



NDRI News

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From the Director's Desk



Independence Day Celebrations

Milk, known as nutritionally wholesome food, is a complex biological fluid. It contains protein, carbohydrate, fat, minerals, vitamins and water. Milk is also a source of nutraceuticals and offers many health benefits. Moreover, milk is one of the important sources of biologically active compounds exhibiting extra nutritional properties. Biologically active peptide fragments are generated after milk proteins are broken down by digestive enzymes or by the proteinases released by lactic acid bacteria during fermentation of milk. These bioactive peptides can be absorbed through the intestine to enter the blood circulation intact and exert systemic effect. These peptides exhibit wide range of biological activity such as antioxidative, antihypertensive, immunomodulatory, hypocholesterolemic, antithrombotic, antimicrobial, mineral binding, osteogenic, opioid agonistic and antagonistic activities.

Historically, camel milk and its products were used for many medicinal properties. Nowadays, camel milk production is increasing in Asia and Africa due to its increased nutritive and medicinal response. Milk and other dairy products made from camel milk are available in the markets in Gulf area, Mauritania and other countries. Taking into account the importance of camel milk in India, ICAR has established and upgraded the National Research Center on Camel (NRCC). In India, there are around five lakh camels and they are mainly confined to the arid and semi-arid regions of North-western parts (Rajasthan, Haryana and Gujarat). In India, *Camelus dromedarius* (one-humped) are found in the warmer regions, whereas, *Camelus bactrianus* (two-humped) are found in cold deserts.

In addition to the good nutritive value, camel milk is considered to exhibit a wide range of medicinal properties. The composition of camel milk is quite varied depending on the region, where it is being reared. The Protein content in camel milk ranges from 2.0 to 5.2%, lactose from 2.7 to 5.8%, cholesterol from 0.031-0.0371% and fat from 2.3-6.6%. The size of the fat globules present in camel milk (1.1-2.1 μm) is comparable to that of the goat milk fat globules (1.1-3.8 μm). Since, they are smaller in size, they have increased surface area for the action of lipases and this helps in rapid digestion of fat. Thus, the fat digestibility of camel and goat milk is better than that of the cow and buffalo milk fat.

The level of saturated fatty acids in camel milk (62.5%) is less as compared to cow (69.38%),



goat (70.42%) and buffalo (70.41%) milk. It is established that these saturated fatty acids present in milk fat exhibit hypercholesterolemic effect. Further, mono unsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), which are the important components in milk, are present to the level of 42.6% and 3.9% in camel; 27.73% and 2.89% in cow; 24.46% and 4.67% in goat; 23.91% and 3.85% in buffalo milk fat, respectively. Also, camel milk has high level of MUFA, which is reported to lower LDL-cholesterol and total cholesterol. Again camel and goat milk have highest level of PUFA. Short chain fatty acids, which are also present in milk fat, are known to improve immune functions, lower heart disease and exhibit antimicrobial activity.

The calcium content in camel milk is 0.143%, which is more than that of cow milk (0.125%). In comparison to bovine milk, camel milk contains high content of zinc, manganese, copper and Vitamins C, E and A, and thus, exerts better antioxidative effects. The vitamin C content is approximately three times higher than that of cow milk. Camel milk also ameliorates steatohepatitis and oxidative stress in non-alcoholic fatty liver disease. Further, it has also been found to be beneficial in alcohol consumption related liver disease, which represents a spectrum of clinical illnesses and morphological changes that range from fatty liver to hepatic inflammation, cirrhosis and necrosis. The feeding of camel milk exhibits improvement in liver function by normalizing liver transferase enzymes (alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase) along with significant reduction of serum triglycerides level. The antioxidative potential of camel milk can prove to be a potential therapy in autism disorder. Camel milk also possesses antigenotoxic and anticarcinogenic effects.

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Camel milk also lacks β -lactoglobulin as well as β -casein, which are main causative etiology for allergy in infants arising from bovine milk. Therefore, camel milk is a safe substitute to human milk for infants having allergy from cow or buffalo milk β -lactoglobulin and β -casein proteins. Here, it is important to mention that human milk does not contain β -lactoglobulin.

A number of studies have shown that ingestion of camel milk by diabetic rats, rabbits and dogs led to decrease in blood glucose level. Similar results were also obtained in human beings. Consumption of camel milk by type 1 diabetic patients resulted in a significant reduction in the dose of insulin required to maintain long-term glycemic control and normalized the blood glucose and glycosylated hemoglobin levels. Camel milk has also controlled the diabetes complications, such as collagen abnormalities and microalbumin urea in type-1 diabetic patients. Consumption of camel milk has also exhibited positive results for type-2 diabetic patients. Effectiveness of camel milk in exhibiting anti-diabetic potential

was not altered when it was pasteurized; however, it decreased when it was boiled. Camel milk has been reported to contain insulin like proteins (52 units/l). It is also reported that camel milk does not form coagulum in the acidic pH of the stomach and raises the possibility that these proteins or peptides, which are exhibiting anti-diabetic potential remain intact and reach the intestine without deactivation, from where these can be absorbed and exhibit hypoglycemic effect. In many published scientific reports and papers in journals of international repute, camel milk consumption is recommended in the management of treatment or to treat jaundice, asthma, anemia, piles, tuberculosis, diabetes, autism and autoimmune diseases. Camel milk stabilizes lipid profile and restores the antioxidative status. The traditional medicinal benefits of camel milk are now being explored step by step for its wide pharmacological application.

A. K. Srivastava
(A. K. Srivastava)

RESEARCH

Swarupa – A Clone of Karan-Kirti

(S. K. Singla, M.S. Chauhan, R. S. Manik, P. Palta, S. S. Lathwal and Anuj K. Raja)

A cloned female calf named “Swarupa” weighing 32 kg was born through normal delivery on August 1, 2015. The donor cell used in the production of this calf was from the ear of an adult outstanding buffalo named “Karan-Kirti” of NDRI farm. Karan-Kirti yielded 4425 kg milk in its first lactation in 427 days of lactation and had a yield of 3812 kg in 305 days. Its peak yield of 25.1 kg was the highest daily yield of a buffalo recorded so far in the history of the Institute. Earlier Purnima, a clone of Karan-Kirti, was born on September 6, 2013, which could survive only for 19 days.

