Veterinary Pharmacovigilance is the management of the detection and investigation of the clinical effects of the veterinary medicinal products, mainly aimed at the safety and efficacy in animals and the safety in people exposed to the products.

Medicinal product with approved claim(s) is having a protective, therapeutic or diagnostic effect or to alter physiological functions when administered to or applied to an animal. The term applies to therapeutics, biological, diagnostics and modifiers of physiological function.

Adverse events: is any observation in animals, whether or not considered to product related, that is unfavorable and unintended and that occurs after any use of veterinary medicinal product (off – label and on – label uses). Included are events related to suspected lack of expected efficacy according to approved labeling or noxious reaction after being exposed to veterinary medicinal products.

Adverse reaction: It is when there is a reasonable possibility (i.e., relationship cannot be ruled out) that harmful and unintended observations were a response to a veterinary medicinal product administered at doses normally used in animals for prophylaxis, diagnosis or therapy of disease or for modification of physiological functions.

Magnitude of the problem

Almost all drugs, no matter how skillfully used, may cause adverse drug effects. The risk of adverse drug reactions is one probable consequence in veterinary practice. A number of studies elsewhere have demonstrated that adverse drug events and other drug related problems have resulted into morbidity, mortality and loss in production in animals. There is however, scarcity of literature on adverse drug reactions and other drug related problems in India. There is therefore need for research to generate data to evaluate the magnitude of ADRs and other drug related problems in India.

Issues

Medication errors, abuse and misuse of drugs, substandard drugs, lack of efficacy, use of drugs for indications that are not approved and for which there is inadequate scientific basis, case reports of acute and chronic poisoning, assessment of drug-related mortality, interactions of drugs with chemicals and other drugs and feed, not observing the drug withholding period.

Primary goal

To promote the safe and proper use of veterinary drugs.
Benefits

- Contribute to the assessment of benefit, harm, effectiveness and risk of drugs, encouraging their safe, rational and more effective (including cost-effective) use.
- Promote understanding, education and clinical training in veterinary pharmacovigilance and its effective communication to the public. Improve public health and safety in relation to the use of veterinary drugs.

Aims

- Identification of risk factors and possible mechanisms underlying adverse reactions.
- Estimation of the quantitative aspects of risk-benefit of drugs. Analysis and dissemination of the information needed to improve the prescription, dispensing, provision and regulation of drugs.

Roles of National Veterinary Pharmacovigilance Centre

The centre is responsible for the collection, processing and evaluation of case reports of suspected adverse events supplied by health and veterinary professionals (mainly spontaneous reporting of reactions associated with the use of drugs).

- Sensitisation of veterinary professionals and other stakeholders on monitoring the safety and efficacy of veterinary drugs.
- Collecting and analyzing case reports of adverse drug reactions and veterinary drugs related problems.
- Distinguishing signals from “background noise”.
- Alerting prescribers, manufacturers and the public to new risks of adverse reactions and other drug related problems.

Identification of signals

- Making regulatory decisions based on strengthened signals
- Provision of feedback to reporters
- Timely advice to animal health-care professionals and consumers on veterinary drugs.

Safety issues

- Communication of relevant safety information to the National and regional Regulatory Authorities, animal health professionals, pharmaceutical companies and other players as appropriate.
- Information sharing at regional and global levels on the effects of veterinary drugs.

Adverse drug effects

- Take proper history and conduct thorough examination of the animal.
- Verify that the onset of the suspected ADR was observed after the drug was taken and discuss carefully the observation made by the animal owner.
- Ascertain that the prescribed drug was used correctly. Assess if there are causes other than the drug that could have caused the reaction.
- Establish that this was a case of an ADR.

Reporting

A reporting form designed suitable enough to capture basic information on animal drug adverse effects and product quality problems. Animal owners and other stakeholders are advised to inform veterinary practitioners of any adverse drug effects as soon as possible.

The reporter communicates with National Drug Controller Authority directly or through the different identified institutions. The Authority then notifies the marketing authorization holder of adverse event reports it has received after analysis and then feedback is given to stakeholders.

Conclusion

Veterinary Pharmacovigilance system has to be established and implemented in India at the earliest which would pave way for the residue free livestock products for human beings. It would also ensure that no unwanted or any adverse reaction to livestock goes unreported. This would also help the livestock farmers to meet the WTO norms while exporting livestock products.

