

FoodPro

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CONTENTS

Research Highlights

2

New Technologies

3

Technologies Transferred

4

New Start-ups

4

Entrepreneurs Speak..

4

New Collaborations

5

Events

5

Visit of Delegations

8

Selected Publications

8

Research Highlights

Glycosaminoglycans from bovine milk

The structure function relation of glycosaminoglycans from bovine milk (bmGAGs) has been studied. Here bmGAGs was isolated and structurally characterized. Chondroitin sulphate was one of the major GAGs present and had 65% of Δ Di-diSB (GlcA(2S)-GalNAc(4S)), followed by 18% of Δ Di-4S(Δ 4,5HexUA α 1 \rightarrow 3GalNAc). Further, bmGAGs exhibited a marked anti-adipogenic effect in 3T3-L1 cells without affecting cell viability. The triglyceride content treated with bmGAGs was significantly decreased as assessed by Oil-Red O staining. Peroxisome proliferator activated receptor γ (PPAR- γ) and CCAAT/enhancer-binding proteins (C/EBP α) the critical transcription factors in adipogenesis showed significant decrease in both gene and protein levels. Sterol regulatory element-binding protein 1c (SREBP-1c) that promotes the adipocyte differentiation was inversely affected by bmGAGs and the fatty acid synthase (FAS) expression was modulated. The present work demonstrates an anti-adipogenic activity of bmGAGs by modulating the adipogenesis-related marker proteins and hence bmGAGs may be used as a supplement/ therapeutic in the management of obesity.

(Source: Chaitra Rai, Nandini, C.D., Poornima Priyadarshini, *Composition and structure elucidation of bovine milk glycosaminoglycans and their anti-adipogenic activity via*

modulation PPAR- γ and C/EBP- α , Int. J. Biol. Macromol., 2021, 193, pp. 137-144)

Heteroresistance in Bacteria: An alternative mechanism to combat antibiotic action

Heteroresistance developed due to usage of antibiotics is a typical bacterial phenotype that evolves as a bacterial resistance efficacy within a susceptible population. Selective antibiotic pressure can induce the bacterial heteroresistance. Till date, a few reports have been emerged with prevalence of heteroresistance in several bacterial species towards different classes of antibiotics. The organisms with stable heteroresistance can sustain the resistance ability even in the absence of antibiotics that can rather revert to susceptibility in the absence of antibiotics. The bacterial heteroresistance is due to genetically unsteady amplification of tandem genes. Heteroresistant infections have clinical implications associated with multiple drug resistance. Heteroresistance is a natural progression towards antibiotic resistance which is a cause of concern to health globally. These phenotypes provide opportunity for bacteria to grow under selective antibiotic pressure. Therefore, judicious use of antibiotics in agriculture, veterinary and human therapeutics would be the possible tool to prevent the dissemination of heteroresistant isolates via food chain. In our study, we have found heteroresistance in the lactic acid bacterial isolates. We found isolates displayed completely resistant to antibiotic disc of erythromycin (15 μ g),

clindamycin (2µg) and pristinamycin (15µg) when treated with erythromycin at 4µg/ml overnight. This indicates that the heteroresistant cultures can become completely resistant upon selective antibiotic pressure.

(Source: Manjunath, A, Thumu S. C., Kumar, S., Halami, P. M., *Bacterial heteroresistance: an evolving novel way to combat antibiotics. Biologia. 2021,76(10), pp.3029-41*)

New Technologies

Tamarind Candy

India is the world largest producer of tamarind; it is estimated that 300,000 tons are produced annually. The fruit is good source of phosphorus, calcium and iron. There is a huge market for export of various tamarind products such as tamarind concentrate, tamarind powder, tamarind kernel powder (TKP) pickles and pastes. Tamarind pulp is rich in glucose (47.7% of total sugar); D-manose (24.5%) and D-maltose (20.4%). The sour taste of the pulp is attributed to tartaric acid (8-18%) together with malic and citric acids (2%), and is the chief acidulant used in the preparation of foods in India. Tamarind pulp has an excellent keeping quality when dried properly and cured with salt. The institute has developed a formulation for making tamarind candy. Soft candy, has been standardized using tamarind pulp and sugar, mimicking traditional tamarind paste with spices. This candy serves dual purpose as it can be used as lozenges for cough and cold with added spice powders or oleoresins. The process involves obtaining a clean tamarind paste after pulping, cooking with sugar

to a soft candy stage and mixing of ingredients. Tamarind candy needs twist wrapping and to avoid moisture absorption and also maintain shape.