Stem Cells from Ovarian Surface Epithelial Cells Differentiated into Oocyte-Like Cells of Goat

(Samreen Fatima, Vishal Sharma, Sikander Saini, Sudarshan Kumar and Dhruva Malakar)

The present study was carried out with the objective to see *in vitro* differentiation of putative ovarian surface epithelial stem cells into oocyte-like cells. Slaughterhouse ovaries were washed with normal saline solution then scraped to isolate Ovarian Surface Epithelium (OSE) and cultured in DMEM/F12 and 20% FBS at 37°C in 5% CO₂ for 20 days. The cultured cells were characterized for stem cell markers viz. Oct-4, Sox2 and Nanog by RT-PCR and immunostaining. The stem cells were spontaneously differentiated in DMEM/F12 medium and round oocyte like cells were observed after 20 days. The primordial germ cells were characterized by RT-PCR and immunostaining using pre-meiotic markers viz. VASA, DAZL and STELLA. The cells were observed round in shape with large nucleus to cytoplasm ratio under inverted microscope. The result showed the presence of Putative Stem Cells (PSCs) with pluripotent characteristics in the OSE. These cells were also observed positive for stem cell markers namely, Oct-4, Sox2, and Nanog

by RT-PCR and immunostaining. The differentiated primordial germ cell-like cells from the PSCs were found positive for pre-meiotic markers like VASA, DAZL, and STELLA by RT-PCR and immunostaining. It was concluded that the ovarian surface epithelial cells have putative stem cell population on the ovary. These stem cells could be spontaneously differentiated to oocyte-like cells in *in vitro* culture condition.

Anti-diarrheal Properties of Folate Producing Probiotic Lactobacillus Strains

(Meenakshi D. and Shilpa Vij)

Folate could play an important role in shortening the duration of diarrhea and also in preventing or modifying persistent diarrhea. The present work deals with the folate producing probiotic *Lactobacillus* strains and their role in diarrhea control. Two *Lactobacillus* cultures LR28 and LR22 produced maximum folate. The cultures grown in broth possessed antimicrobial activity against test pathogens viz. *S. typhi* NCTC 6017, *S. aureus* MTCC 1144, *S. dysenteriae* NCDC 107, *L. monocytogenes* ATCC 15303, *B. cereus* ATCC 13061 and *E. coli* ATCC 35150. The cultures were also sensitive to most of the clinically important antibiotics. These cultures were characterized upto genus and species level as *L. reuteri*. LR28 showed maximum folate production at 2% inoculum level at 100 rpm in 48 hrs. The addition of lactose and maltose at 3% led to maximum folate production. Addition of 5 mg/l PABA led to maximum folate. Melon juices enhanced folate production. The production of folate increased in skim milk and 300 μ l/ml melon juice medium under optimal conditions. Immunomodulatory activity of different cultures i.e. non folate producing probiotics (NFP), folate producing non-probiotic (FPN) and folate producing probiotic (FP) were studied *in vivo* for specific immune response on challenging with *S. dysenteriae*. On the 15th day, significant increase in IgA concentration of 4.86 ng/ml, 4.73 ng/ml by FP and NFP, respectively. *S. dysenteriae* counts also reduced to 4.20 log and 1.36 log cfu/ml, 4.73 log and 1.33 log cfu/ml, 5.06 log and 1.13 log cfu/ml in intestine

and liver by FP, NFP and FPN, respectively. FP group showed significant colonization of *Lactobacillus* in gut (7.18 log cfu/ml) followed by NFP group (6.78 log cfu/ml) and FPN (5.95 log cfu/ml). FP showed significant reduction of *S. dysenteriae* by 4.94 log cfu/ml followed by NFP group (5 log cfu/ml) and FPN group

(4.95 log cfu/ml). FP and FPN showed significant increase in haemoglobin followed by NFP. Folate producing *Lactobacillus reuteri* LR28 with good probiotic attributes may be used for the diarrhea control.

EXTENSION

DAIRY EXTENSION DIVISION

Dairy Education at Farmers' Door

Dairy Extension Division organized the ongoing Extension Education Programme "Dairy Education at Farmers' Door" to strengthen the effective dissemination of dairy production and processing technologies among farming community. Under this programme, a team of NDRI scientists including subject matter specialists from production, processing and management group visited a new cluster of villages viz., Gorgarh, Padha and Dungro in Karnal district on 2nd Saturday of every Month.

Veterinary Camps: A total number of 9 Veterinary Camps were conducted and 180 cases were treated for various veterinary ailments. Special attention was given to improve the productive and reproductive performance of dairy animals.

Kisan Sangosthies: A total number of 9 Kisan Sangosthies were organized on various topics related to veterinary aids and livestock management practices at village level.

Empowerment of Farm Women: Seven women empowerment training programmes and campaigns were organized for 143 farm women with the objective to create awareness and also impart skill in the field of dairying and home science.

Educational Visits and Tours: A total of 1847 visitors (students & Faculty) from 29 colleges/Institutions/Universities visited the Institute and were sensitized about the different research, teaching and extension activities of the Institute.

Distribution of Disaster Preparation Kit in Uttarakhand

A team of extension scientists distributed disaster preparation kits for livestock among the identified key communicators in eight villages of Chamoli and Rudraprayag district. The kit contained *Anthelmintics*, feed additives, feed supplements, mineral mixture, betadine, bandage, cotton etc and instructions to use kit. Apart from the disaster preparation kit for livestock, team also distributed literature specially prepared on 10 different aspects of disaster management to create awareness among the respondents. The interventions introduced in the study area were awareness creation about disaster management, plantation of perennial fodder grasses (*Nandi*, Napier grass and Bhimal tree), deworming for livestock, mineral mixture, animal health camps (with local veterinary hospital), capacity building of youth and mobile advisory services for dairy farming community.

KRISHI VIGYAN KENDRA

Extension Activities

- A total number of 63 training programmes (On-campus, Off-campus and Study-cum-visits) on different aspects of dairy production and processing, crop production, crop diversification and home science were organized for 2122 farmers, women and rural youth from Haryana and other states.
- KVK organized 18 training programmes on scientific dairy farming, clean milk production and commercial dairy farming for 570 farmers and rural youth from different districts of Bihar and Jharkhand.
- KVK also organized 22 exposures cum study visits for 706 progressive farmers and farm women from different districts of Uttar Pradesh, Chhattisgarh, Madhya Pradesh, Punjab, Gujarat, Rajasthan, Haryana, Odisha and Himachal Pradesh.
- At Stockman centers in adopted villages of KVK, a total number of 355 cattle and 196 buffaloes were artificially inseminated and as a result 415 calves were born. Besides these, 03 animals were treated for general ailment and infertility and 29 calves were dehorned.

Field Activities

KVK team organized following activities and visited various villages of Karnal District to educate and bring awareness amongst the farmers on scientific agricultural practices including soil health, Swachh Bharat, and recourse conservation.

- A pre-kharif sammelan was organized in KVK in which about 345 farmers, farm women and rural youth participated. On this occasion, an exhibition of various activities of ICAR institutes situated in Karnal and Horticulture Research Center was also arranged for updating the knowledge of farmers.
- A breast feeding week was celebrated in village Rindal of Karnal district in which about 55 rural women participated. The women were apprised of the importance of Mother's milk and its role in the growth of infants.
- A Parthenium awareness programme was organized in village Tikri Kailash to apprise the farmers, farm women and school children of ill effects of weed.