Dr. G. SARATHCHANDRA
Professor and Head
Pharmacovigilance Laboratory for Animal Feed and Food Safety, Directorate Centre for Animal Health Studies, Tamilnadu Veterinary and Animal Sciences University, Chennai - 600051
AN INTRODUCTION TO “IN VITRO MEAT”

“In vitro meat”, also called cultured meat, cruelty-free meat, shmeat, test-tube meat, artificial meat, synthetic meat, tube steak, and victimless meat, is an animal-flesh product that has never been part of a living animal with exception of growth media obtained from animal origin. Shmeat is a nickname given to lab-created meat grown from a cell culture of animal tissue. The combination of sheet and meat is called shmeat.

In the 21st century, several research projects have worked on in vitro meat in the laboratory. The first in vitro beef burger, created by a Dutch team, was eaten at a demonstration for the press in London in August 2013.

History

To begin with, Dr. Alexi Carrel (1908) took a piece of embronic chicken heart and bathed in nutrient broth. The tissue doubled in size and never seemed to die or age. He transferred a tiny piece of heart tissue in to a new container and the whole process started again and the process is continuing even after his death (1944).

Theoretical, possibility of growing meat in an industrial setting has captured the public imagination. In vitro cultivation of stem cells from animals has been possible since the 1990s, including the production of small quantities of tissue was cooked and eaten. NASA has been conducting experiments since 2001, producing in vitro meat from turkey cells.

In 2001, dermatologist Wiete Westerhof from the University of Amsterdam, medical doctor Willem van Eelen, and businessman Willem van Kooten announced that they had filed for a worldwide patent on a process to produce in vitro meat. The process included a matrix of collagen seeded with muscle cells, then bathed in a nutritious solution and were induced to divide.

In 2003, Oron Catts and Ionat Zurr of Harvard Medical School exhibited in Nantes a “steak” a few centimeters wide, grown from frog stem cells, which was then cooked and eaten. The first peer-reviewed journal article published on the subject of laboratory-grown meat appeared in a 2005 issue of Tissue Engineering.

In 2008, PETA offered a US$1 million prize to the first company to bring lab-grown chicken meat to consumers by 2012. The Dutch government has put US$4 million in to experiments regarding in vitro meat. The In Vitro Meat Consortium, a group formed by international researchers interested in the technology, held the first international conference on the production of in vitro meat, hosted by the Food Research Institute of Norway in April 2008, to discuss commercial possibilities. Time Magazine declared in vitro meat production to be one of the 50 break through ideas of 2009. In November 2009, scientists from the Netherlands announced they had managed to grow meat in the laboratory using the cells from a live pig.

At the end of the year 2012, 30 laboratories from around the world have announced that they are working on in vitro meat research. On August 5, 2013, the world’s first lab-grown burger was cooked and eaten at a news conference in London. Scientists from the Netherlands, led by Professor Mark Post, took stem cells from a cow and grew them into strips of muscle and combined to make a burger.

Process

The process of developing in vitro meat involves taking muscle cells and applying a protein that promotes tissue growth. Once this process has been started, it would be theoretically possible to continue producing meat indefinitely without introducing new cells from a living organism. It has been claimed that, conditions being ideal, two months of in vitro meat production could deliver up to 50,000 tons of meat from ten pork muscle cells.

In vitro meat may be produced as strips of muscle fibre, which grow through the fusion of precursor cells – either embryonic stem cells or specialized satellite cells found in muscle tissue. This type of meat can be cultured in a bioreactor.

Cultured meat production requires a preservative, such as sodium benzoate, to protect the growing meat from yeast and fungus. Collagen
powder, xanthan gum, mannitol and cochineal could be used in different ways during the process. Due to the strictly controlled and predictable environments, \textit{in vitro} process may also decrease exposure of the meat to bacteria and disease.

\textbf{Challenges}

The science for \textit{in vitro} meat is an outgrowth of the field of biotechnology known as tissue engineering. The technology is simultaneously being developed along with other uses for tissue engineering such as helping those with muscular dystrophy and similarly, growing transplant organs. There are several obstacles to overcome if it has any chance of succeeding; at the moment, the most important ones are scale and cost of production.

