



SREE NARAYANA COLLEGE

(Affiliated to the University of Calicut)
NAAC Accredited with B Grade

Erattakulam P.O, Alathur 678682

sncalathur1970@gmail.com

04922 222 391

www.sncollegealathur.ac.in



CRITERION: 3

**RESEARCH, INNOVATIONS AND
EXTENSION:**

**RESEARCH PUBLICATION AND
AWARDS**

**SREE NARAYANA COLLEGE**

(Affiliated to the University of Calicut)
NAAC Accredited with B Grade

Erattakulam P.O, Alathur 678682

sncalathur1970@gmail.com

04922 222 391

www.sncollegealathur.ac.in

CRITERION	3: Research, Innovations and Extension
KEY INDICATOR	3.3- Research Publication and Awards
METRIC NO	3.3.1 Number of research papers published per teacher in the Journals notified on UGC care list during the last five years
FILE DESCRIPTION	<ul style="list-style-type: none">• Front page of the publications/certificates

Novel Intense Red Emitting Eu³⁺ Doped CePO₄ Nanocrystals for Solid State Lighting Applications

S Sisira^{1*}, K P Mani², P Punathil³, L A Jacob⁴, B Baby⁵, P R Biju⁵, N V Unnikrishnan⁵, C Joseph^{5*}

¹Department of Physics, Sree Narayana College, Alathur, Palakkad, Kerala India, Pin: 678 682

²Inter National School of Photonics, CUSAT, Ernakulam- 682022, Kerala, India,

³University of Verona, Italy

⁴Department of Physics, Baselius College, Kottayam, Kerala, India. Pin: 686 001

⁵School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam-686560, India

*Corresponding author: cyriacmgu@gmail.com, sisirasivan0@gmail.com

Abstract. Novel red emitting europium doped Cerium phosphate nanocrystals were synthesized by microwave assisted sol gel method. X-ray powder diffraction analysis identified the monoclinic structure of synthesized samples. The morphology of the samples were found to be constructed from elongated spheres and is explained with the help of TEM analysis. Intense orange red emission on excitation with Ce⁴⁺ - O²⁻ charge transfer band is established by photoluminescence analysis. The effect of annealing on the efficiency of excitation with Ce⁴⁺ - O²⁻ charge transfer band is demonstrated and is explained in association with the concentration of surface Ce⁴⁺. Chromaticity coordinates indicate good colour purity of the sample. All the results indicated that microwave assisted method is suitable for synthesizing red emitting CePO₄:Eu phosphors and become a potential candidate for optoelectronic and biological applications.

Key words: Cerium phosphate; microwave synthesis; Rietveld refinement; Europium;

1 Introduction

Rare earth based luminescent materials have attracted much attention by many researchers over the last few years in terms of lighting applications owing to their energy saving properties [1-2]. Nowadays, in the field of lighting mainly in the fabrication of white LEDs, blue LED chip with a yellow-emitting YAG: Ce³⁺ phosphor strategy is extensively used even though its color rendering properties are poor due to the lack of red component [3-4]. In order to compensate the scarcity of red component the only solution is the incorporation of suitable phosphor in LEDs in combination with YAG:Ce³⁺ phosphor. Hence in recent years the search for novel red emitting phosphors became the focus of many researchers which are beneficial for white LEDs [5].

In the field of phosphors, trivalent rare earth ions are widely used as activators owing to the intense narrow emission and their independent nature of peak positions with crystal field environment [6]. Among the different rare earth ions one of the important activator is Eu³⁺, which gives out intense bright red emission ranging from 580 - 720 nm due to ⁵D₀→⁷F_j intra configurational transitions [7-8]. Moreover, Eu³⁺ is considered as a potential candidate to probe the environment around the europium ion in a matrix via its hypersensitive transitions [9].

The selection of host is an important factor while considering the luminescence characteristics of a phosphor [8]. Rare earth orthophosphates have attracted more interest in recent years since they exhibit unique luminescence properties and showed high chemical stability and thermal stability [9]. Cerium Phosphate with chemical formula CePO₄ among various monazite type rare earth phosphates (RePO₄) is extensively investigated owing to the presence of Ce³⁺ - an excellent sensitizer for rare earth ions [10]. From many literatures it is well understood that unwanted non-radiative energy loss via multiphonon transition must be reduced to have an efficient phosphor. Hence



q -QUASI-2-ISOMETRIC COMPOSITION OPERATORS

E. SHINE LAL, T. PRASAD AND V.DEVADAS

ABSTRACT. In this paper we characterize q -quasi-2-isometric and $(2, q)$ -partial-isometric composition operators on L^2 space.

1. INTRODUCTION AND PRELIMINARIES

Let \mathcal{H} be an infinite dimensional separable complex Hilbert space and $B(\mathcal{H})$ denote the algebra of all bounded linear operators acting on \mathcal{H} . An operator $T \in B(\mathcal{H})$ is said to be m -isometric if

$$\sum_{k=0}^m (-1)^k \binom{m}{k} T^{*m-k} T^{m-k} = 0$$

for some integer $m \geq 1$ ([1]). Inparticular 2-isometric operators has been studied extensively by Agler and Stankus ([1]), Richter ([17]) and Hillings ([8]). An operator $T \in B(\mathcal{H})$ is said to be a q -quasi- m -isometry if

$$T^{*q} \left(\sum_{k=0}^m (-1)^k \binom{m}{k} T^{*m-k} T^{m-k} \right) T^q = 0,$$

where q is a positive integer ([11, 12, 13]). It is evident that if T is an m -isometry, then T is a q -quasi- m -isometry.

An operator $T \in B(\mathcal{H})$ is called (m, q) -partial isometry or q -partial- m -isometry if

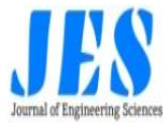
$$T^q \left(\sum_{k=0}^m (-1)^k \binom{m}{k} T^{*m-k} T^{m-k} \right) = 0.$$

A detailed study of this class can be found in ([10]). Let (X, \mathcal{F}, μ) be a σ finite measure space and T be a function from X into itself such that $T^{-1}(S) \in \mathcal{F}$, for all $S \in \mathcal{F}$. If T is a nonsingular measurable transformation on (X, \mathcal{F}, μ) and if the Radon-Nikodym derivative $d\mu T^{-1}/d\mu$ denoted by h is essentially bounded, then the composition operator C on $L^2(\mu)$ induced by T is given by $Cf = (f \circ T)$, $f \in L^2(\mu)$. Let $L^\infty(\mu)$ denote the space of all essentially bounded complex valued

2000 *Mathematics Subject Classification.* 47B20, 47B38.