EVENTS

Education of Farmers through Farmers' Farm School

NDRI has started Farmers' Farm School (FFS) since 30th August, 2014 wherein farmers of Haryana State are being provided formal education in the field of dairying, horticulture and agriculture through Farmers' Farm School. In this School, farmers interact with the scientists of the Research Institutes and required arrangements have been made for class room teaching as well as for practical classes. There is a provision of enrolling 25 farmers in one batch on first come first basis and the course duration is of one year. The candidates enrolled in the first batch of the Farmers' Farm School have passed out in the month of July 2015 and they were awarded certificates by Dr. A. K. Srivastava, Director & Vice-Chancellor NDRI during the Meeting of Academic Council held on 27th July, 2015. Director, NDRI informed that the main aim of Farmers' Farm School is to extend the latest research done by scientists to the farmers through lab. to land programme. The classes of first batch of Farmers' Farm School were organized in Gorgarh village Karnal from 30.08.2014 to 17.07.2015. The registration fee is ₹ 10 and the classes practicals were conducted throughout the year on every Friday and Saturday for three hours. The course curriculum also includes a visit to various agricultural Institutes.



Dr. A. K. Srivastava, Director NDRI with the group of first batch of Farmers' Farm School

New Academic Session Started at NDRI

A total of 302 students got admission at various levels in the year 2015-16. In the flagship B.Tech (Dairy Technology) programme of the Institute, 30 students got admission. In sixteen disciplines, 157 students got admission in Masters Degree Programme and 115 students in Ph.D. Degree Programme this year.

All these students representing different states of India got admission after clearing the National Level Entrance Examination. At the orientation programme, Director NDRI emphasised on the need to inculcate positive attitude addressing students. He elaborated various activities of the Institute and hoped that these students would rank the prestige of the NDRI to newer heights. He advised the students that they should actively participate in sports and cultural activities besides academic pursuits. A number of students from abroad also got admission this year and there is a mixed culture at NDRI and this is evident during various cultural programmes of the Institute.

NDRI Celebrated 69th Independence Day

NDRI celebrated the 69th Independence Day on 15th August 2015 with the theme "Swatantrata ki Udaan". On this occasion, Sh. Vinod Bhatia, IFS, Conservator of Forests, Haryana Forest Department, Karnal was Guest of Honour. Sh. Bhatia and Sh. Jitender Ahlawat, District Forest Officer, Karnal were present during flag hoisting and cultural programme. Director NDRI, Dr. A. K. Srivastava, hoisted the national flag followed by national anthem and addressed the gathering of more than 800 employees, their family members and NDRI University students. The highlight of this year's Independence Day celebration was plantation of 3000 saplings at Dairy Mela ground by students, faculty members and staff of NDRI.

NDRI Launched Natural Dairy based Health Drinks

NDRI launched "Whey Protein Enriched Drink" from its Milk Parlour on 27th August, 2015. The drink has been made with nature's most complete protein (whey protein) and minerals with the perfect blend of natural fruit pulps and spices. The drink having zero cholesterol does not contain any fat or trans-fat was launched by Dr. A. K. Srivastava, Director, NDRI.

The technology of the drink was perfected at Dairy Technology Division of NDRI and is being launched with the help of an entrepreneur. This has been possible by the efforts of Business Planning & Development (BPD) Unit of NDRI, which encourages young entrepreneurs to take up the technologies developed at NDRI and test the same under field conditions. The technology of "Whey Protein Enriched Drink" was adopted by Mohak Kabaria, a mechanical engineer from Ahmedabad, Gujarat. The drink has been made in three different variants i.e. Jaljeera, Imli and Lemon. All the three drinks are fortified with high quality protein and essential minerals.



Dr. A. K. Srivastava launching newly developed natural dairy based health drinks at NDRI milk parlour

Short Course on Good Dairy Farming Practices

NDRI organized a 10 day short course entitled "Good Dairy Farming Practices: Nobel Initiatives and Extension Approaches" sponsored by ICAR during 18th - 27th August, 2015. Dr. Narendra Singh Rathore, Deputy Director General (Agricultural Education), ICAR, New Delhi was the Chief Guest

at the valedictory function and gave away the certificates to 24 participants who were Associate Professors/Assistant Professors/Scientists representing 13 states of India. Dr. Jitendra Singh Chauhan, Scientific Advisor to Union Minister for Agriculture was Guest of Honour and Dr. A. K. Srivastava, Director and Vice-chancellor NDRI presided over the valedictory function of the short course.

Dr. Rathore advised the young participants to pass on the newly learnt skills to the farming community. He suggested 5 qualities of young agricultural professionals i.e. right type of education, functional skill, soft skill, innovativeness and liaison abilities, which can make them successful in their professional career.

Director, NDRI delivered a lecture on recent scientific advancements in the dairy sector and its future prospects. Topic of the lectures covered all six key elements viz., animal health, milk hygiene, nutrition, welfare, environment and socio-economic management of good dairy farming practices.

A Two day Lecture Series on Mentoring for Attaining Excellence in Science

The two day motivational lecture series on the topic, "Mentoring for Attaining Excellence in Science" was organized by NDRI Karnal on 23rd - 24th September, 2015. Dr. P. K. Chhonkar, Former Head and ICAR Emeritus Scientist and a well-known Motivational Counsellor was the guest speaker. On the day 1, the session was presided over by Joint Director (Research), NDRI, Dr. R. K. Malik, while on the day 2, the session was presided over by Hon'ble Director, NDRI, Dr. A. K. Srivastava. On the first day, Dr. P. K. Chhonkar made a presentation on "How to Attain Excellence in Science". He highlighted the importance of observation, curiosity and solitude in Science. The brilliant

ideas are undoubtedly the products of individual minds but are an impact of group work. He stressed that to be a great leader, one must inculcate good communication and listening skills, instilling the capabilities to be a realistic goal setter and be a person of high integrity. Dr. Chhonkar concluded the first session with the words of one of the eminent scientists, late Dr. Louis Pasteur: "Whether we succeed or not, let's be able to say when there is time to depart, "I have done what I could".



Dr. P. K. Chhonkar delivering motivational lecture at NDRI

On the day 2, the motivational counsellor, Dr. Chhonkar, addressed the audience on the topic, "Improving Soft Skills at Workplace for Attaining Professional Excellence". He addressed human beings as software infrastructure, which can be threatened by two viruses that can lead to failure in the working of this software. He apprised the faculty and the students about the concept of 'mind diet' that can lead to better work environment. The eminent speaker concluded his two day lecture by a famous quote by Nobel laureate, Dr. Albert Einstein, "Use your mind to think rather than using it as a warehouse of facts". Prof. A. K. Srivastava also emphasized on the importance of the soft skills at the work place and motivated the audience to achieve 6 Cs: 'competence', 'character', 'commitment', 'conviction', 'courage' and 'courtesy'.

राजभाषा एकक

राजभाषा चेतना मास

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HONOURS/AWARDS

ICAR AWARDS - 2014-15

Dr. Sunita Grover, Head, Dairy Microbiology Division was awarded **"ICAR Rafi Award Kidwai Award 2014 in Animal and Fisheries Sciences Category"** for her outstanding research contributions in the area of probiotics.