\begin{itemize}
  \item \textbf{Proliferation of muscle cells:} Although, it is not very difficult to make stem cells divide, for meat production, it is necessary that they divide at a quick pace, producing the solid meat. This requirement has some overlap with the medical branch of tissue engineering.
  \item \textbf{Culture medium:} Proliferating cells need a food source to grow and develop. The growth medium should be a well-balanced mixture of ingredients and growth factors. Scientists have already identified possible growth media for turkey, fish, sheep and pig muscle cells. Depending on the motives of the researchers, the growth medium has additional requirements.
    \begin{itemize}
      \item \textbf{Commercial:} The growth medium should be inexpensive to produce. A plant-based medium may be less expensive than fetal bovine serum.
      \item \textbf{Environmental:} The production of the growth medium should not have a negative effect on the environment. This means that the production should be energetically favorable. Ideally, the ingredients should come from completely renewable sources.
      \item \textbf{Animal welfare:} The growth medium should be devoid of animal sources (except for the initial “mining” of the original stem cells).
    \end{itemize}
  \item \textbf{Non-Allergenic:} While plant based growth media are “more realistic,” will be cheaper, and reduce possibility of infectious agents, there is also the possibility that plant-based growth media may cause allergic reactions to some consumers.
  \item \textbf{Bioreactors:} Nutrients and oxygen need to be delivered close to each growing cell, on the scale of millimeters. In animals, this job is handled by blood vessels. A bioreactor should emulate this function in an efficient manner. The usual approach is the creation of a sponge-like matrix in which the cells can grow, and perfusing it with the growth medium.
\end{itemize}

There are difficulties to overcome, before the \textit{in vitro} meat can be available in supermarkets. Cultured meat is prohibitively expensive, but it is expected that the cost could be reduced to compete with that of conventionally obtained meat as technology improves.

\textbf{Ethical considerations}

Animal welfare groups are generally in favor of the production of \textit{in vitro} meat because it does not have a nervous system and therefore, there is no feel pain reactions.

Laws and regulations on the proper creation of \textit{in vitro} meat products have to be modernized to adapt this newer food product. Some societies may decide to block the creation of cultured meat according to religion - Jews may disagree or claim that \textit{in vitro} meat may not be a Kosher (Jewish dietary laws) meat.

\textbf{Conclusion}

Despite the cost of production, controversies, cultured meat will be the “food for thought” in the year 2050, due to decrease in the land and increase in population. In future, retail outlets like grocery stores and supermarkets may decrease the price of \textit{in vitro} meat to the level that middle-class consumers might consider as “inexpensive” due to technological advancements.

\textbf{Dr. R.K. Kanimozhi, M.V.Sc., Ph.D.}

Assistant Professor, University Publication Division
TANUVAS, Chennai - 600 051.
**Development and evaluation of recombinant protein based latex agglutination test for rabies virus antibody assessment**

- Recombinant glycoprotein of rabies has been cloned and expressed in insect cell system and the expressed glycoprotein was used in standardizing Latex Agglutination Test (LAT) for rabies virus antibody detection to a level up to 0.88 I.U./ml
- LAT was compared with standard RFFIT method in 228 dog serum samples and results in both tests were found to be comparable with a concordance of 97.39%

Grading of LAT results with known titer of standard anti-rabies antibodies

**E. Angel Jemima**  
M.Phil. Student  
Department of Biotechnology  
Madras Veterinary College, Chennai

**Influence of early weaning on productive performance in Large White Yorkshire pigs**

- Groups weaned at 28 and 42 days showed similar and better feed efficiency (3.35 ± 0.06 and 3.31 ± 0.20 respectively) compared to 56 days weaning group (4.15 ± 0.29).
- Number of days to post-weaning estrus was significantly (P < 0.05) less and the number of days from farrowing to subsequent oestrus was significantly (P < 0.01) less in Large White Yorkshire sows when the piglets were weaned at 28 days of age.
- Both 28 days and 42 days weaning groups showed similar and better feed efficiency (3.35 ± 0.06 and 3.31 ± 0.20 respectively) compared to 56 days weaning group (4.15 ± 0.29). Weaning to oestrus (days) and farrowing to oestrus intervals (days) in sows was less in 28 days weaning group than 42 days weaning group.

**Jayashree Chiring Phukon**  
M.V.Sc. Student  
Department of Livestock Production and Management  
Madras Veterinary College, Chennai

**Comparative efficacy of diagnostic tests in early diagnosis of canine liver diseases**

- The incidence of canine liver diseases was 0.15 per cent of the total number of medical cases attended and 0.43 per cent of the gastrointestinal case loads of the Madras Veterinary College Teaching Hospital.
- The most common liver disease was that of parenchymal disorders with 73 per cent incidence, followed by biliary disorders 18 per cent and neoplastic disorder 9 per cent.
- Ultrasound imaging was deployed and the same was found to have better diagnostic yield.
- Histopathology is the gold standard in classification of type of liver diseases. 3D ultrasonography studies helped in better visualisation of lesions in liver diseases.