Key words and phrases. quasi-2 isometric operator, $(2, q)$ partial isometry, weighted composition operator, conditional expectation.

Submitted Jan. 31, 2022. Revised April 6, 2022.



Journal of Engineering Sciences

ISSN:0377-9254, Web:www.jespublication.com

UGC CARE APPROVED GROUP 'II' JOURNAL

CERTIFICATE OF PUBLICATION

This is to certify that the paper entitled

“NEW EDUCATIONAL PLATFORMS AND EMOTIONAL WELL-BEING DURING PANDEMIC ON RURAL COLLEGE STUDENTS IN KERALA”

Authored By

DR. JEOTHILAKSHMI S K

From

SREE NARAYANA COLLEGE, ALATHUR, PALAKKAD, KERALA, INDIA.

Has been published in **JES JOURNAL, Vol 3, Issue 03, March/2022**



**POST PANDEMIC SCENARIO OF HIGHER EDUCATION: AN
ANALYSIS WITH REFERENCE TO TEACHERS OF ARTS
AND SCIENCE COLLEGES IN KERALA**

Mrs.Archana K M,

Assistant Professor, Department of Commerce, SreeNarayana College, Alathur,
Palakkad Dist. Kerala, India.
archanamohan898@gmail.com

Abstract

The paper discusses the attitude of teachers in Higher Educational Institutions (HEIs) towards the remote digitalised classroom teaching-learning activities in the post pandemic scenario of our country. As the pandemic crisis has seriously affected almost all the sectors of our socio-economic system, higher education is a key sector which has far reaching implications for the development of our country. The traditional classroom teaching has shifted rapidly to remote online classes and has serious drawbacks and issues including the cultural and social development of students and hence it seeks more attention and discussion. The study is held among the teachers from the Arts and Science Colleges of Kerala spread mainly across the districts of Thrissur and Palakkad. Non-parametric tests of hypothesis are conducted to test the attributes under study. The study would help develop a better adaptive system of education to survive the contingency period.

Introduction

Beginning from early 2020, we all witnessed how the COVID-19 (caused by the SARS-CoV-2 virus) pandemic shocked the world, almost bringing it to an abrupt stop. On 11 March 2020, the World Health Organization (WHO) declared the COVID-19 a pandemic. By 31 July 2020, COVID-19 had spread across 217+ countries and territories, with almost 17.1 million confirmed cases and 668,073 deaths. The threats and challenges put forth by this pandemic situation will affect and is continuing to affect all of our lives irrespective of our nationalities. (Aristovnik et al., 2020)

As far my study is concerned the focus is on Higher Education Sector and our education sector has been seriously impaired by the crisis set forth by the pandemic situation. As per the records of the Ministry of Human Resource Development, 14.04 lakhs teachers are engaged in 53,620 institutions in the field of higher education in India. Also, 3.74 Crore students were registered for higher education in India in 2018-19. Studies reveal that the number of employable students are steadily decreasing in proportion, it is still more adversely affecting our education sector as physical real-time classes are continuously being stopped due to Covid -19. Besides the drawbacks

Optimization of Keratinase Production Using *Pseudomonas aeruginosa* SU-1 Having Feather as Substrate

Dhiva S¹, Ranjith K R¹, Prajisy P¹, Sona K P¹, Narendrakumar G², Prakash P², Emilin Renitta R³, Antony V Samrot^{4*}

¹ Department of Microbiology, Sree Narayana College, Alathur, Palakkad, Kerala – 678682, India

² Department of Biotechnology, School of Bio and Chemical Engineering, Sathyabama Institute of Science and Technology, Sholinganallur, Rajiv Gandhi Salai, Chennai, Tamil Nadu, 600119, India

³ Department of Food Processing Technology, School of Agriculture and Biosciences, Karunya Institute of Science and Technology, Karunya Nagar, Coimbatore – 641 114, India

⁴ School of Biosciences, Faculty of Medicine, Biosciences and Nursing, MAHSA University, Jalan SP2, Bandar Saujana Putra, 42610, Jenjarom, Selangor, Malaysia

* Correspondence: antonysamrot@gmail.com;

Scopus Author ID 36100751800

Received: 18.04.2020; Revised: 8.05.2020; Accepted: 10.05.2020; Published: 13.05.2020

Abstract: In this optimization study, *Pseudomonas aeruginosa* SU-1 was producing keratinase at optimal condition of 4 days, pH – 7 and temperature 37 °C, where it was producing 23.7 U/mL. After the one factor at a time, RSM was performed to understand the combination of the physical parameter that ends up for the maximum production of keratinase enzyme and the degradation percentage. The study involved in three variables (pH(A), temperature(B) and Incubation Design (C)) in three ranges (-1,0,+1) using Box-Behnken Design (BBD). The results of the analysis of variance and regression analysis of the second order model showed that the factorial effect if the degradation. The optima of the variables pH - 7, temperature - 30 and incubation time – 4 days. The isolated *Pseudomonas* species was subjected to feather degradation for 4 days and it was degrading 55.26 %. Keratinase was to be size of 56KDa.

Keywords: *Pseudomonas aeruginosa* SU-1; Keratinase; Biomass; Feather Degradation.

© 2020 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Chicken is one of the major sources of protein for non-vegetarian lovers. During the processing of chicken bulk quantities of feather gets discarded on the barren lands, roadsides, dump yards etc. In many of the developing countries like India it causes public disturbances like dust pollution, bad odour, flies and rodents [1]. As the freshly disposed feather carries blood and few pieces of meat which facilitates the growth of various pathogenic microorganisms which emits various toxic gases such as nitrous oxide, ammonia and hydrogen sulphide, which is a major threat for life [2]. Feather waste has also suggested being a cause of H5N1 virus outbreaks [3]. Over a period of time these wastes are burnt to reduce the solid waste by the local people which also leads to air pollution, water pollution, the introduction of contaminants in water bodies, creates health problems such as asthma, skin infections etc [4-8] These waste needs proper management to reduce such pollutions.

