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Popular Article

## Metabolic (or) Production Diseases & Concept of Metabolic Profile Testing in Animals

Ambica Gadige<sup>1</sup>, Anil Kumar Banothu<sup>2\*</sup> & Suresh Rasamalla<sup>3</sup>

P.V. Narsimha Rao Telangana Veterinary University, College of Veterinary Science, Korutla-505  
326, Jagtial, Dist. Telangana.

<sup>1</sup> Assistant Professor, Dept. of Veterinary Medicine.

<sup>2\*</sup> Assistant Professor & Head, Dept. of Veterinary Pharmacology & Toxicology.

<sup>3</sup> Assistant Professor, Dept. of Veterinary Clinical Complex

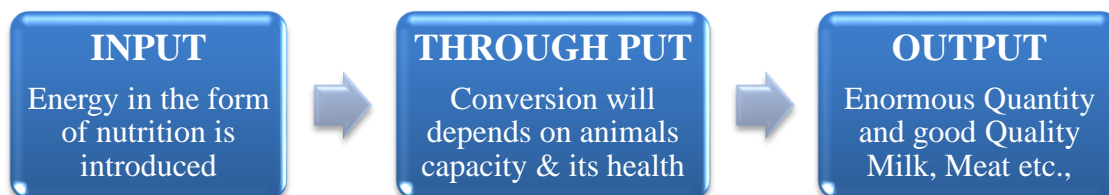
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### Metabolic diseases

- Occur due to change in metabolism, mainly due to deficiency of nutrients (or) certain components and affect males and females equally irrespective of age.  
Eg: Diabetes Mellitus – Both sexes at any age  
Deficiency disease – Equally affects all age groups

### Production diseases

- Noticed in high yielding females only like cows, buffalos, Sheep, Goats, and Equines.  
Eg: Milk Fever/ Post parturient Hypocalcemia, Ketosis etc.,
- Production diseases are concerned with peri-parturient period i.e., 2 months before and 2 months after parturition.
- Presently, 'Metabolic disease' word is replaced by 'Production diseases' which encompasses all metabolic disorders which are due to an 'Imbalance between Input and Output'. Wherein Input is in the form of Diet/feed and Output is by production (Milk & meat) & reproduction
- If we assume dairy cattle can be considered as living milk producer machine, then the method of production would be as follows,



- Any disturbance in either of the above three would end up in metabolic derangement. Hence, a 'balanced ration' along with an 'ideal managemental system' would prevent the occurrence of production diseases.

### **Metabolic Profile Tests (MPT'S):**

- This is a method of prediction of health status of dairy animals based on blood biochemical profiles.
- The basic concept of MPT'S was laid by Payne *et al.* in 1970
- He described a system of monitoring the dairy herds as an aid in different angles like nutrition, production, reproduction & health status of animals.

### **Concept of Metabolic Profile Testing:**

- Laboratory measurement of certain components of body fluids like blood/serum will reflect the nutritional/health status of the animals with (or) without (sub clinical) presence of clinical signs.

### **Objectives of Metabolic Profile Testing:**

- To monitor nutritional status of herd
- To know the relationship bet input & output
- To estimate Qualitative & Quantitative adequacy of the diet
- To know any imbalance at an early stage
- To predict occurrence of production diseases at an early stage so that we can prevent their occurrence by making proper arrangements.
- In this test, major biochemical changes which are apt to occur in dairy animals while under production are evaluated.

### **Selection of Metabolite/Component:**

The selected metabolite should have following characters

- The metabolite should be stable in blood /body fluid even after collection/storage
- We must able to analyze the metabolite at lab level with minimum error
- That metabolite must be consistently present in diet
- It should not be influenced by sex/age environmental factors.