Dr. Kumaresan, Sr. Scientist, Livestock Production & Management was awarded **"ICAR Lal Bahadur Shastri Outstanding Young Scientist Award 2014 in Animal and Fisheries Sciences Category"**.

Dr. Bimlesh Mann, Head, Dairy Chemistry Division was awarded **"ICAR Bharat Ratna Dr. C. Subramanian Award for Outstanding Teachers 2014 in Animal and Fisheries Sciences Category"**.



Sh. Chiranjee Aggarwal, Assistant, Director Office, NDRI, Karnal received **"Best Worker Award"** under cash award scheme for administrative category employees of ICAR.

Sh. Ram Pal Saini, Skilled Supporting Staff, Dairy Technology Division, NDRI, Karnal received **"Best Worker Award"** under cash award scheme for supporting category employees of ICAR.

Dr. Sanjit Maiti, Scientist received **"Jawaharlal Nehru Award"** for outstanding doctoral thesis research in Social Science for the year 2014.



Sh. Prabhjit Singh Behl, Member CJSC (Admn.), NDRI Karnal has been nominated as Representative (North Zone) in the Central Sport Promotion Committee constituted by the Council for monitoring and improving the sport activities of ICAR w.e.f. 12th August, 2015.



TRANSFER OF TECHNOLOGY

- An indigenously developed technology for the **"preparation of low cholesterol ghee"** was transferred by NDRI Karnal to Vaishal Patliputra Dugdh Utpadak Sahkari Sangh Ltd. Patna (popularly known as Patna Dairy Project) on 15th July, 2015. Memorandum of Understanding (MoU) was exchanged between NDRI and Patna Dairy. Through this technology, cholesterol content in ghee can be reduced by 85%. The ghee prepared using this technology meets all requirements laid by Food Safety Standards Authority (FSSAI). Its flavour as well as colour are similar to the normal ghee.
- The technology of **"Misti Doi with Fast Acidifying High Sugar Tolerating Lactic Culture(s)"** was transferred to CP Milk and Food Products Pvt. Ltd., Lucknow, U.P. for an amount of ₹ 1,60,000 + Service Tax.

DISTINGUISHED VISITORS

01.07.2015 A delegation led by Sh. M. Vinod Kumar, Hon'ble Member of Parliament and other officials of Karim Nagar Milk Producer Company Ltd., Karim Nagar, Telangana.

10.08.2015 A delegation under US India-Africa Training Programme Co-ordinated by MANAGE, Hyderabad.

PERSONALIA

Joining/Appointments

- Dr. (Mrs.) Smita Sirohi, Principal Scientist, NDRI, Karnal was appointed as Vigilance Officer NDRI w.e.f. 01.09.2015.
- Sh. Sanjit Maiti, Scientist (Vety. Extn. Education) joined his duty on transfer from ICAR- National Research Center on Yak, Arunachal Pradesh, w.e.f. 17.09.2015.

Promotions

- Dr. Rakesh Kumar, Sr. Scientist, Forage Research & Management Centre promoted in the pay scale of Rs. 37,400-67,000+ RGP of Rs. 9,000 w.e.f. 22. 11.2013.
- Sh. P. S. Minz, Scientist, Dairy Engineering Division promoted in the pay scale of Rs. 15,600-39,100+ RGP of Rs. 7,000 w.e.f. 10.02.2014.
- Dr. Narender Raju P., Scientist, Dairy Technology Division promoted in the pay scale of Rs. 15,600-39,100+ RGP of Rs. 7,000 w.e.f. 15.12.2013.
- Dr. Yogesh Khetra and Dr. Ganga Sahay Meena, Scientists, Dairy Technology Division promoted in the pay scale of Rs. 15,600-39,100+ RGP of Rs. 7,000 w.e.f. 15.12.2014.
- Dr. Rekha Ravindra Menon, Scientist, SRS, Bangalore promoted in the pay scale of Rs. 37,400-67,000+ RGP of Rs. 9,000 w.e.f. 22. 02.2014.
- Dr. S. Subash, Scientist, SRS, Bangalore promoted in the pay scale of Rs. 15,600-39,100+ RGP of Rs. 7,000 w.e.f. 04.11.2013.

- Dr. (Mrs.) F. Magdaline Eljeeva Emerald, Scientist, SRS, Bangalore promoted in the pay scale of Rs. 37,400-67,000+ RGP of Rs. 9,000 w.e.f. 04.07.2014.
- Dr. A. Manimaran, Scientist, SRS, Bangalore promoted in the pay scale of Rs. 15,600-39,100+ RGP of Rs. 7,000 w.e.f. 07.02.2014.
- Dr. Sanchita Garai, Scientist, ERS, Kalyani promoted in the pay scale of Rs. 15,600-39,100+ RGP of Rs. 7,000 w.e.f. 01.09.2014.

Retirements

- Dr. J. P. Sehgal, Principal Scientist, Dairy Cattle Nutrition Division retired from Council's service w.e.f. 31.07.2015.
- Dr. A. K. Doodeja, Principal Scientist, Dairy Engineering Division retired from Council's service w.e.f. 31.07.2015.
- Dr Satish Kulkarni, Principal Scientist (DT), SRS, Bangalore retired from Council's service w.e.f. 31.08.2015
- Sh. Jai Kumar Kewalramani, Joint Director (Admn. & Registrar) retired from Council's service w.e.f. 30.09.2015.

Transfer

- Dr. H. C. Devaraj, Scientist (DT) was transferred from NDRI, Karnal to SRS of NDRI, Bangalore and joined for duties w.e.f. 04.08.2015.

SOUTHERN CAMPUS, BANGALORE

RESEARCH

Ethno Veterinary Practices followed by Dairy Farmers of Malnad and Coastal Regions of Western Ghats Biodiversity, Karnataka, India

(K. P. Ramesha, M. Basavaraju, Akhila Rao and S. Jeyakumar)

Traditional knowledge about the herbage based remedies in the treatment of livestock ailments in the Malnad Gidda cattle was documented during 2014-15. It was observed that the use of medicinal herbages in the treatment of livestock ailments was common practice among small scale livestock farmers in the Malnad and Coastal regions, mainly owing to low cost and strong traditional beliefs. A total of 42 herbages distributed in 25 families and 5 species were found to be commonly used in the management of livestock health by traditional healers and farmers. This provides a strong platform for conducting in-depth scientific studies which would unravel the science underlying the efficacy of these plants, plant products and ethno-veterinary practices in managing animal health. The traditional healers had a rich history of successful use of medicinal herbages practices as

reflected in their knowledge of the prevention, control and treatment of various livestock ailments.