Since feather is made up of more than 90% of a protein called keratin which is composed of various aminoacids such as cystine, glutamine, lysine, proline, serine, threonine,

Synthesis, Characterization, and Antibacterial Activity of Biosynthesized Gold Nanoparticles

Emilin Renitta R ¹, Smitha I ², Chamarthi Sai Sahithya ³, Antony V Samrot ^{4*}, Abirami S ⁵, Dhiva S ⁶, Daniel Alex Anand ⁷

¹ Department of Food Processing, Karunya Institute of Technology and Science, Coimbatore, Tamil Nadu, India

² Department of Biotechnology, Karunya Institute of Technology and Science, Coimbatore, Tamil Nadu, India

³ Department of Biotechnology, School of Bio and Chemical Engineering, Sathyabama Institute of Science and Technology, Sholinganallur, Rajiv Gandhi Salai, Chennai, Tamil Nadu, 600119, India

⁴ School of Bioscience, Faculty of Medicine, Bioscience and Nursing, MAHSA University, Bandar Saujana Putra, 42610 Jenjarom, Selangor, Malaysia

⁵ Department of Microbiology, Kamaraj College of Arts and Science, Thoothukudi, Tamil Nadu, India

⁶ Department of Microbiology, Sree Narayana College, Alathur, Palakkad, Kerala - 678682, India

⁷ Department of Bioinformatics and The Centre for Molecular Data Science and Systems Biology, Sathyabama Institute of Science and Technology, Chennai-600119, India

* Correspondence: antonysamrot@gmail.com;

Scopus Author ID: 36100751800

Received: 19.08.2020; Revised: 11.09.2020; Accepted: 12.09.2020; Published: 15.09.2020

Abstract: In this study, *Acalypha indica* was utilized to green synthesize gold nanoparticles. The characteristics of the synthesized nanoparticles were observed through UV-Vis, FTIR, TEM, particle size analyzer, and XRD. Furthermore, the nanoparticles were investigated for antibacterial properties. The particle size of gold nanoparticle was around 50 – 100 nm, and the antibacterial property of the nanoparticle was assessed using agar well diffusion, swarming motility, MIC, and protein leakage assay. The gold nanoparticles were observed to be active against *E. coli* alone with MIC at 160 µg, and it was observed to inhibit its swarming motility and to make the cell leak out proteins.

Keywords: *Acalypha indica*; gold nanoparticles; antibacterial activity; protein leakage assay.

© 2020 by the authors. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Nanobiotechnology can be defined as the manipulation of biological living systems at the molecular size between 1 and 100 nm. These nanoparticles have been well exploited in the field of biomedical engineering, biotechnology, pharmaceutical industries, environment, etc. [1-3]. Metal-based nanoparticles are used more these days as they possess various bioactivities [4, 5]. Nanomaterials possess unique properties that have drawn major attention in terms of pharmaceutical applications [6]. However, there are certain disadvantages involved in physiochemical methods that include the usage of noxious chemicals, time consumption, stability, production of hazardous products, and large-sized and aggregated products [7]. Hence, these impediments have called for the advancement of an environmental-friendly, less consumption of energy and green production approach using biological systems (microbes, algae, plants, and plant-derived products) [8, 9]. This environmental and green synthesis approach does not involve the usage of hazardous chemicals as opposed to chemical procedures that make use of hazardous reagents in its practice [10].

Sambodhi

CERTIFICATE OF PUBLICATION

Sambodhi Journal is delighted to award you for publishing your Research Paper Entitled

New Educational Platforms during Pandemic Impact on Rural College Students in Kerala

Authored By

Dr. Jeothilakshmi S K

Assistant Professor, Department of Commerce, Sree Narayana College, Palakkad, Kerala.

Published in Vol 43 No. 3, July - September 2020 of Sambodhi Journal with ISSN : 2249-6661

UGC Care Approved, Peer Reviewed and Referred Journal

Impact Factor 5.80



Mahalingam P. P.

Editor, Sambodhi Journal



ISSN No: 2249-6661 (Print)

Pectin—Extraction from underground stem of banana and its structural, rheological, and textural analyses and grading

N. S. Rajendran  | B. S. Harikumar Thampi 

Department of Life Sciences, University of Calicut, Calicut, India

Correspondence

B. S. Harikumar Thampi, Department of Life Sciences, University of Calicut, Calicut, Kerala, India.

Funding information

FTIR, Rheological, and Texture Profile analyses were funded by Nita Gelatin India Ltd, Kerala, India

Abstract

Pectin was extracted from underground stem of banana (*Musa species*). Optimum conditions of extraction required for maximum yield were examined. Structural features were analyzed. Pineapple jam, prepared using this pectin, was analyzed for rheological and textural features. Banana pectin was made in to a viscous solution using sucrose and the viscosity of this solution was measured. Grade of the banana pectin was estimated. Significant yield was observed under the experimental conditions used for investigation. Banana pectin was found to have a degree of methylation of about 60% and percentage of anhydro uronic acid was above 70, with a monomeric composition similar to pectin from other sources. Viscosity of banana pectin was comparable with that of citrus pectin, while yield stress and shear modulus were less. Banana pectin could influence the textural properties of pineapple jams. Banana pectin was found suitable to be used as a gelling agent in fruit jams.

Practical applications

Pectin may be extracted from banana farms on a commercial basis and may be used as a gelling agent in food and other industries. There is a potential for production of large quantity of pectin globally from banana cultivation. Both damaged plants as well as waste after harvesting may be used as raw materials. Generation of pectin increases the effectiveness of the agricultural process, by providing new food additive from waste materials.

1 | INTRODUCTION

Agriculture has always been the backbone of food industry ever since the beginning of human civilization. Agriculture and food industry supported one another, such that growth in one of them strengthened the other also. Value-added products from agricultural waste have contributed a lot toward the development and diversification of food industry. Pectin is such a value-added product, obtained from fruit waste. It is a heteropolysaccharide commonly occurring in the primary cell wall of most plants. It is particularly seen in fruits, where it provides firmness when cross-linked by calcium ions (Sirjariyawat & Charoenrein, 2014). Chemical structure of pectin differs between species and also between different parts of the same plant (Coenen et al., 2007).