**Dr. D. Sumathi**  
Assistant Professor  
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence  
Madras Veterinary College, Chennai

**Economic impact of FMD and its control in the dairy and meat value chains of selected high potential regions in India: A pilot study**

- Characterization and valuation of dairy and meat market chains of sample districts of Andhra Pradesh.
- Estimation of costs and losses associated with FMD on the dairy and meat value chain actors in Andhra Pradesh.
- Characterization and quantification of the costs and benefits associated with FMD control programme.
- The results of the study would be useful to study the economic impact of FMD on livestock population.

**Dr. G. Kathiravan**  
Associate Professor  
Department of Animal Husbandry Statistics and Computer Applications,  
Madras Veterinary College, Chennai
THESIS ABSTRACTS

PRIORITIZATION OF CHICKEN PRE-LAY NUTRITION TO IMPROVE LAYER PERFORMANCE

Name of the student: T. SUJATHA
Degree for which thesis was submitted: Ph.D. (Poultry Science)
Name of the Chairman: Dr. R. Asha Rajini, Ph.D.

Two biological experiments were conducted to study the effect of pre-lay feeding strategy during transition period (15 weeks to sexual maturity) in commercial layers (Bovons). In the first experiment pullets were randomly assigned to each of five prelay feeding strategies namely, T1- BIS control with 16% protein and 2500Kcal/KgME, T2- 16% protein and 2700Kcal/KgME, T3-18% protein and 2700Kcal/KgME, T4-16% protein supplemented with 10% higher lysine and methionine to BIS requirement and 2700Kcal/Kg ME and T5- 16% protein supplemented with 10% higher lysine and methionine to BIS requirement and 2700Kcal/Kg ME with addition of 2% oil. In the second experiment, the best two feeds were identified and provided with 1.5 and 2% calcium during pre-lay period (15 weeks up to sexual maturity). Pre-lay diet T3 with high protein and energy (18% with 2700Kcal/Kg) proved to be the best, with high body weight at sexual maturity, it advanced sexual maturity, increased carcass protein and fat, best egg production and feed efficiency. This group gave the lowest pullet production cost and best egg: feed price ratio. This high dense diet gave the best results in the second experiment also; both levels of calcium (1.5 and 2%) gave similar results. Henday and hen housed egg production was the best in this group, Kg egg mass, shell and bone index was significantly (P≤0.05) and positively influenced by this diet. It is advised that a pre-lay diet of 18% CP with 2700Kcal/kg and added 2% calcium may be fed to pullets under a humid tropical climate from 15 weeks to sexual maturity.

EVALUATION OF CLINICOPATHOLOGICAL ALTERNATIONS AND TREATMENT EFFICACY OF BABESIOSIS IN DOGS

Name of the student: P. VIJAYALAKSHMI
Degree for which thesis was submitted: Ph.D. (Vet. Clinical Medicine, Ethics and Jurisprudence)
Name of the Chairman: Dr. R. Palanidorai, Ph.D.

Canine babesiosis, a tickborne blood protozoan disease is caused by different Babesia species with worldwide distribution and global significance. The study on “Evaluation of clinicopathological alterations and treatment efficacy of babesiosis in dogs” was conducted in the Small Animal Medicine Unit of Madras Veterinary College Teaching Hospital.

This study included 149 cases of Babesiosis diagnosed by blood smear examination and / or PCR. Two types of Babesia were identified viz., Babesia canis vogeli, larger Babesia and B. gibsoni, a smaller Babesia. Babesia gibsoni was found to be the most common and produce latent infection when compared to Babesia canis. The common clinical manifestations of Babesiosis included fever, depression, lethargy, pale mucosa, vomiting and dehydration. Regenerative anaemia, thrombocytopenia, monocytopsis and splenomegaly were the prominent laboratory findings. The cost effective treatment for Babesia gibsoni affected dogs was found to be a combination of single dose of diminazene aceturate @ 3.5 mg/kg body weight intramuscular followed by oral doxycycline for 14 days. Babesiosis caused by Babesia canis had excellent recovery with one shot of diminazene aceturate intramuscular with out any side effects. Supportive therapy included oral haematinics in anemic dogs. Vomiting dogs were treated with fluids, parenteral injections of ranitidine and ondansetron.