Antioxidant Activities of Pomegranate Peel Extract in Ghee

(M. Manjunatha, B. Surendra Nath, Menon Rekha Ravindra and F. Magdaline E. E)

Pomegranate peel is a cheap natural source of bioactive compounds including antioxidants and is an under utilized by-product. Therefore, the present work was carried to investigate antioxidant activities of pomegranate peel extract in ghee at different storage temperatures. The total phenol content (TPC) and radical scavenging activity (RSA) of the extract were found to be 282.61 mg of gallic acid equivalent (GAE)/g and 89.8% inhibition, respectively at the optimized extraction process. The colour and flavour scores of ghee incorporated with pomegranate peel powder extract (PPPE) @ 1% were comparable with the sensory scores of the control. Significant decrease in peroxides, thiobarbituric acid and carbonyl values were observed in the ghee samples incorporated with 1% PPPE than ghee samples incorporated with BHA (0.02%) and control. Antioxidant activities of pomegranate peel extract in ghee have been found to be better than BHA.

Design and Development of Eutectic Module for Cooling Raw Milk

(Darshan G. B. and Manjunatha M.)

The present work was carried to design and develop a eutectic module for raw milk cooling. Spherical in shape eutectic module containing secondary refrigerants designed, developed and evaluated for its cooling performance. The eutectic module containing water as refrigerant provided the maximum cooling effect (cooled 5 L of milk from 33.2 to 12.8°C in 26 min) followed by 20% propylene glycol solution (from 33.4 to 17.1°C in 22 min). The microbiological quality (TBC and MBRT) of raw milk cooled using the developed spherical eutectic module was found to be better than control (milk without cooling). The developed eutectic module was found to be useful for raw milk cooling at the farm level for small quantities of milk.

Dairy Entrepreneurship Development of Rural Women: An Action Research

(S. Subash, M. C. A. Devi and P. K. Dixit)

Development of entrepreneurship through women based Self Help Groups (SHGs) exclusively in dairying was taken up with the specific objective of improving the livelihood of SHG members through dairy based activity. Two women SHGs on dairying were formed in association with local NGOs. Based on member's information/technology needs and knowledge level, the Institute interventions in terms of orientation training, on farm/on campus lectures, meeting, on-farm demonstrations (fodder crops), infertility & health camp etc. were organized for the SHG members. The women SHG members also visited SRS of NDRI campus and attended one day orientation training on scientific dairying including demonstration on manufacturing of indigenous dairy products (Paneer, Khoa, curd, gulab jamun mix) at experimental dairy plant. The performance of promoted SHGs were studied in terms of improvement in their socio-economic level, gain in knowledge, adoption of scientific dairy farming practices and improvement in their overall entrepreneurial behaviour. Dairying as an income generating activity could be taken up by the rural women through SHG platform which enabled members to earn a monthly income of Rs.5000-7000 from dairying activity alone. SHG is a movement for women empowerment; dairying through SHG movement plays a major role in sustaining the livelihood of members.

Training Programmes

- Eight students from GKV, Bengaluru underwent In Plant Training in Dairy Engineering Section for period of one month from 01.07.2015 to 31.07.2015.

- One week training was conducted on 'Commercial Dairy Production' for eight candidates from 17.08.2015 to 22.08.2015.

Extension Activities

A total of 139 visitors in four batches comprising of students from various educational institutes and entrepreneurs of southern region, visited the Institute. The visitors were taken round the institute to various sections as per their needs and were explained about the ongoing research and extension activities. Advisory services/technical advice were rendered to six of the needy clientele during personal visits to the Institute and mail enquires/phone queries on information regarding transferrable technologies for field extension personnel and dairy farmers, training programmes on commercial dairy farming, indigenous dairy products, guidance to set-up a new dairy farm and short-term training programme for students.

SRS of NDRI, Bangalore participated in Dairy Tech India 2015, International Exhibition on Dairy Products & Technology held during 21st to 23rd August, 2015 at Bengaluru International Exhibition Centre (BIEC), Bengaluru. NDRI stall depicted innovative & educative information on dairy production & processing technologies, Indigenous breeds of South India & Indigenous dairy products of the region for the benefit of the clientele groups.

The 'Dairy Education at Farmers' Door as a new initiative was organized and visits were made by the multidisciplinary team on Second Saturdays to Valepura and Muthasandra villages of Bengaluru South and North Taluks during the period under the report. The multi-disciplinary team visited individual households and interacted with the farmers regarding dairy farm management and the problems faced in dairy farming.

Visit of Canadian Delegation

Canadian Delegation visited SRS, Bangalore to explore areas of collaboration in research between the University of Alberta and the NDRI of SRS, Bangalore. Canadian Delegation comprised Mr. Sudhiranjan Banerjee, Commercial Officer, International and Intergovernmental Relations, Govt. of Alberta, High Commission of Canada, New Delhi Office; Mr. Grant Winton, Manager, International Relations and Marketing, Agriculture and Forestry, Alberta; Mr. Joel Huberdeau, Offshore Manager, Supreme International Ltd. and Mr. Kapil Malhotra, Trade Commissioner, Canadian High Commission. It was felt that both the Institutions can collaborate with each other in the areas of animal management including feeding and genetic improvement, farm automation, processing machinery, validation of bio-active compounds and exchange of faculty and students.

EASTERN CAMPUS, KALYANI

RESEARCH

Determination of Plasma Kisspeptin Concentrations during Reproductive Cycle and Different Phases of Pregnancy in Crossbred Cows Using Bovine Specific Enzyme Immunoassay

(M. Mondal, M. Karunakaran, M. K. Ghosh and T. K. Dutta)

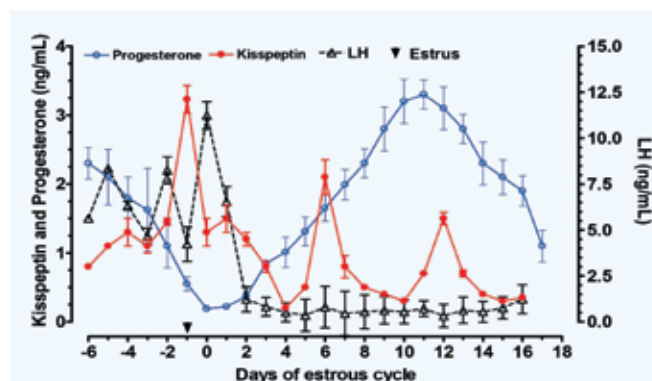
Kisspeptin, a decapeptide and potent secretagogue of GnRH has emerged recently as a master player in the regulation of reproduction in animals. The objective of this study was to develop and validate a simple and sufficiently sensitive enzyme immunoassay (EIA) for kisspeptin determination in bovine plasma using the biotin-streptavidin amplification system and second antibody coating technique. Biotin was coupled with kisspeptin and used to bridge between streptavidin-peroxidase and the immobilized kisspeptin antiserum in the competitive assay. Plasma kisspeptin concentrations increased ($P < 0.001$) from first through last trimester of pregnancy. Kisspeptin concentrations were also measured in different follicular, luteal and placental tissues. Follicular and placental kisspeptin levels increased ($P < 0.01$) during follicular development and with the advancement of pregnancy, respectively. On the other hand, luteal concentrations of kisspeptin decreased ($P < 0.01$) with its developmental process. In conclusion,

a simple, sufficiently sensitive and direct EIA procedure was developed for the first time to determine plasma kisspeptin levels in bovine. A wide range of kisspeptin concentrations can be detected during different physiological stages in bovine using this Kisspeptin-EIA procedure.