Even though pectin is traditionally used as a gelling agent, recent studies have proven that it has infinite potential applications. Studies have demonstrated that pectin-based composite films can immobilize antimicrobial agents effectively so its use can prevent the growth of microbes on the surface of stored food materials for a longer period of time (Eghbal et al., 2019; Liu et al., 2014). Pectin-based polyelectrolyte complexes could be used as antimicrobial agents in food systems (Lv et al., 2020). Pectin-based coating materials have been found to be useful to increase the shelf life of freshly cut fruits (Radi et al., 2018; Ramirez et al., 2015). Pectin-based composite materials have been shown to entrap and release food preservatives such as potassium sorbate, thus, enabling the development of new, biodegradable, environment-friendly packing systems in food industry (Aitboulahsen et al., 2020; Yu et al., 2017).

Extraction, rheological and textural analyses and grading of pectin from stem pith of banana

Rajendran Neravathu Sivan,
Balakrishnan Saraswathy Harikumar Thampi

University of Calicut, Kerala, India

Abstract

Keywords:

Banana
Pectin
Extraction
Rheology
Texture
Grading

Article history:

Received 20.09.2020
Received in revised
form 17.03.2021
Accepted 25.03.2021

Corresponding author:

Dr. B.S.
Harikumar Thampi
E-mail:
drhari@uoc.ac.in

DOI: 10.24263/2304-
974X-2021-10-1-11

Introduction. Purpose of the work – to identify suitable conditions for the extraction of pectin from stem pith of banana and to investigate how it affects rheological and textural properties of fruit jams.

Materials and methods. Stem pith of local banana cultivar. Pectin extracted using hot water acidified with sulfuric acid. Yield was studied and expressed as percentage of dried raw material used. Degree of methylation was studied using titration method, monomeric composition was studied using high performance anion exchange chromatography with pulsed amperometric detector. Effect of banana pectin upon flow behavior and texture profile of the pineapple jam prepared with it was studied using rheometer. The pectin was graded using modified line spread method.

Results and discussion. 27.91% of yield was obtained. All independent variables were found to affect the yield to varying degrees. Temperature and pH were found to be the most important conditions affecting yield, while time of heating and SLR (time of heating and solid to liquid ratio) were also found to be affecting the yield, but to a lesser extent. The highest of the yield was at a SLR of 50, pH of 1.5, temperature of 82°C and a time of heating of 52.5 minutes.

Degree of methoxylation was found to be 62% with a composition similar to that of pectin from other sources reported by other workers.

Banana pectin was found to be affecting the rheological and textural properties of pineapple jam. Yield stress of pineapple prepared using banana pectin was found to be 113 Pa, compared with 96 Pa for control. At the same time highest shear modulus for the test was 94 Pa, against a value of 60 Pa for the control. While banana pectin was found to be affecting the strength of pineapple jam, more of it was required to achieve it compared with citrus pectin. More force was required to make the jam flow, indicating a higher yield stress compared with citrus pectin.

Textural properties of the jam were affected by the addition of banana pectin. Hardness was reduced from 6.18 for the control to 2.3 for the test while cohesiveness was reduced from 5.3 for control to 1.96 for test. At the time springiness was increased from 6.24 to 7.52. Grade banana pectin was found to be 90.9.

Conclusions. Stem pith of banana is a potential alternate raw material for the extraction of pectin and the pectin so extracted is suitable to use as a gelling agent in food materials.



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 6.078

(Volume 7, Issue 1)

Available online at: <https://www.ijariit.com>

Trends in domestic and foreign tourist arrivals in Kerala

Archana K. M.

archanamohan898@gmail.com

Sree Narayana College, Alathur, Kerala

ABSTRACT

Worldwide governments have recognized tourism as a sector with immense potential for economic development and employment generation. Various international agencies like World Tourism Organization (WTO) have pointed out the vast development potential of tourism particularly with reference to developing countries like India. Kerala tourism is one of the most popular tourist destinations in the world. It is famous especially for its eco-tourism initiatives and beautiful backwaters. Growing at a rate of 13.31%, the Kerala tourism industry is one of the major contributors to the economic development of the state. The paper analyses the trend of tourist arrival to Kerala over the past few years and evaluate the revenue generation trend and growth prospects of the industry. Secondary data published by the Kerala tourism department has been analyzed using tools like trend analysis and simple percentage analysis. The published records of Kerala tourism statistics have also been used in the study. The study may throw light on the future prospects of the Kerala tourism industry with respect to tourist arrival and revenue generation.

Keywords: Domestic Tourist, Foreign Tourists, Kerala Tourism

1. INTRODUCTION

World over, particularly among the developing nations, tourism is fast picking up as a tool for economic development and employment generation. However, the question as to the long-term sustainability of tourism is increasingly becoming a challenge for all concerned, because of the adverse effects of tourism on the environment and the universal pandemic situation of Covid-19. Kerala tourism has won several national and international recognitions, mainly due to the region's picturesque beauty and state's responsible tourism projects. Based on the tourism policy documents of the central and state governments, the Kerala tourism model is acclaimed as one of the most liberalized tourism models with the private sector leading tourism development and the state acting as a facilitator rather than a regulator. Kerala government's tourism expenditure is one among the highest in the country. Tourism constitutes 10 per cent of Kerala's GDP, as per official statistics, and reportedly contributes around 23.5 per cent to the total employment in the state. This study, however, shows that most of the claims made by the government about Kerala tourism are inflated and growth prospects in Kerala tourism depends on further attempts made by Govt. to improve the tourist infrastructure.

2. SCOPE AND SIGNIFICANCE OF THE STUDY

Analogously, though Kerala tourism has got an enviable potential for growth its relative position among the Indian states is quite small, in spite of appreciable growth over the last few years. In this regard, it may be stated that meticulously planned, carefully designed and clearly articulated strategies are essential to maintain and further improve the performance of tourism sector in the days to come. These strategies for tourism development in turn need to be formulated based on sound principles of ecotourism, for ensuring their long term sustainability. This situation is more acute in respect of Kerala – the state in India with one of the best physical infrastructure for tourism development, though grossly underutilized at present. The paper tries to analyze the growth prospects of Kerala tourism with respect to tourist arrivals and the revenue generated from tourism.