(Source: Shankaracharya, N. B. (1998), *Tamarind - chemistry, technology and uses - a critical appraisal. Journal of Food Science and Technology*, 35 (3). pp.193-208)



Moringa Chikki

Chikki is a ready to eat traditional favourite snack for all sections of population in our country. The product can be utilized under the label Ready to Eat sweet snack or enriched snacks targeted for specific target group as a concentrated source of energy and protein. Moringa chikki is made from natural sources without using any preservatives. Moringa chikki with natural phytonutrients, vitamins, minerals, contribute to antioxidant activity and with other nutrients, amino acids and fatty acids in this product can help maintain good immunity. Moringa chikki has an ORAC of 616 umole TE and a

TEAC value of 50 mg. It is an excellent source of Vitamin E, Beta carotene, Thiamine and Niacin.



Technologies Transferred

- ◆ Online fortification of atta/maida (Fortify Health at Development Consortium, New Delhi)
- ◆ Egg wafers, RTE shelf stable egg crunchy bites, Dehydration of egg cubes, Egg loaf (Srinivasa Farms Pvt Ltd, Telangana)
- ◆ Instant upma mix millet and multimillet semolina, Instant halva mix with millet and multimillet semolina (Saakya Foods, Mysuru)
- ◆ Shelf stable jowar flour (Priya Gruha Udhya, Vijayapura)
- ◆ Egg wafers, Shelf stable chicken biriyani, Chicken wafers, Chicken pickle, Shelf stable kabab mix with chicken meat, Shelf stable chicken tit-bits (North East Animal Farming Initiatives LLP, Assam)
- ◆ Preparation of shelf stable biriyani paste (Charminar Foods & Exports Pvt Ltd., Hyderabad)

New Start-ups at CSIR-CFTRI

Plantish Foods Pvt. Ltd., Haryana

Plantish is a food-tech company making the food healthy and sustainable starting with a Plant-based alternative to egg scrambles, omelette as well as whole boiled egg. As the current animal-based food system is highly unsustainable and will not be able to fulfil the needs of the next generation. Hence, plant-based alternatives which are healthy, safe and sustainable without compromising on taste, convenience & nutrition are explored by this start-up.



Agromatic Nutrifoods Pvt. Ltd., Bangalore

Agromatic Nutrifoods is a food-tech company which strives to create healthier and tastier plant based



food products. The company is working on the development of plant based meat and meat derived products from protein-rich ingredients having a property to mimic meat in terms of its unique structure, texture and mouth feel. Further the company focus on plant based milk & milk derived products like paneer, cheese and so on.

Entrepreneurs Speak..

Abhay Natural Food Processing was established by Mr. Naveen, a weekend natural farmer with 15+ years of experience in Investment Research Analytics and project management along with Ms. Veena KS, a farmer in Hunsur. They are enthusiastic about natural foods, food processing, and market development. They are the first beneficiary under PMFME scheme in Karnataka for establishing a banana processing unit. He has collaborated closely with CSIR-CFTRI and the National Research Centre Banana, Tiruchirapalli to come out with a product, "Shuddha Aahar".



Product ranges & brand

- ◆ Bakahu (Bale Kayi Hudi), Gluten-Free raw nendran banana flour is an all-purpose healthy flour and can be alternative for maida, wheat and rice flour. This reduces glycemic index of wheat and rice and work as thickening agent as well. This can be added to various food

preparations for better health attributes. Banana flour is extremely rich in resistant starch, which can help diabetics to improve insulin sensitivity and maintain blood sugar levels. Banana Grids, Wheat flour mix with raw banana flour, Rice flour mix with raw banana flour, Banana pasta, Banana noodles, Banana vegetable soup and Banana health drink /chocolate drink are some of the other products marketed by the firm.

Vision & Challenges

We would like to be the market leader in the raw banana flour market and create multiple options for end users to avoid lifestyle problems for our community. Being a new product in the market, you need to put a lot of effort on product awareness and marketing will be very challenging.

Role of CFTRI in catalyzing growth of your firm

We are also producing turmeric powder and jams.

- ◆ Dehydrated fruit strips viz., Banana figs/Sukeli/ Dry banana are also a healthy snacking options. Dried fruit offers several advantages over fresh fruit in terms of cost, availability, ease of storage and transport. It could also replace more unhealthful snack food that is high in sugar, salt, and saturated fat.
- ◆ Mixed Fruit Jam from Jackfruit, Mango, Pineapple and Chikoo using osmotic dehydrated technology from CSIR-CFTRI.