DEVELOPMENT OF PROBIOTIC YOGHURT WITH MICROENCAPSULATED PROBIOTICS

Name of the student: V. JAYALALITHA
Degree for which thesis was submitted: Ph.D. (Dairy Science)
Name of the Chairman: Dr. R. Palanidorai, Ph.D.

Owing to the perceived health benefits, probiotics have been incorporated into a range of dairy products including yoghurt, cheese, ice-cream, milk powder and frozen dairy desserts. As the viability of probiotic cultures is a major challenge, the present study has been envisaged to exploit their full potential by increasing both the technological suitability and expanding the performance of some probiotic strains viz., Lactobacillus acidophilus (NCCDC005), Lactobacillus helveticus (NCCDC232), Bifidobacterium longum (BB46) and Bifidobacterium lactis (BB12) through encapsulation techniques and preparation of yoghurt with these microencapsulated cultures. Microencapsulation was done by extrusion...
and emulsion method using sodium alginate and starch as wall material. Control and encapsulated probiotic yoghurt were prepared with free and encapsulated probiotics. SEM analysis of beads revealed that average size of extrusion and emulsion beads were 2-3 mm and 0.5-1.0 mm respectively. In control yoghurt at 21 days of storage, lactobacillus survived four log units and bifidobacterium survived six log units. Statistical analysis revealed a highly significant (P<0.01) difference in the viability of free cells of probiotics and encapsulated probiotics at different incubation time in Simulated Gastric Fluid (SGF) and Simulated Intestinal Fluid (SIF). Though the two methods of encapsulation improved the viability, it is concluded that extrusion method of encapsulation using sodium alginate (2.0%w/v) and starch (0.5w/v) provides maximum viability to probiotics in yoghurt throughout the storage period, as the size of beads was bigger and integrity of wall materials was good and thus the same can be scaled up for the targeted delivery of probiotics.

**MOLECULAR DETECTION AND TYPING OF CRYPTOSPORIDIUM IN DAIRY CALVES**

Name of the student : R. VENU
Degree for which thesis was submitted : Ph.D. (Vet. Parasitology)
Name of the Chairman : Dr. Bhaskaran Ravi Latha, Ph.D.

Six hundred and sixty seven dung samples from dairy calves of South India were screened for Cryptosporidium infection by conventional microscopic methods. Randomly selected 459 dung samples were subjected to two-step nested PCR for screening Cryptosporidium DNA. Genotyping of Cryptosporidium was done by using molecular techniques such as PCR-RFLP and DNA sequence analysis. Conventional microscopic methods such as direct smear examination revealed 3.15 per cent of Cryptosporidium infection. In faecal concentration techniques, formal-ethyl acetate method (6.15 %) yielded slightly higher per cent of infection than sugar flotation technique (5.85 %). Stained preparation by modified cold strong Ziehl-Neelsen technique was sensitive (11.09 %) in detection of Cryptosporidium oocysts rather than other unstained conventional methods used in the present study. Morphometric studies of Cryptosporidium species revealed that; *C. andersoni* appeared larger, oval and were clearly differentiated from other species of Cryptosporidium i.e. *C. parvum*, *C. ryanae* and *C. bovis*. Average oocysts length and width measurements of *C. andersoni* in mZN stained smear was recorded as 7.30 mm X 5.19 mm with a shape index of 1.406, where as for *C. parvum*, *C. ryanae* and *C. bovis*, the average measurements were observed to be 5.01 mm X 4.56 mm (S.I. = 1.098), 3.86 mm X 3.22 mm (S.I. = 1.198) and 4.89 mm X 4.60 mm (S.I. = 1.060), respectively.

Randomly selected 459 dung samples from calves were subjected to genomic DNA extraction, subsequently to two-step nested PCR using 18S rRNA gene primers for detection of Cryptosporidium DNA. Analysis of PCR products on gel electrophoresis revealed a total of 24 (5.23 %) samples that showed primary PCR band at ~1325 bp size, whereas secondary amplicons were observed at ~830 bp size for 182 (39.65 %) samples. Detection limit of nested PCR in the present study was 100 oocysts per sample. Parameters like age, dung consistency, sex, breed and rearing system of the animals were studied in relation to Cryptosporidium infection. Less than one month age group (41.69 %) and semi-solid dung consistency group (44.05 %) animals showed highest prevalence of infection. Statistical analysis revealed that sex, breed and rearing system has no influence in acquiring the Cryptosporidium infection.