The study shows the need for the government to act as a facilitator by providing the basic infrastructure conducive for tourism and allow the private sector to play the lead role in tourism promotion and development. Tourism promotion and marketing should be the responsibility of the private sector, which will help in implementing innovative marketing methods for attracting international tourists from more countries and domestic tourists from other states. This will help in exploiting the natural potential of Kerala tourism rather than placing artificial constraints on tourism development in the state through government interventions.

3. REVIEW OF LITERATURE

After furnishing a general introduction, an attempt is made in this chapter to review the literature on the subject. The literature on various aspects of ecotourism is quite extensive. In order to find out major developments that took place in ecotourism, a brief review of existing literature on different aspects of ecotourism is made in this chapter. Tourism industry in India plays a significant



POST DEMONITIZATION EVALUATION OF ATM SERVICES IN RURAL KERALA: A STUDY WITH SPECIAL REFERENCE TO SBI, PALAKKAD.

Smt. Archana K M
Asst. Professor
P G Department of Commerce
SreeNarayana College, Alathur
Palakkad

INTRODUCTION

Banks are the reservoirs of the financial resources. They store nation's wealth. These banks have made continuous improvement and development in their operations. Diversification and innovations are introduced in the functioning of banks with a view to improve their performance and to meet the developmental needs of the economy. Apart from traditional banking functions such as lending and borrowing banks provide a number of value added services.

SIGNIFICANCE OF THE STUDY

The evolutionary trend from cash economy to cashless economy and onwards to plastic card economy is witnessed in the introduction of ATMs. ATM is a device that allows customers to have an ATM card to perform routine banking transactions like withdraw of deposited funds, check account balances, transfer funds and check statement information. ATM cards are known by a variety of names such as bank card, MAS (money access card), client card, key card or cash card. In banking networks, two functions of ATM cards and debit cards are combined into a single card simply called debit card. Any ATM on the road side can provide cash needs of customer. The ATM services has achieved noticeable acceptance by the bank customers. All people irrespective of rural or urban deals with banking institutions and day by day popularity and uses of ATM are increasing among people. With the arrival of different utilities of ATMs, customers migrated from routine bank transactions of teller counters to automated teller machine.

REVIEW OF LITERATURE

In order to have better understanding about the present study in its proper perspective, the researcher has undertaken to present the corresponding studies through review of what has already been done in the field.

R. Renuka et al (2014), in the study "Customers satisfaction towards ATM" focuses on customer satisfaction towards ATM services offered by the banks and tries to suggest ways to improve services. Amongst other suggestions, the authors have suggested increasing awareness about various facilities and enhancing the withdrawal limit of cash per day. Hourly access got the first rank while quality of receipt got the second rank for level of satisfaction. To find out the level of satisfaction respondents were provided a list of fourteen factors which were to be ranked. Likert scale was used for the purpose. The study considers only customer perceptions towards ATMs. However, staff perceptions have not been considered.

Sisat S. et al (2014), in the paper "Secured Automatic Teller Machine (ATM) and Cash Deposit machine (CDM)" has segmented ATM threats into three types of attacks: card and currency fraud, logical attacks and physical attacks. The paper gives an idea about the basic ATM and its major security issues and basic requirements. Since, ATMs deal with currency notes, focus should be on note security while designing ATM. This paper is more theoretical in nature and is not backed by primary data.



Anti-microbial activity of seed extract of *Cucumis sativus* L., *Carica papaya* L. and *Annona squamosa* L.

Abirami S¹, Antony V Samrot^{*2}, Emilin Renitta R³, Kanchana S¹, Noorudeen M B¹, Yamunadevi K¹, Dhiva S⁴, Saigeetha S⁵

¹Department of Microbiology, Kamaraj College, Thoothukudi, Thirunelveli, Tamilnadu, India

²School of Bioscience, Faculty of Medicine, Bioscience and Nursing, MAHSA University, Jalan SP2, Bandar Saujana Putra, 42610, Selangor, Malaysia

³Department of Food Processing, Karunya Institute of Technology and Science, Coimbatore, Tamilnadu, India

⁴Department of Microbiology, Sree Narayana College, Alathur, Palakkad, Kerala-678682, India

⁵Department of Biotechnology, School of Bio and Chemical Engineering, Sathyabama Institute of Science and Technology, Chennai, Tamilnadu, India

Article History:

Received on: 22 Sep 2020

Revised on: 22 Oct 2020

Accepted on: 24 Oct 2020

Keywords:

Anti-microbial activity,
Antibiotic resistance,
Cucumis sativus L.,
Carica papaya L.,
Annona squamosa L.

ABSTRACT

In recent days, threat related to infectious and antibiotic-resistant pathogens are increasing widely, and this created an urge to search for an alternative way of producing drugs. The sources selected for the production of drugs must have some attributes like readily available, available in bulk quantities, easy processing and containing less or negligible toxic effects. Herbal medications and drugs derived from medicinal plants may serve as a smart and an alternate way. In this study, ethanolic seed extracts have been used from three readily available plants like *Cucumis sativus* L., *Carica papaya* L., *Annona squamosa* L. The antibacterial activity of ethanolic seed extracts was performed against the pathogens present in the pus sample using agar disc diffusion method. It was found that the ethanolic seed extracts of *Cucumis sativus* L. were found to have a maximum zone of inhibition of 14 mm at conc., of 900 µg against *S. aureus*, *Carica papaya* L. was found to have maximum inhibition of 13mm at conc., of 900µg against *S. aureus* and *Annona squamosa* showed negligible resistance to all pus pathogens. From the various bioactive compounds present in the plants, an efficient drug can be manufactured, and it may find a great place in the pharmaceutical industry.



*Corresponding Author

Name: Antony V Samrot

Phone:

Email: antonymsamrot@gmail.com

ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i4.3603>

Production and Hosted by

Pharmascope.org

© 2020 | All rights reserved.