Under PMFME scheme, we had undergone training program which has opened up the door for many innovations. After taking two of the technologies from CSIR-CFTRI, further we have worked on standardizing the product for the market

Your advice to emerging start-ups

Before beginning any processing activities, make sure that a complete action plan is made ready.

New Collaborations

Indian Institute of Packaging (Oct 20, 2021)

This collaboration is meant to promote research and development in the cutting-edge areas of food packaging applications.



Karnataka Agriculture Produce Processing & Export Council (KAPPEC), Bengaluru (Nov 18, 2021)

This collaboration is aimed at the establishment of Common Incubation Centre (CIC) at CSIR-CFTRI

with the processing line viz., Coffee processing, Banana products and Minimally processed vegetables under PMFME scheme.

National Sugar Institute (NSI), Kanpur (Nov 30, 2021)

Series of R&D programmes have been chalked under this MoU in sugar fortification, non-chemical jaggery development will be pursued.



SLN Coffee Pvt. Ltd., Kushalnagar (Dec 10, 2021)

A collaborative project has been launched focusing on value addition to the instant coffee and product development.

Events

Swachhta Abhiyan (Oct 7, 2021)

Swachhta Abhiyan was organized in the campus as part of Swachhta Pakwada.

CSIR-CFTRI Foundation Day (Oct 21, 2021)

CSIR-CFTRI Foundation Day and 'Stakeholders Connect' was organized. Prof. G. Hemanth Kumar, VC, University of Mysore, delivered the Foundation day lecture, and Dr. Tanweer Alam, Director, IIP-Mumbai, was the Guest of Honour. The occasion was presided over by Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI. A Stakeholders Connect was also organized on the occasion. In the Stakeholders Connect programme, developments in the areas of coffee products, probiotics and banana products were presented and 13 companies participated.



Ambedkar Birth Anniversary (Oct 22, 2021)

130th Birth Anniversary of Bharath Ratna Dr. B.R. Ambedkar celebrations was celebrated in the Institute

International Conference on Gut-Brain-Health Connections (Oct 28-29, 2021)

An International conference on "Gut-Brain-Health Connection" was organised by the Department of Studies in Microbiology, KSOU, Mysuru in collaboration with CSIR-CFTRI. The conference was inaugurated by Prof. S. Vidyashankar, VC, KSOU, Mysuru and presided by Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI. Prof. Arun Sharma, IMANAH (USA); Prof. Srinivas Arka, CCA (UK) were Guests of Honour.



Vigilance Awareness Week (Oct 26-Nov 1, 2021)

As part of the Vigilance Awareness Week, Dr. Manjunatha A. Kanamadi, Sr. Divisional Commercial Manager, South Western Railways, Mysuru, delivered the talk on "Independence India at 75: Self Reliance with Integrity", Director, CSIR-CFTRI presided and prizes were distributed to winners of the various competitions.

Kannada Rajyotsava (Nov 1, 2021)

The Kannada Rajyotsava was celebrated and Shri. R. Dhruvanarayan, Ex Member of Parliament, addressed the staff and students. Director, CSIR-CFTRI presided over the function.



Skill Development Programme on Baking (Nov 15-Dec 10, 2021)

NSDC-aligned Baking Technician programme under CSIR Integrated Skill Initiative was conducted at CSIR-CFTRI in which 20 participants attended.



Training on "Sustainable Rural Food Processing Enterprises for Livelihood generation" (Nov 18, 2021)

The programme under Integrated CSIR Skill Initiative was Inaugurated by Ms. Chayaa Nanjappa, Founder & MD, Nectar Fresh Pvt. Ltd., Mysore. Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI presided the inaugural session. A total of 50 representatives attended including 4 SHGs.

Inauguration of "We-Mill" Plant (Nov 21, 2021)

'We-Mill' plant, a social enterprise project to empower rural women through a sustainable livelihood was inaugurated at Bilikere Village, Mysuru, with the technical support for Ragi-based products from CSIR-CFTRI.



JIGYASA Scientist-Student Connect Program (Nov 22, 2021)

CSIR JIGYASA Scientist - Student connect program conducted on November 22, 2021 with the participation of students from Navodaya Vidyalaya, Mysuru. The programme was Inaugurated by Dr. Jahnavi Phalkey, Director, Science Gallery, Bengaluru and Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI presided.