## **METABOLIC PROFILE TESTS**

### **1) Compton Metabolic Profile Test (CMPT):**

- It is widely followed. 'Compton' is a place in U.P.
- Here 7 cows are taken as group, like that '3 groups' are selected



- The basis for selection of groups is that, at a given point of time no animal is producing (or) in lactation i.e., should be in dry period
  - 1<sup>st</sup> Group - Dry animals
  - 2<sup>nd</sup> Group – Medium yielding animals
  - 3<sup>rd</sup> Group – High yielding animals
- Collect blood from all animals and both whole blood & serum are collected separately
- For whole blood collection, commonly used anticoagulant is EDTA @ 1mg/ml of blood but glucose estimation “NaF” is used as anticoagulation.
- Time of collection - This test has to be done thrice in a year (4 months interval) (or) any change in the diet (or) any suspicion of imbalance.
- Generally, ‘9’ parameters are selected, among these ‘6’ are done routinely

S. No.	Biochemical Parameter	Normal Range in Cows
1	Blood Glucose	35-55 mg/dL
2	Hemoglobin (Hb)	08-15 mg/dL
3	Packed Cell Volume (PCV)	24-46%
4	Serum Ca, Mg, P (SIP), Na & K	Ca: 9.7–12.4 mg/dL Mg: 1.2-3.5 mg/dL P: 5.6-6.5 mg/dL Na: 132-152 meq/L K: 3.9–5.8 mg/L
5	Total Protein & Albumin	TP: 5.7 – 8.1 g/dL Alb: 2.1 – 3.6 g/dL
6	Blood Urea Nitrogen (BUN)	6.0 – 27 mg/dL
It any deficiencies are suspected then		
7	Serum ‘Cu’	1.26 ± 0.31 µg/dL
8	Serum ‘Fe’	57 – 162 µg/dL
9	Non-Esterified Free Fatty acids (NEFA)	<30 mg/L

## 2) Mini Metabolic Profile Test (MMPT):

- Alternative to CMPT is MMPT and is laid by ‘Blowey’ in 1975
- In this no need of herd (or) grouping
- Individual animal can be tested
- Done at time of 4- 10wks after calving
- Only adequacy of energy and proteins are tested i.e.,  
Energy – Blood Glucose &  
Proteins – Total Protein, Albumen & BUN
- Interpretation of the test depends on input & output along with values & also mastitis status of the animals.



### 3) Individual Prevention Test:

- Invented by Sommer & Zepgi in 1975 & 1976
- Blood collection is done 8 wks before calving
- The parameters estimated are blood Glucose, SGOT/AST (78–132 U/L) & Total cholesterol (65-220 mg/dl)

One Indian, “Gnan Prakashan” said that not only blood Glucose, SGOT, Total Cholesterol but also “Rumen liquor” can be analyzed for nutritional status of the animals.

### Transition period in Dairy Animals

- Transition period in dairy cows is 3 weeks before and 3 weeks after parturition during which there would be abnormal homeostasis.
- During the last term of pregnancy and early phase of lactation, deficiency of nutrients like vitamins, minerals and enzymes along with the abnormal selection of hormones will lead to abnormal metabolism ultimately resulting in metabolic/production disease.

### Common Peri-parturient Metabolic/ Production Diseases of Animals

#### 1) Calcium deficiency: Causes

- **Milk Fever/Peri-parturient Peresis/ Parturient Epoplexy in Cows & Buffaloes** – During 48 hours before and 48 hours after parturition due to heavy ‘Calcium demand’ for the induction of parturition, synthesis of colostrums and milk. It is characterized by generalized muscular weakness, depression of consciousness, recumbency, ultimately circulatory collapse, shock and death.
- **Milk Fever/Lactation Tetany/ Eclampsia in Mares** – Occur 10 days after foaling (or) 1-2 days after weaning
- **Acute Post-parturient Hypocalcemia in Ewes & Does** – 6 weeks before & 10 weeks after lambing in Ewes, whereas, in Does can occur before (or) after kidding (or) at later stages during 3 weeks after kidding.
- **Eclampsia in Bitches** – During 1-3 weeks after whelping, however can occur during last days of pregnancy characterized by high temperature, stiff and rigid legs, muscular tremors and results in death if not treated.

#### 2) Energy/Glucose deficiency: Causes

- **Ketosis/ Acetonemia/Ketonemia in Cows & Buffaloes** – During peak milk yield 4-6 weeks after parturition characterized by partial anorexia with reluctance to eat concentrates,



depression and signs of nervous dysfunction like bellowing, aggressiveness, circling, abnormal gait, ataxia, pica & convulsions.