INTRODUCTION

The skin act as a first-line defence mechanism, any incision in the skin structure leads to microbial contamination, due to penetration of pathogens into the skin. Folliculitis, Impetigo, furunculosis, abscesses, cellulitis, scarlet fever, erysipelas, necrotizing fasciitis etc. are some of the most occurring types of skin infection. These types of pyogenic infection cause severe local inflammation with pus (Shama *et al.*, 2018). Pallavali *et al.* (2017) reported that the most common isolated wound pathogens are *S. epidermidis*, *S. aureus*, *Streptococcus spp.*, *K. pneumoniae*, *P. aeruginosa*, *E. coli*, and

Synthesis, Characterization, and Antibacterial Activity of Biosynthesized Gold Nanoparticles

Emillin Renitta R ¹, Smitha I ², Chamarthi Sai Sahithya ³, Antony V Samrot ^{4*}, Abirami S ⁵, Dhiva S ⁶, Daniel Alex Anand ⁷

¹ Department of Food Processing, Karunya Institute of Technology and Science, Coimbatore, Tamil Nadu, India

² Department of Biotechnology, Karunya Institute of Technology and Science, Coimbatore, Tamil Nadu, India

³ Department of Biotechnology, School of Bio and Chemical Engineering, Sathyabama Institute of Science and Technology, Sholinganallur, Rajiv Gandhi Salai, Chennai, Tamil Nadu, 600119, India

⁴ School of Bioscience, Faculty of Medicine, Bioscience and Nursing, MAHSA University, Bandar Saujana Putra, 42610 Jenjarom, Selangor, Malaysia

⁵ Department of Microbiology, Kamaraj College of Arts and Science, Thoothukudi, Tamil Nadu, India

⁶ Department of Microbiology, Sree Narayana College, Alathur, Palakkad, Kerala – 678682, India

⁷ Department of Bioinformatics and The Centre for Molecular Data Science and Systems Biology, Sathyabama Institute of Science and Technology, Chennai-600119, India

* Correspondence: antonysamrot@gmail.com;

Scopus Author ID 36100751800

Received: 19.08.2020; Revised: 11.09.2020; Accepted: 12.09.2020; Published: 15.09.2020

Abstract: In this study, *Acalypha indica* was utilized to green synthesize gold nanoparticles. The characteristics of the synthesized nanoparticles were observed through UV-Vis, FTIR, TEM, particle size analyzer, and XRD. Furthermore, the nanoparticles were investigated for antibacterial properties. The particle size of gold nanoparticle was around 50 – 100 nm, and the antibacterial property of the nanoparticle was assessed using agar well diffusion, swarming motility, MIC, and protein leakage assay. The gold nanoparticles were observed to be active against *E. coli* alone with MIC at 160 µg, and it was observed to inhibit its swarming motility and to make the cell leak out proteins.

Keywords: *Acalypha indica*; gold nanoparticles; antibacterial activity; protein leakage assay.

© 2020 by the authors. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Nanobiotechnology can be defined as the manipulation of biological living systems at the molecular size between 1 and 100 nm. These nanoparticles have been well exploited in the field of biomedical engineering, biotechnology, pharmaceutical industries, environment, etc. [1-3]. Metal-based nanoparticles are used more these days as they possess various bioactivities [4, 5]. Nanomaterials possess unique properties that have drawn major attention in terms of pharmaceutical applications [6]. However, there are certain disadvantages involved in physiochemical methods that include the usage of noxious chemicals, time consumption, stability, production of hazardous products, and large-sized and aggregated products[7]. Hence, these impediments have called for the advancement of an environmental-friendly, less consumption of energy and green production approach using biological systems (microbes, algae, plants, and plant-derived products) [8, 9]. This environmental and green synthesis approach does not involve the usage of hazardous chemicals as opposed to chemical procedures that make use of hazardous reagents in its practice [10].

Isolation of soya bean trypsin inhibitor-binding protease from the gut of *Aedes albopictus* (Diptera: Culicidae) larvae

Smrithy PS¹, Kannan Vadakkadath Meethal²

^{1,2}Department of Zoology, University of Calicut, Thenjipalam, Kerala, India

Abstract

Aedes albopictus is a mosquito widely distributed across tropical and sub-tropical regions of the world and is associated with the transmission of several arboviruses including that for Dengue fever, Yellow fever and Chikungunya. *Ae. albopictus* is increasingly relevant to public health due its ability to successfully colonize both urban and rural habitats, favouring the wide dispersion of viral infections. Trypsin-like enzymes play an important role in the *Aedes albopictus* digestive process. The trypsin-like enzymes present in adult mosquito were characterized previously, but little is known about enzymes in the larvae. In the present work, for the first time, from the gut of fourth instar larvae of *Ae. albopictus*, a protease was purified by affinity chromatography on Soya Bean Trypsin Inhibitor covalently linked to Sepharose. On gelatin zymography of the gut extract of fourth instar larvae of *Aedes albopictus*, there were four major protease bands of which one corresponds to the isolated protease. The isolated protease is a serine protease as it is inhibited by serine protease inhibitors, PMSF and Soya Bean Trypsin Inhibitor, to the extent of $88.3 \pm 0.002\%$ and $87.2 \pm 0.003\%$ respectively. On SDS-PAGE, the isolated protease runs as a 21.5 kDa single band indicating that it a pure protein. As serine proteases represent the major proteases in the gut of mosquito larvae, targeting the protease isolated from gut of the larvae of *Ae. albopictus* will be a promising strategy for the control of the mosquitoes.

Keywords: *Aedes albopictus*, gut proteases, soya bean trypsin inhibitor, mosquito larvae, zymography

1. Introduction

Many diseases affecting humans are spread by invertebrate vectors. A wide variety of pathogens, including viruses, bacteria, protozoans, and worms cause debilitating diseases and the transmission of these pathogens by vectors add impact on human and animal health [1]. More than 17% of all infectious disease are vector-borne diseases and account more than 700,000 deaths annually [2]. This is a major health concern worldwide and adds to the economic growth constraints by increasing expenses on health care system.