"Antimicrobial Resistance in Food Chain" workshop (Nov 25-26, 2021)

The workshop was inaugurated by Prof. Abdul Gaffur, Apollo Hospital, Chennai and Dr. Sumana MN, Head Microbiology Dept., JSS Hospital, Mysuru delivered the keynote address

Launch of Nutritional Intervention for SAM children (Dec 6, 2021)

Nutritional Intervention project for 135 SAM Children of Mysuru district was launched on December 6, 2021. This initiative is a collaboration between the CSIR-

CFTRI, the Dept. of Women & Child Development (DWCD), Mysuru, Govt. of Karnataka, and the Tumkur-based Spirulina Foundation. Shri. AM Yogeesh, IAS, CEO-ZP, Mysuru officially launched the programme by distributing the kits to the families of SAM children on the occasion.

Ragi and Value Added Products (Dec 6-10, 2021)

Training programme on ragi and value added products from ragi was conducted for Women SHG supported by WASAN and District Mineral Foundation, Keonjhar under Odisha Millet Mission.



Kerry Scholarship Scheme (Dec 16, 2021)

A Scholarship scheme for M.Sc. (Food Technology) programme was launched in association with Kerry Ingredients India Pvt. Ltd. Bangalore under a CSR Programme for a period of 3 years. In the function, scholarships were awarded to M.Sc Food Tech. students of fresh batch who excelled in the entrance exams conducted for admission.



JIGYASA Online Quiz (Dec 22, 2021)

JIGYASA Online Quiz programme was conducted on December 22, 2021 to School students of six Kendriya Vidyalaya schools in Mysore, Chamarajanagar, Mandya, Hassan and Coorg.

Visit of Delegations

- ✦ KVIC (Mumbai) team visited and interacted with scientists on establishment of CoE on Food Processing on October 28, 2021.
- ✦ Laghu Udyog Bharati office bearers of Karnataka visited the Institute on October 28, 2021 and interacted with scientists.
- ✦ Dr. KG Jagadeesha, IAS, CEO & Secretary, Coffee Board visited the Institute on October 30, 2021 and interacted with scientists with respect to initiating R&D on development of Innovative Coffee based beverages and other value added products.
- ✦ Dr. G. Narahari Sastry, Director, CSIR-NEIST, Jorhat interacted with scientist on November 2, 2021.
- ✦ Denmark delegation visited CSIR-CFTRI on November 10, 2021 as part of Indo-Danish Food Coalition for ensuring safe, wholesome & hygienic food sustainability. Mr. Tobias Hansen, Confederation of Danish Industries & Mr. Tom Sebastian, Program Director at NORDIN, Asia House and Ms. Anandita Prakash, Embassy of Denmark-India interacted with scientists.



- ✦ The delegation of Officer Trainees from the 2020 batch of IAS visited CSIR-CFTRI as part of their winter study tour on December 28, 2021 and interacted with scientists in the Institute.

Awards

- ✦ The 40th ISMT Course's award ceremony and valedictory function was held on October 29, 2021. The valedictory address was given by Mr. S.K. Ramprasad, Managing Director, Muhlenbau Equipments, Bengaluru. The occasion was presided over by Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI and medals were presented to meritorious students.



- ✦ Shri Rangadhamaiah, Food Engineering Dept., received the Certificate of Appreciation from the Department of Kannada and Culture, Mysuru Dist., for his contribution to Kannada language on Kannada Rajyotsava Day.

Selected Publications

- ✦ Sapna, I., Jayadeep, A., Influence of enzyme concentrations in enzymatic bioprocessing of red rice bran: A detailed study on nutraceutical compositions, antioxidant and human LDL oxidation inhibition properties, *Food Chem.*, 2021, 351, art. no. 129272. (IF: 7.514)
- ✦ Nagaraju, P.G., Sindhu, P., Dubey, T., Chinnathambi, S., Poornima Priyadarshini, C.G., Rao, P.J., Influence of sodium caseinate, maltodextrin, pectin and their Maillard conjugate on the stability, in vitro release, anti-oxidant property and cell viability of eugenol-olive oil nanoemulsions, *Int. J. Biol. Macromol.*, 2021, 183, pp. 158-170. (IF: 6.953)
- ✦ Noore, S., Ramesh, G., Vendan, S.E., Nagaraju, V.D., Persistence and diffusion behaviour of chlorpyrifos in five different species of vegetables: A comparative analysis, *Ecotoxicol. Environ. Saf.*, 2021, 217, art. no. 112208. (IF: 6.291)
- ✦ Penta, D., Mondal, P., Natesh, J., Meeran, S.M., Dietary bioactive diindolylmethane enhances the therapeutic efficacy of centchroman in breast cancer cells by regulating ABCB1/P-gp efflux transporter, *J. Nutr. Biochem.*, 2021, 94, art. no. 108749. (IF: 6.048)

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