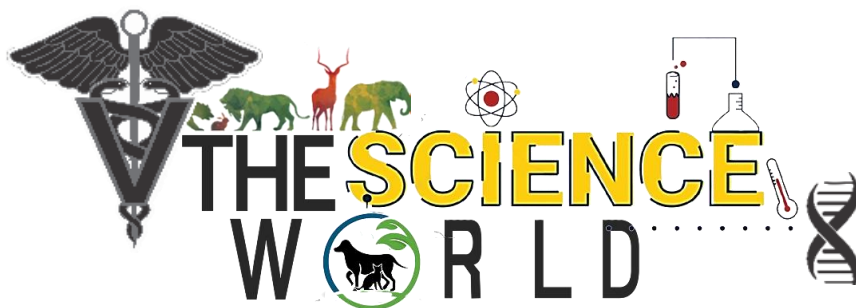




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Importance of Serum Biochemistry Tests in Livestock Disease Diagnosis

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Abstract

Serum biochemistry testing is an important diagnostic tool in veterinary medicine that provides information about organ integrity, metabolic stability and disease pathogenesis in domestic animals. It supports disease identification, treatment monitoring and preventive health management, while helping detect subclinical conditions that may reduce milk yield, reproductive performance, weight gain and overall livestock productivity. Routine serum profiling evaluates enzymes, proteins, electrolytes, metabolites and trace elements and can identify organ stress, metabolic disorders, nutritional deficiencies and physiological changes before obvious clinical signs appear. Liver, kidney, electrolyte, intestinal and pancreatic markers, along with lipid and mineral profiles, provide information relevant to different disease conditions. Metabolic monitoring during the transition period is particularly useful for identifying negative energy balance, hyperketonemia, hepatic lipidosis and mineral imbalances. Herd-level metabolic profiling can assist in assessing nutritional deficiencies and fine-tuning dietary rations. Interpretation of serum biochemical results should consider reproductive status, stage of lactation and seasonal variations. Thus, serum biochemistry is a practical component of livestock health management that supports animal welfare, production efficiency and economic sustainability.

Keywords- Serum Biochemistry Panel, Veterinary Diagnostics, LFT, KFT.

Introduction

Serum biochemistry testing serves as an indispensable tool in modern veterinary medicine, providing critical insights into organ integrity, metabolic stability, and disease pathogenesis across domestic animal species (Kaneko et al., 2008; Russell & Roussel, 2007). For farmers, livestock represents a vital source of livelihood and a significant financial



investment. However, diseases adversely affect the overall productivity and health of these animals. Disease negatively impacts a cow's milk production capacity. Various symptoms of disease can be observed in animals. A sick cow may isolate itself in the pasture, or a sick lamb may display complete lethargy; however, beyond these visible symptoms, the underlying nature of the disease can often be severe. Internal damage is frequently already quite advanced before external signs appear.

In many such conditions, alongside physical symptoms, diagnostic tests such as Complete Blood Count (CBC) or blood serum biochemistry testing serve as the cornerstone of modern veterinary diagnosis. Beyond disease identification, these tests play a vital role in monitoring treatment success and formulating preventive health measures. Without timely diagnosis, diseases can aggravate, requiring expensive emergency veterinary care and resulting in permanent losses in livestock production capacity. Subclinical disease conditions, where external clinical signs are absent, cause substantial financial losses through reduced milk yield, poor reproductive performance, poor weight gain, and higher culling rates.

Rather than testing only after illness occurs, blood biochemistry is frequently used preventatively to avoid disease or assess an animal's general physiological status. In large dairy farms, routine blood sampling acts as an early warning system that detects organ stress, metabolic strain, and nutritional deficiencies long before clinical symptoms appear. For instance, conditions such as subclinical ketosis, silent hypocalcemia, mineral deficiencies, and liver disorders reduce feed intake and feed conversion efficiency, compromise immune function, lower conception rates, and diminish overall yield.