Many arthropods are dangerous vectors of deadly pathogens and parasites, which may hit as epidemics [1]. Of the arthropods, mosquitoes represents a key menace, since they act as vectors of many diseases like Malaria, Yellow fever, Dengue fever, Chikungunya, Lymphatic filariasis, Japanese encephalitis etc. The global incidence of dengue has grown dramatically in recent decades and about half of the world's population is now at risk as per World Health Organisation. The global estimate of the dengue infections may range from 100-400 million each year [2]. Dengue is mainly transmitted by the female *Aedes aegypti* mosquitoes but in recent years, the *Aedes albopictus* mosquito is also involved in dengue transmission in numerous countries around the world, especially in Southeast Asia [2, 3, 4].

The mosquito, *Aedes albopictus* (Skuse), has a wide geographic distribution and is reported from Europe, Middle East, Asia, North and Central America, South America, and Africa. Adult *Aedes albopictus* mosquito is with bold black shiny scales and silver white scales on the palpus and tarsi [5]. The scutum (back) is black with a white stripe down the center beginning at the dorsal surface of the head and continuing along the thorax. *Aedes albopictus* (Skuse), the Asian tiger mosquito, is an aggressive daytime-biter and in

addition to spreading dengue it acts as vectors of Yellow fever virus, Chikungunya virus and Zika virus. In recent years, the relevance of this species to public health has increased because it is able to successfully colonize both urban and rural habitats [6].

An important step in food digestion is the hydrolysis of proteins to amino acid residues by proteolytic enzymes. Among the enzymes, trypsin-like and chymotrypsin-like proteases are the important digestive proteases for most insects, except for some hemipterans and coleopteran species [7]. Molecular characterization of genes encoding trypsin-like enzymes from *Aedes aegypti* larvae was carried out and purified a 28 kDa protease [8]. The main peptidases expressed during the egg, larval and pupal stages of *Ae. albopictus* were identified as trypsin-like serine peptidases [9] but no protease from the gut of *Ae. albopictus* larvae is purified. In this study we purified a serine protease from the gut of *Ae. albopictus* larvae by affinity chromatography on Soya Bean Trypsin Inhibitor coupled to Sepharose (SBTI-Sepharose).

2. Materials and methods

2.1 Materials

Azocasein and Bovine Trypsin was purchased from HiMedia Laboratoris, India, Protein molecular weight Marker and cyanogen bromide (CNBr) were from Sisco Research Laboratories Limited, Mumbai. All other reagents used were of analytical grade.

2.2 Collection and maintenance of mosquito larvae

Mosquito larvae collected from the Campus of University of Calicut, Kerala, India and were brought to the laboratory and transferred to small plastic trays containing water. The larvae were fed with yeast granules. The larvae were

Antimicrobial effect of probiotic food against intestinal pathogens

S.Dhiva

Department of Microbiology, S.N. college, Alathur, Palakkad, Kerala - 678 682.

Abstract

A food can be defined as functional if it is shown to beneficially affect one or more target functions in the body beyond adequate nutritional effects in a way that is relevant to either the state of well-being and health, or to a reduction in disease incidence. The clinical situations studied presently include diarrhea, intestinal infections and colonization by pathogenic bacteria (including *Helicobacter pylori* and *Clostridium difficile*), so two different probiotic strains *Pediococcus* sp and *Bifidobacterium* sp. containing Dairy based probiotic drink were checked for their clinical benefits, which showed a good reduction in the number of intestinal pathogens. When the same experiment was conducted invitro the zone of inhibition clearly showed the antimicrobial effect of the probiotic strains against the intestinal pathogens. There are many mechanisms by which probiotics enhance intestinal health, including stimulation of immunity, competition for limited nutrients, inhibition of epithelial and mucosal adherence, inhibition of epithelial invasion and production of antimicrobial substances. From the findings it is clear that probiotic cultures are efficient in the removal of colonization of intestinal pathogens to the host intestine thereby giving protection to the host body.

Key words: Probiotics, Fermented foods, colonization, Pathogens, etc.,

Received : December 2017

Revised and Accepted : December 2018

INTRODUCTION

Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and or the activity of one or a limited number of bacteria in the colon (Gibson and Roberfroid, 1995). At the start of the 20th century, the term "Probiotics" was first introduced in 1953 by Werner Kollath (Hamilton-Miller *et al.*, 2003). A food can be defined as functional if it is shown to beneficially affect one or more target functions in the body beyond adequate nutritional effects in a way that is relevant to either the state of well-being and health, or to a reduction in disease incidence (Salminen *et al.*, 1998). Probiotics were thought to beneficially affect the host by improving its intestinal microbial balance, thus inhibiting pathogens and toxin producing bacteria. Today, specific health effects are being investigated and documented including alleviation of chronic intestinal inflammatory diseases (Mach, 2006), prevention and treatment of pathogen-induced diarrhea (Yan and Polk, 2006), urogenital infections, and atopic diseases. The word "probiotic" was derived from the Greek word which means "on behalf of". The concept was introduced by Lilly and Stillwell (1965) and was intended to stimulate substances produced by one microorganism to enhance the growth

of another. Probiotic therefore is the exact opposite of antibiotic. The ability of lactobacilli and Bifidobacteria to survive in and colonize the gastrointestinal track has been associated with various health promoting properties (Ballongue, 2004). The colonization of probiotic bacteria decreased with the increase of age of the host (Ballongue, 2004). In recent years there has been interest in incorporating those bacteria in live form (called probiotics) into food especially fermented milk to counteract harmful bacteria in the gastrointestinal track and to promote health effect (Fuller, 1989; Schillinger *et al.*, 2005, Tamime *et al.*, 2007). Several criteria have to be met for selecting probiotic strains those include acid and bile tolerance, survival through the gastrointestinal tract, ability to adhere to intestinal surfaces, exhibiting antimicrobial activity against potential pathogenic bacteria (Ouwehand *et al.*, 2004).

In the present work strains of *Pediococcus* sp. and *Bifidobacterium* sp. were isolated from various fermented cereals and evaluated for their potentiality to be used as a Probiotic. The isolated organisms were used to prepare Dairy based probiotic yoghurt. Their effect on removal of pathogenic microbes and its antimicrobial effect against food borne pathogens were detected.