Sixty four Cryptosporidium DNA positive isolates were genotyped using SspI, VspI and MboII restriction enzymes and confirmed as *C. andersoni*, *C. ryanae*, *C. parvum* and *C. bovis* in 39 (60.94%), 18 (28.13%), 4 (6.25 %) and 3 (4.69 %) isolates, respectively. DNA sequence analysis of 19 Cryptosporidium positive isolates revealed that, nine (47.37%) samples were of *C. andersoni*, *C. ryanae*, *C. parvum* and *C. bovis* were identified in 39 (60.94%), 18 (28.13%), 4 (6.25 %) and 3 (4.69 %) isolates, respectively. DNA sequence analysis of 19 Cryptosporidium positive isolates revealed that, nine (47.37%) samples were of *C. andersoni*, *C. ryanae*, *C. parvum* and *C. bovis*. In Andhra Pradesh *C. ryanae* was the major species distributed among dairy calves and the zoonotic species, *C. parvum* was identified from Gannavaram isolate of Andhra Pradesh. In Karnataka and Puducherry *C. andersoni* was identified, where as in Kerala *C. ryanae* was identified. PCR-RFLP and DNA sequence analysis results were correlated. Morphologically distinct *C. andersoni* was genotypically confirmed by both PCR-RFLP and DNA sequence analysis. Other species of Cryptosporidium of cattle viz., *C. parvum*, *C. ryanae* and *C. bovis* were not distinguished by morphology, but genetically differentiated.
TECHNOLOGY RELEASED

SIS-LIVESTAN
(Spatial Information System for Livestock Sector in Tamil Nadu)

Name of the Scientists involved
G. Kathiravan and M. Thirunavukkarasu

Broad outline of Technology

- The Information System was developed in MS-Visual Basic 6.0 environment using MS-Access as backend for the resources that can support livestock production and development in Tamil Nadu.
- A number of forms were created in Visual Basic that could display district as well as block level resources (data). The main forms included would display livestock population, veterinary institutions, livestock production, feeds and fodder, land classification, area under crops, operational land holdings, irrigation, rainfall, potable water supply, agricultural implements, livestock marketing, human population and communication.
- Each of the above main forms has navigation tools towards the screen showing “District-wise information” and “Block-wise information”. Once the user clicks his choice of information, the new screen opens with drop down menus to choose the district/block and year.
- The GIS maps which were created using Geomedia 6.0, will be spawning upon user’s query in the map server (ms4w).

Utility of technology

- The Information System would act as ready reckoner for the researcher, planners and policy makers.

Cost advantage of technology

- The Information System enables the user to get all the micro and macro level data related to animal husbandry instantly and thus saves cost of searching for information.

SYNBIOTIC WHEY DRINK CULTURED WITH BIFIDOBACTERIA

Name of the Scientists involved
B. Suresh Subramonian, T. Senthil and Rita Narayanan

Broad outline of Technology

- Whey is a by-product of milk obtained during the preparation of cheese, panneer and other coagulated products. Though the nutritive value of whey is good, it has got poor acceptability due to its poor palatability. The lactose content, whey proteins, mineral and soluble nutrients helps the growth of probiotic lactic acid bacteria like bifidobacteria. By adding prebiotic rich substances like honey will make the product synbiotic as well as a neuteraceutical product. The product is developed by modifying the composition of whey and improving the quality of paneer whey. This modified whey with honey was cultured with Probiotic lactic acid bacteria *Bifidobacterium longum*. The product prepared under standardized method had the following properties.
  - Synbiotic whey drink is a fermented milk by–product with sweet and sour taste and HPLC analysis revealed presence of hydrophobic and hydrophilic peptides.
  - The optimum acidity is of 0.45 to 0.51 per cent lactic acid.
  - The probiotic load of $10^8$ cfu ml gives better health benefits when consumed and the maximum count of $8.93 \log_{10} \text{cfu/ml}$ was reached in 4 hr of incubation.

Utility of Technology

- Can be used for small or medium or large scale production depending upon the marketing strategy and availability of paneer whey.

Cost advantage of technology

- Raw material whey is normally wasted and can be value added by the above process into a health drink . The cost of production includes the cost of culture, ingredients, packaging and overheads. At lab level , it is around Rs.4/- approximately.