Serum biochemistry shifts livestock management from reactive troubleshooting to a proactive health strategy. Through routine serum profiles, veterinarians can evaluate metabolic diseases, dietary imbalances, and physiological stress. Assessing chemical components in serum- including enzymes, proteins, electrolytes, metabolites, and trace elements, enables livestock clinicians to detect subclinical conditions, establish precise health baselines, provide accurate prognoses, and fine-tune targeted therapeutic regimens. In addition to laboratory testing, handheld point-of-care meters measuring whole-blood or serum ketones, glucose, and lactate are available in the market for rapid field diagnosis and immediate treatment decision-making. Combining pre-clinical animal history, physical examination findings, and complementary diagnostic assessments ensures comprehensive animal welfare, maximum biosecurity, and financial security for livestock owners.

Serum sample collection involves drawing blood, allowing it to clot in a collection tube, and separating the serum via centrifugation in a laboratory setting. All subsequent biochemical



tests are performed on this separated serum sample. Diagnostic biochemistry panels evaluate the health and functional capacity of specific organ systems through targeted groups of blood biomarkers. The key diagnostic panels are detailed below.

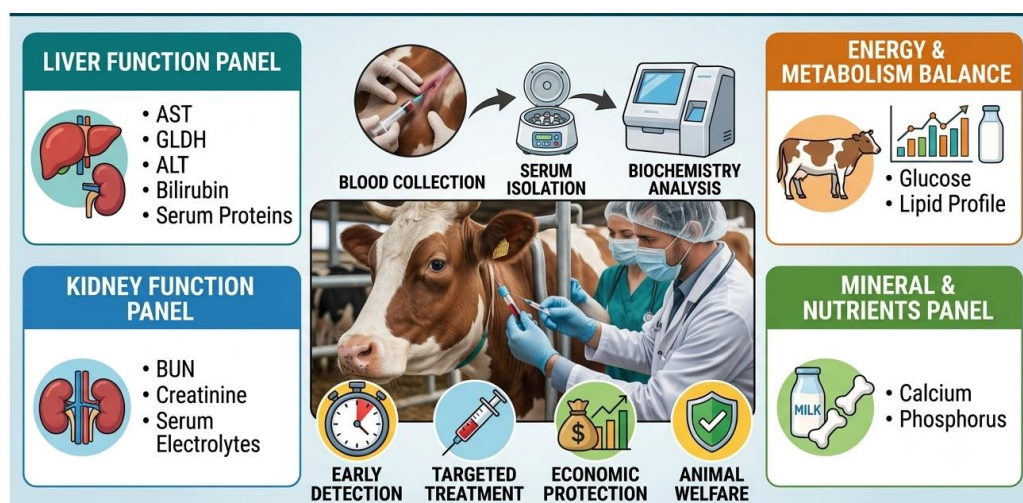


Figure: Serum Biochemistry test workflow

Liver Function Panel

In the liver function panel, measuring levels of total, direct, and indirect bilirubin in blood serum is useful for diagnosing jaundice and classifying it into pre-hepatic, hepatic, or post-hepatic (biliary) origins. This aids in diagnosing conditions such as tick fever in animals, hepatitis, and gallbladder pathologies. The panel also includes serum protein profiling and measuring enzymes associated with hepatocellular integrity.

Among these enzymes, Glutamate Dehydrogenase (GLDH) and Aspartate Aminotransferase (AST) reflect active liver cell injury. In monogastric species (humans and small companion animals), Alanine Aminotransferase (ALT) is heavily relied upon; however, in ruminants and horses, ALT lacks hepatic specificity. Consequently, GLDH testing serves as the gold standard for diagnosing acute liver injury in cattle, sheep, and horses.

Kidney Function tests -

Standard kidney function tests and blood electrolyte levels are used for diagnosing renal diseases and evaluating kidney performance, related pathologies, and nephrotoxicity. Serum creatinine and Blood Urea Nitrogen (BUN / Serum Urea) serve as primary markers of azotemia. This allows classification of renal-related conditions into pre-renal (dehydration, reduced perfusion), renal (primary kidney injury), or post-renal causes (urinary tract obstructions, such as urolithiasis found in bulls).



Electrolyte Analysis-

Evaluating blood levels of sodium, potassium, chloride, and bicarbonate allows assessment of acid-base balance and systemic hydration. Metabolic acidosis—resulting from electrolyte imbalances or lactic acid accumulation—is common in neonatal calf scours and ruminal lactic acidosis.

