data further supports the effectiveness of AI in predicting metabolic changes and preventing complications. Future developments in AI-driven healthcare systems are expected to enhance patient safety, improve treatment outcomes, and enable more precise medical interventions.

### References

- [1] Cahill, G. F. (2006). Fuel metabolism in starvation. *Annual Review of Nutrition*, 26, 1–22.
- [2] Paoli, A., et al. (2013). Ketogenic diet applications. *European Journal of Clinical Nutrition*, 67(8), 789–796.
- [3] Kitabchi, A. E., et al. (2009). Hyperglycemic crises in diabetes. *Diabetes Care*, 32(7), 1335–1343.
- [4] Eric Topol (2019). *Deep Medicine*.
- [5] Contreras, I., & Vehi, J. (2018). AI in diabetes management. *Journal of Diabetes Science and Technology*, 12(4), 689–695.
- [6] Shah, V. N., et al. (2019). Artificial pancreas systems. *Diabetes Technology & Therapeutics*, 21(S2), S-254–S-259.