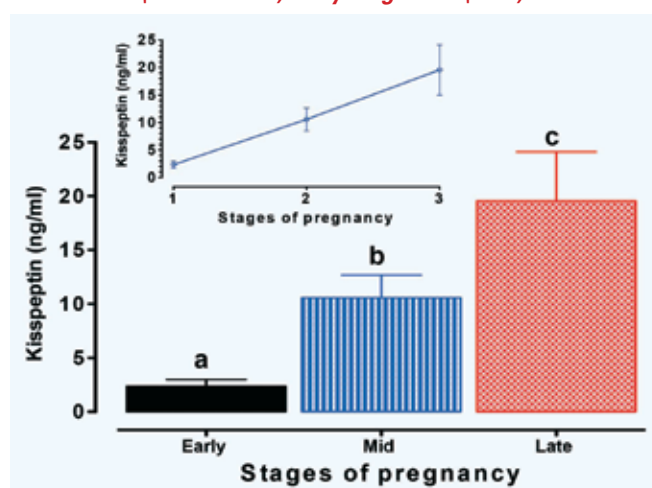
Effect of Supplementing Azolla Microphylla on Growth Rate and Blood Parameters of Crossbred Female Calves

(Arbind Khare, Anupam Chatterjee, M. Mondal, M. K. Ghosh and T. K. Dutta)

Throughout the world, and particularly in Asia, farmers have harvested naturally produced aquatic plants for a number of purposes including animal feed. Azolla is a floating aquatic macrophyte belonging to the family of Azollaceae. The fern Azolla, hosts a symbiotic blue green algae *Anabaena azollae*, which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla has been reported to be a very good source of protein, essential mineral elements and vitamins for livestock. The study was designed to evaluate the effect of supplementing *Azolla microphylla* on growth performance and blood parameters in crossbred female calves. The supplementation of *Azolla microphylla* to @ 1.5 kg/day/animal was found to be beneficial for the crossbred growing heifers without any adverse effect on health.



Plasma kisspeptin, LH and progesterone profiles (mean $\pm$ SEM) in cycling cows ($n=6$).



Plasma kisspeptin profiles (mean $\pm$ SEM) in pregnant cows during early (< 10 weeks; $n=6$), mid (> 10 to < 20 weeks; $n=6$) and late (> 20 to 36 weeks; $n=6$) stages of pregnancy. Bars indicated with different letters (a,b,c) differ ($P < 0.001$)

EVENTS

1. Training programme on Artificial Insemination and Scientific Goat Rearing Practices (August 12-14, 2015).
2. Training Programme on Improved Dairy farming Practices for Tribal Unemployed Youth under TSP (July 28-Aug 6, 2015).
3. Collaboration Programme "Scientist Farmers' Interface" Under TSP (August 28, 2015).

Extension Activities

- Team ERS visited the flood affected areas and a special animal health camp was organized on 8th August, 2015 (2nd Saturday) in the village Muratipur. Medicine and mineral mixture was distributed to flood affected twenty dairy farmers and veterinary aid was given to fifty dairy animals.
- Frontline demonstration on Azolla production for animal feeding was organized in Muratipur village of Nadia District on 12th September 2015.
- One common interest group consisting of 10 members namely "Kamdhenu" in Char birpara village of Nadia district was established on 12th September 2015 to do liaison and act as key communicator between NDRI and in that village.
- Three "Anoestrous and Deworming Camps" were organized on 11th August 2015 in the Muratipur village of Nadia District for twenty five (25) farmers on 18th August 2015 in the Dakkhin Chandamari village of Nadia District for seventeen (17) farmers and on 29th August 2015 in the, Ghoshal danga Village, Birbhum for one hundred (100) farmers.
- Decision support system on Reproductive Management in Dairy Cows and Goat farming was developed by Dr. M. Karunakaran and published in the ICAR- Central Coastal Agriculture Research Institute web site <http://www.icargoa.res.in/>.

INSECTICIDE TOXICITY AND ITS MANAGEMENT IN DAIRY ANIMALS

V. K. Dumka* and A. K. Srivastava

*Department of Pharmacology and Toxicology, GADVASU, Ludhiana

Agrochemicals continue to be the main cause of accidental poisoning in all animal species. Careless use of insecticides is responsible for innumerable cases of fatal poisoning in animals. Most insecticides encountered in livestock are not selective and toxic to non-target species including domestic animals. It is extremely important to be aware of the potential danger to livestock arising out of the misuse or excessive use of such poisonous compounds. The most common adverse effects are produced by organochlorine or organophosphate insecticides, but other compounds such as pyrethroids also have significant and widespread effects.

Organochlorine Compounds: Chlorinated hydrocarbon insecticides (CHIs) were widely used in agriculture and for malaria control in the past. Their use is now discouraged owing to their greater mammalian toxicity, extreme environmental persistence and development of insect resistance. They have high potential to cause greater chronic toxicity as compared to other insecticides. Organochlorine pesticides are now rarely used in developed world and poisonings in domestic animals has become rare. Lindane and endosulfan are still used in some developing countries. CHIs are diffuse CNS stimulants and do not act upon any specific receptor. They change the electrical activity in the CNS by altering Na⁺ and K⁺ flux across the nerve membranes. They also increase the concentration of free ammonia and glutamine in the brain. In acute toxicity, symptoms appear within 24 hours including restlessness, hyper excitability, muscle tremors, starting from facial and cervical muscles, which progresses to lower parts of body, incoordination, clonic and tonic convulsions, high rise in body temperature, sticky salivation and death due to respiratory failure.

Treatment aims at controlling convulsions by administering chloral-hydrate or pentobarbital sodium in ruminants. CNS depressants/anesthetics are contraindicated, if the animal is already depressed. A small dose of atropine sulfate may be given to control the parasympathetic signs. Intravenous administration of calcium borogluconate is recommended to prevent liver damage and nullify the effect of pre-convulsive increase in K⁺ ions concentrations. Phenobarbital (10 mg/kg/day) has also been tried to induce hepatic microsomal enzymes to promote faster metabolism and excretion. In small animals Cholestyramine may be used alternatively to bind these highly lipophilic agents. It reduces reabsorption and retains bound agent in the GI tract for fecal elimination. Following ingestion of chlordecone, multiple repeated doses of cholestyramine can be administered to interrupt enterohepatic circulation of chlorinated hydrocarbons.