- **Pregnancy toxemia/ Twin Lamb Disease/ Sleeping Sickness in Ewes** – A highly fatal disease of Ewes & Does occurring in later part of pregnancy mostly ‘last 2m (or) 4-6 weeks’ of pregnancy characterized by anorexia, nervous signs, recumbency and death.

### 3) Phosphorous deficiency: Causes

- **Post-Parturient Haemoglobinuria/ Red Water in Cows & Buffaloes** - Common in high yielding dairy animals several weeks after calving due to more drain of Phosphorous in milk. It is characterized by anorexia, haemoglobinuria, icterus and anaemia.
- **Pica/ depraved appetite** - Due to feeding of Phosphorous deficient diets and is characterized by Craving/ Chewing the substances that have no nutritional value such as ice, clay, soil, paper etc.,
- **Nutritional Haemoglobinuria in Cows & Buffaloes** – Due to feeding of certain Cruciferous plants causing haemolysis.

### 4) Magnesium Deficiency: Causes

- **Hypomagnesemic Tetany/Lactation Tetany in Cows & Buffaloes** – Seen after parturition during 2<sup>nd</sup> – 4<sup>th</sup> month of lactation. A highly fatal disease of all classes of ruminants clinically characterized by tono-clonic convulsions and results in death due to respiratory failure
- **Grass Tetany/ Grass Staggers** – Due to feeding of lush green grass which is deficient in Magnesium
- **Wheat Pasture Poisoning** - Also causes hypomagnesemia

### 5) Udder related problems

- **Mastitis (or) Udder oedema** - Due to large size of the udder and heavy milking resulting in inflammation/ infection of udder.

**6) Reproductive system problems** - Just before and after parturition due to smooth muscle flaccidity and improper closure of genital opening and incomplete involution of uterus dairy animals may suffer from

- **Dystochia** – Difficulty in parturition
- **Retention of placenta (ROP)**– Delay in expulsion of placenta even after 24 hours after calving
- **Metritis/ Pyometa** – Inflammation of uterus/ Pus formation in uterus



7) **Gastro Intestinal Tract related problems** - Just before and after parturition dairy cattle may prone to

- **Left Displacement of Abomasum** - Due to fast growing and larger size of foetus there is a chance of left displacement of abomasums.
- **Bloat** – Due to decreased GI Tract motility causes failure of eructation of gases.

8) **Other disorders**

- **Downer/ Downer Cow Syndrome (DCS)/ Bovine Secondary Recumbency** - It is the condition developed due to pressure damage to muscles and nerves of cattle making them unable to rise after the 24 hours of recumbency and 2 treatments with i.v Calcium and are non-ambulatory.
- Acute hypokalemia in cattle
- Sub Acute ruminal acidosis (SARA)
- Fatly cow syndrome (FCS)
- Fatty liver
- Liver abscess
- Laminitis

**Common Metabolic Diseases of Cattle**



Hypocalcemia/ Milk fever in cow



Hypomagnesemic Tetany in cow







Ketosis in cow



Phosphorous deficient Post parturient haemoglobinuria in cow

### **Subclinical form of production diseases and their Economic Implications in dairy animals**

- Subclinical form of a disease means an abnormality/ a disease that is staying below the surface of clinical detection/ without externally exhibited clinical signs.
- Subclinical production disease may be resulted due to increased or decreased levels of certain metabolites inside the body.
- When it comes to the dairy animals, almost all will experience subclinical form of the production diseases at the onset of lactation cause due to the imbalance between the feeding, milk yield and other managemental deficiencies.
- Only manifested findings of subclinical form of production diseases are Inappetance/Anorexia as there is decreased reticulo rumen motility which affects the appetite and exacerbates the 'Negative Energy Balance (NEB)' that is already existed in animal and other finding is decrease in milk yield.
- Subclinical form of production diseases is of major economic concern and has to be screened during the early stage to prevent its further progression into clinical form which ends up with the expensive treatment cost and also permanent fall in the milk yield.
- Incidence rate of subclinical production diseases will increase as age advances due to decreased in the metabolism in the body.
- Subclinical form of the production diseases can be diagnosed by metabolic profile testing by screening the blood, serum and urine samples both prepartum and postpartum.