Intestinal & Pancreatic Markers-

Blood serum tests are also useful in identifying intestinal injury, malabsorption markers, Johne's disease (*Mycobacterium avium* subsp. *paratuberculosis*), hemorrhagic bowel syndrome in cattle, or extensive mucosal barrier damage, enterocyte loss, and protein-losing enteropathy caused by necrotizing enteritis. Common markers include serum protein profiling, citrulline, Serum Amyloid A (SAA), and detecting protein-losing enteropathy through albumin. Identifying severe metabolic acidosis and hyperlactatemia through serum testing is crucial during outbreaks, as these life-threatening conditions require immediate intravenous fluid therapy. Additionally, serum panels assist in diagnosing hypokalemic, hypochloremic metabolic alkalosis resulting from abomasal displacement or intestinal obstruction.

Regarding other organ diagnoses, primary pancreatic disease is generally rare in ruminants and swine, making these markers secondary indicators. Pancreas-specific lipase and amylase typically point secondary to acute pancreatic necrosis, heavy metal toxicities (such as zinc toxicity in sheep and calves), or severe parasitic larval migration (e.g., *Strongylus* spp. in horses or *Ascaris suum* in pigs).

Metabolic & Energy Balance Indicators (Lipid Profile)-

In livestock production, the periparturient or transition period presents a severe physiological challenge, where rapid homeostatic and endocrine adaptations frequently trigger subclinical metabolic disorders and mineral imbalances (Goff & Horst, 1997). Systematic metabolic health monitoring during this transition phase is essential for identifying physiological stress before overt clinical signs manifest (LeBlanc, 2010). For instance, hyperketonemia and elevated ketone body concentrations in early lactation significantly compromise cow health, milk yield, and herd reproductive performance (Duffield et al., 2009). Monitoring energy metabolism in dairy cattle, sheep, and camels relies heavily on lipid profiles. Early predictive screening using serum biochemical and hematological profiles at calving allows clinicians to identify individual cows at high risk for ketosis, facilitating preemptive therapeutic management (Ha et al., 2022). Elevated Non-Esterified Fatty Acids (NEFA) and Beta-Hydroxybutyrate (BHB) levels indicate severe negative energy balance (NEB), helping



predict hepatic lipidosis (fatty liver syndrome) in cows and mares, as well as pregnancy toxemia in ewes carrying twins or triplets.

A standard lipid profile panel measures NEFA, BHB, total cholesterol, and triglycerides. Serum NEFA levels reflect the degree of adipose tissue lipolysis during energy deficits, while BHB is the primary circulating ketone body used to diagnose subclinical and clinical ketosis. Blood serum metabolic profiling plays an essential role in intensive livestock production, particularly during the transition period (3 weeks before to 3 weeks after calving) in high-producing dairy cattle. Furthermore, monitoring macro-minerals—calcium, phosphorus, and magnesium—is vital: acute hypocalcemia triggers parturient paresis (milk fever) in lactating animals, whereas hypomagnesemia causes grass tetany.

Beyond individual animal diagnostics, implementing herd-level metabolic profiling enables farm managers to evaluate subclinical nutritional deficits, fine-tune dietary rations, and safeguard overall herd productivity (Oetzel, 2004; Sako et al., 2023). Furthermore, biochemical evaluations yield diagnostic and prognostic markers for specific reproductive conditions across diverse livestock breeds (Molefe & Mwanza, 2019). To ensure diagnostic precision, serum biochemistry interpretation must also incorporate physiological and environmental context, as non-pathological factors such as reproductive state, stage of lactation, and seasonal shifts naturally alter baseline metabolite, vitamin, and hormone concentrations in ruminants (Yokus et al., 2006).

Considering the wide diagnostic scope and utility of these various blood serum tests, applying appropriate tests for different illnesses can prove to be a boon for farmers in livestock management. Serum biochemistry or blood serum testing is a practical, profit-protecting essential component for modern livestock producers. By revealing hidden physiological stress in livestock, it enables farmers to enhance animal welfare, increase production efficiency, and ensure long-term economic sustainability and profitability for livestock operations.

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