Organophosphates: Organophosphates (OPIs) is the most widely used group of insecticides used in agriculture, veterinary and public health practices. Acute toxicity is frequently encountered in dairy animals due to careless use or following accidental ingestion of these chemicals. Besides their acute toxic effects, OPIs are also implicated in various disorders

like cancer, reproductive dysfunctions, peripheral neuropathy, impaired immune functions and neurobehavioral changes. Products like diazenon, dimethoate and malathion possess toxicity equivalent to that of CHIs in mammals. Some less toxic ones like coumaphos, crufomate, fenclorvos and trichlorphon are used as insecticides. Other compounds like dichlorvos, haloxon and naphthalphos are used as anthelmintics. Lot of research has been conducted on toxicity of organophosphates including the newer compounds. Sub-chronic quinalphos exposure, for example, produced mild signs of toxicity in buffalo calves. There was a significant increase in the extent of lipid peroxidation and in the activity of anti-oxidant enzymes blood glutathione and catalase. However, quinalphos caused a significant reduction in glutathione peroxide and superoxide dismutase levels. The biochemical parameters also showed alterations like inhibition of cholinesterase activity in RBC and plasma. There was significant increase in creatinine, gamma-glutamyl transferase, aspartate transaminase, alkaline phosphatase and alanine transaminase on administration of quinalphos.

OPI poisoning occurs as a result of persistence of excess ACh at the nerve endings. Besides their anticholinesterase activity, some OPIs like DFP, mipafox and TOCP produce delayed neuropathy involving demyelination of the peripheral nerves and white matter of spinal cord as a result of inhibition of neurotoxic esterases. The net effect of two or more OPIs may be supra additive. The toxicity of OPIs is also increased by other xenobiotics such as urea, copper sulphate and some plant poisons. Susceptibility to OPIs also depends on species e.g. fenitrothion is more toxic to buffaloes than cows.

Onset of symptoms after exposure to OPIs is usually rapid, within 10 min to 2-3 hours and may include bronchoconstriction, difficult breathing, increased bronchial secretions, hypersalivation with watery drooling saliva, lacrimation, sweating, frequent and involuntary urination, increased gastrointestinal tone, diarrhea, abdominal cramps, hypotension, bradycardia, miosis, muscular weakness, twitching, fasciculations, cramps, tremors, atrophy, dyspnoea, cyanosis, restlessness, convulsions, tremors, ataxia, hypothermia, cardiac and respiratory arrest and coma. Duration of symptoms is generally from 1-5 days. In fatal cases, death occurs within 24 hours. There are no characteristic lesions, however, hemorrhagic gastroenteritis, pulmonary edema and degenerative changes in liver and kidney may be found.

Exposure to OPIs may be diagnosed on the basis of history, circumstantial and symptomatic evidences and estimation of Acetylcholine esterase enzyme (AChE). In living animals whole blood or plasma enzyme levels are measured, while in dead animals brain enzyme inhibition is considered a better index. Treatment of OPI toxicity is aimed along two lines: To abolish the muscarinic effects of excess acetylcholine, atropine sulphate is given @ 0.2-0.5 mg/kg body weight as 0.15 % solution in physiological saline. One-fourth of this dose is

administered intravenously and three-fourth intramuscularly. The treatment may be repeated symptomatically or at 6-12 h intervals with half the dose. The second line of treatment involves the use of oxime reactivators such as diacetyl monoxime (DAM), 2-pyridine aldoxime methiodide (2-PAM), obidoxime, trimedoxime, monoisonitroso acetone (MINA) or aldoxime, which regenerate the phosphorylated AChE enzyme and greatly accelerate clinical recovery. It also reduces the dose of atropine required. DAM, which is inexpensive and freely available, is preferred and administered @ 30 mg/kg, intramuscularly as 6 % solution in normal saline. It may be repeated at half the dose after 12 h.

Carbamates: Carbamates are narrow spectrum insecticides and show erratic patterns of selectivity to insects. They are used for the control of ectoparasites in both large and small animals. Carbamates are potent, reversible inhibitors of AChE enzyme and generally produce toxicity similar to OPIs but effects are less severe and last for shorter duration. Acute toxicity is characterized by salivation, lacrimation, miosis, convulsions and death. Symptoms of chronic toxicity include incoordination, ataxia, recumbancy, and prostration but there is no damage to nerves. Postmortem findings of acute toxicity are limited to congestion and edema of lungs, liver and kidneys and patchial hemorrhage of gastric mucosa. Neuromuscular lesions are seen in chronic poisoning.

Carbamate poisoning is much more difficult to diagnose than OPI toxicity because carbamates are rapidly metabolized, so not detected in tissues and blood and unlike in OPI toxicity, the level of AChE is normal in carbamate poisoning due to reversible inhibition. Diagnosis is, thus, made on the basis of history and circumstantial evidence. Carbamate toxicity is treated by administration of atropine sulphate in a similar manner and same dose as that in OPI toxicity. Diuretics such as hydrochlorothiazide are helpful. Oxime reactivators are ineffective and are contraindicated since they may aggravate the toxicity of carbamates.

Pyrethroids: The pyrethroid class of insecticides is being used as substitutes for organochlorines and organophosphates in pest-control programs because of their short environmental persistence and low mammalian toxicity. Pyrethroids act on sodium channels in the axonal membranes inhibiting inactivation of sodium channels and activation of potassium channels, thus, prolonging the action potential of nerve membranes. Subacute or chronic toxicities are very rare. Signs of acute toxicity are salivation, hyperexcitability, tremors, seizures, restlessness, incoordination, dyspnoea, weakness, hyperthermia, prostration and death from respiratory failure. Clinical signs resolve in either death or recovery within 24-72 hours. Diagnosis is difficult and depends upon history and clinical signs. Pyrethroids are difficult to detect and confirm in blood or tissues and often tissue levels do not correlate well with the severity of signs. Lesions are usually not associated with clinical toxicosis. Specific antidotes are not available for pyrethroids and are generally not required since toxicosis is mild to moderate. Prognosis is good unless the exposure is massive. Symptomatic and supportive treatment is given. Diazepam or barbiturates can be given to control seizures

and hyperexcitability. Phenothiazine tranquilizers should be avoided since they lower the seizure threshold. Atropine can be used sparingly to alleviate symptoms of excessive salivation or gastrointestinal hypermotility.

Neonicotinoids: Several recently developed insecticides with new chemical entities have been added to the list of agrochemicals over the past few years, including the neonicotinoids. Since the introduction of the first compound of this group, imidacloprid, neonicotinoids have become the largest selling group of insecticides worldwide. Due to a different mode of action, neonicotinoids are effective for the control of several harmful pests that have evolved strains resistant to many other insecticides. These are widely used for the control of crop-pests as well as ectoparasites in domestic and farm animals. Nicotinoids interfere with the transmission of impulses in the nerve system of insects. Similar to the naturally occurring signal-transmitting acetylcholine, nicotinoids stimulate certain nerve cells by acting on a receptor protein. In contrast to acetylcholine, which is quickly degraded by the enzyme acetylcholine-esterase, nicotinoid is inactivated either very slowly or not at all. It has both contact and ingestion activity. Nicotinoids have a safer toxicological profile for warm-blooded mammals. The symptoms observed following oral intake include behavioural, respiratory and motility disturbances; narrowed palpebral fissures, transient trembling and spasms. Sub acute toxicity of acetamiprid in our lab in buffalo calves did not produce any significant toxic signs with no significant effect on the plasma levels of lactate dehydrogenase (LDH), phosphatases, cholesterol, creatinine, blood urea nitrogen (BUN), blood glucose and haematological parameters but produced significant elevation of aspartate amino transferase (AST) and alanine amino transferase (ALT). Nicotinoids are known to have practically no acute dermal toxicity and low acute inhalation toxicity. There are no available antidotes, but being mildly toxic only symptomatic treatment is recommended.

Phenylpyrazoles: A new group of insecticides, the phenylpyrazoles, has been launched with broadspectrum activity that possesses a wide range of biological effects including insecticidal, miticidal and herbicidal activity. Their mode of action is entirely different from the earlier groups with gamma-amino butyric acid (GABA)-regulated chloride ion channels being the primary site of action. Fipronil belonging to this group, has been extensively tried and experimentally used particularly against insect pests, locusts, ticks and fleas. Fipronil is considered moderately toxic to rats and mice, highly toxic to aquatic invertebrate, fish and upland game birds but non toxic to water fowl and other bird species. In one of our studies, oral sub chronic toxicity was manifested by toxic signs of salivation, lachrymal discharge, dullness, depression, decreased body weight gain, muscle weakness, alopecia and sunken eyes in buffalo calves. There was significant elevation in LDH, GGT, ALT, ACP, plasma proteins, blood glucose, blood urea nitrogen, phosphorus, LPO and TSH along with significant decline in the plasma levels of cholesterol and T3 in buffalo calves.

Benzenedicarboxamide: A new promising class of insecticide called benzenedicarboxamide or phthalic acid diamide, has been recently developed. Flubendamide belongs to 1,

2-benzenedicarboxamide and is a novel activator of ryanodine-sensitive calcium release channel (ryanodine receptors, RyR) present only in insects. In contrast to most commercially successful insecticides, which act on the nervous system, flubendiamide disrupts proper muscle function in insects and therefore, represents a novel, unique mode of action. Manifestations of its chronic toxicity in other mammalian species remain widely unknown. The only study reported on toxicity of flubendiamide in dairy animals is in buffalo calves. Chronic oral toxicity study of flubendiamide revealed significant increase in ALT, AST, AKLP and BUN levels while GGTP and creatinine levels did not alter significantly. Likewise, Hb, TEC and MCV did not differ significantly, but significant decrease in packed cell volume (PCV) was noted. TLC decreased significantly, but DLC count did not show any significant alteration. Flubendiamide exposure resulted into significant increase in LPO, catalase and GST activity but decrease in SOD, GPx, blood glutathione, TAA, glutathione reductase and G6PD activities. Calcium, Phosphorus, iron, zinc, copper, lead and manganese levels in blood did not show any significant change. Decrease in level of T3 and T4 suggested thyrotoxic effects of flubendiamide administration in buffalo calves.

Management of Poisoning: Early diagnosis in all the cases of poisoning is the key to proper treatment and prognosis. Response of the affected animal to specific antidote of a poison confirms toxicity. Actual diagnosis is made by the combined evaluation of all types of evidences. All cases of poisoning should be treated as emergencies and immediate life saving measures must be ensured since delay causes irreparable damage to animals. Treatment involves four basic principles namely removal of affected animal from source of poisoning, prevention of further absorption of poison, supportive or symptomatic treatment and finally specific antidote to neutralize and remove the poison from body. Management practices aid in therapy such as change of feed lot, shifting animals from area of exposure or changing source of feed and water to prevent further exposure. First attempt is to remove the poison from body. Topically applied poisons are washed with soap and water. If poison has been ingested, then attempts are made to decrease rate of absorption from site of administration by providing non-specific treatment such as emesis, gastric lavage, purgation, adsorption therapy or specific treatment. Vomition is useful in removing poison from GIT of monogastric animals if induced within 2 h of ingestion of poison. Vomition can be induced orally by locally acting emetics like NaCl (5-10 g in 200 ml warm water), H_2O_2 (3% sol 1-5 ml orally) or $CuSO_4$ (1% sol, 10-60 ml orally, or using

centrally acting emetics such as apomorphine HCl (0.05 mg/kg, iv/im, 0.08 mg/kg sc in NSS) or xylazine (1.1 mg/kg, im) in cats. Gastric lavage is highly useful when emesis is refused or contraindicated in poisoned animals. Lavage solution (water or NSS: 10 ml/kg, $KMnO_4$: 1: 2000 sol, Tr. iodine 5% sol, 1: 250 dilution, tannic acid sol or Soda bi carb sol.) is drenched by stomach tube and pumped out by suction till clear fluid comes out. Purgation is achieved by giving saline purgatives (Mag sulph or Sod. Sulphate-250 mg/kg) orally to remove poisons from gut. Adsorption therapy is done by physical binding of the toxic compound with an unabsorbable carrier which is eliminated in feces. Activated charcoal (2.5 g/kg in water as 1 g/ml suspension) is the most effective adsorption of wide variety of toxicants. It is administered along with a cathartic (Sod. Sulphate, 250 mg/kg, or 70% sorbitol, 3ml/kg) orally.

Specific treatment involves interaction/neutralization of toxicants by some substance to prevent absorption. Antidotes interact with toxicants to form stable complexes, which are non-toxic and excreted. Fluid therapy is given to overcome shock and dehydration due to excessive fluid loss, vomition, diarrhea etc. Antiarrhythmic drugs may also be helpful. Correction of acid-base and electrolyte imbalance is required since metabolic acidosis commonly occurs during toxicity which can be corrected with Sod bi carb @ 0.5-2 mEq/kg, iv, 4 hrly or Sod. Lactate @ 16-32 mg/kg as 0.17 M sol, iv. Seizures can be prevented by administering diazepam @ 0.5mg/kg iv, repeated 3-4 times at 20 min interval, which is the drug of choice for acute seizures of unknown etiology or with Pentobarbitone @ 10-30 mg/kg, iv or phenobarbitone @ 6 mg/kg, iv for prolonged control of seizures. Coma can be managed by giving stimulants like amphetamine @ 0.25 mg/kg, sc. Renal flow is increased to reduce cerebral edema by diuretics such as mannitol @ 1-2 g/kg, iv. Maintenance of body temp is essential. Hyperthermia is managed by cold water or ice application since antipyretics are not effective during toxicosis, whereas hypothermia is prevented by warming the surroundings. Specific antidotes are used to neutralize effect of toxicants at their receptors e.g. atropine inhibits action of ACh at muscarinic receptors in OPI toxicity,

Prevention of Insecticide Toxicity: Alternatives to pesticides are available, which include polyculture methods of cultivation, use of biological controls, genetic engineering, and methods of interfering with insect breeding. The key to safe environment ultimately lies in creating awareness among the masses on the hazards of insecticides. Human beings as well as animal and wildlife can only be protected if we learn to say no to the use of synthetic pesticides and adopt organic farming.

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Tel.: 0184-2252800 | Fax: 0184-2250042 | E-mail : dir@ndri.res.in | Gram : DAIRYRESEARCH