MATERIALS AND METHODS

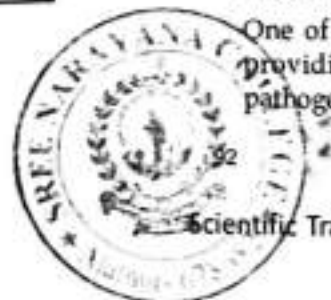
Effect on pathogenic microbes

One of the prime roles of probiotic organisms is providing immunity by competitive inhibition of pathogenic microorganisms especially coliforms from

*Corresponding Author :
email: dhivasoju@gmail.com

P - ISSN 0973 - 9157
E - ISSN 2393 - 9249

October to December 2018



binding to the intestinal mucosa, and the inhibition of food borne pathogens (Midolo *et al.*, 1995). In order to study the effect of probiotics in removing the pathogenic coliforms, fecal coliform count was done by spread plate method and antimicrobial sensitivity test was done to detect its role against food borne pathogens (Mack *et al.*, 1999).

Fecal coliform count

Total microbes present in the trial animal feces were counted on weekly intervals by spread plate method by using Eosin methylene blue agar; the colonies formed were counted and recorded.

Antimicrobial activity against Food borne pathogens

Agar diffusion assay was used for the detection of antimicrobial activity of probiotic product against food borne pathogens. Muller-Hinton agar was prepared and inoculated with bacterial test pathogen such as *Escherichia coli*, *Salmonella enteritidis*, *Clostridium difficile* and *Helicobacter*. 50µl each of three different yoghurt samples (S2, S3 and S2S3) were added to wells punctured on the plate. They were then incubated at 37°C for 24 h. The diameter of the zone of inhibition was measured and recorded.

Table.2. Antagonistic activity due to probiotic product

RESULTS AND DISCUSSIONS

Effect on pathogenic microbes

Fecal coliform count

Probiotic organisms were efficient in the removal of pathogenic coliforms from intestinal mucosa, which was studied by spread plate method using Eosin methylene blue agar. There was a increase in the number of coliforms (Fig.1) removed at the end of every week. The difference in the fecal coliform count due to S2, S3 and S2 and S3 are perceived to be significant over control based on regression analysis (Table 1, 1a-c).

Table.1. Coliform count

S2 - *Pediococcus sp.* S3 - *Bifidobacterium sp.*, S2S3 - *Pediococcus sp + Bifidobacterium sp.*

Treatment	Number of weeks					
	1	2	3	4	5	6
Control	16	32	40	51	68	73
S2	22	39	43	57	75	87
S3	18	41	58	69	79	90
S2S3	19	39	48	61	78	87



Table.1a.

R	R Square	Adjusted R Square
0.999	0.998	0.997

Table.1b.

	Sum of Squares	df	Mean Square	F	Sig
Regression	2361.997	1	2362		0
Residual	5.337	4	1.334	1770.43	(S)
Total	2367.333	5			

S - Significant

Table.1.c.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
Constant	-0.95	1.226		-0.776	0.48
S2S3	0.861	0.02	0.999	42.08	0

Table.2. Antagonistic activity due to probiotic product

S. No.	Pathogenic organism	Test strains			
		S2	S3	S2S3	Control
1	<i>Clostridium diffide</i>	16mm	18mm	15mm	16mm
2	<i>Salmonella enteritidis</i>	22mm	23mm	24mm	23mm
3	<i>Escherichia coli</i>	15mm	17mm	19mm	16mm
4	<i>Helicobacter</i>	NA	NA	NA	NA

NA - No Activity

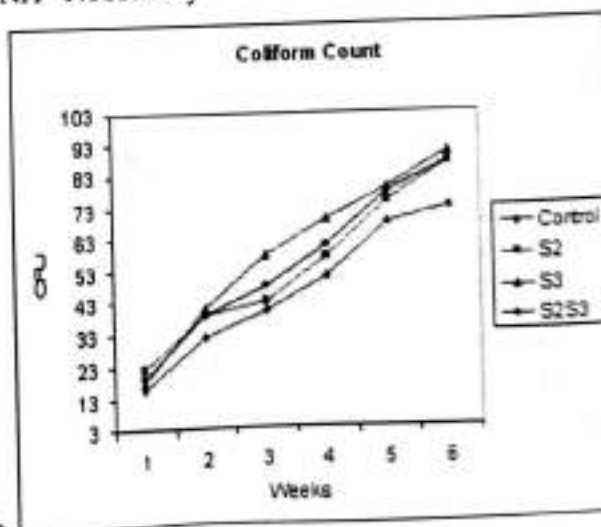


Fig.1. Coliform Count

It is very obvious that the number of organisms removed in the first week was less which could be due to the extension in the adaptability of the probiotic strains to the intestinal tract of the host. Similarly stress in the gastro intestinal region also reduces the number of probiotic organisms in the stomach, and hence the load of pathogens might be high. So it could be suspected that only very few probiotic organisms that can tolerate the stressful environment in the stomach were involved in the defense mechanism for the removal of the pathogens. However in the subsequent weeks they became very efficient in the removal of pathogens. This could be due to competition for attachment or adherence to the intestinal epithelium, and many reports suggest that the strains of *Bifidobacterium* are more efficient in adhesion to the intestinal mucosa.

In a similar study, Shi-Shun Zhong *et al.* (2004) reported that *Bifidobacteria*, the predominant bacteria, in the human intestinal microflora are considered to be a microorganism with a great influence on human health, and having inhibitory properties against enteropathogenic bacteria. Similarly Bernet *et al.* (1993) reported the occurrence of *Bifidobacteria* adhered to the human intestine by a mechanism of adhesion which involves a proteinaceous component.

Similar work was also done with *L. acidophilus* by Fourniat *et al.* (1986) and reported that the administration of killed *Lactobacillus acidophilus* in mice infected with a strain of Enterotoxigenic *E. coli* extended their survival. A protective effect of probiotic fermented food mixture was found in a similar model of mice infected with *E. coli* (Rani and Khetarpaul, 1998).

Antimicrobial activity

Probiotic organisms were antimicrobial in nature against food borne pathogens. The probiotic organisms (S2, S3, S2S3) were able to control the growth of *Clostridium difficile*, *Salmonella enteritidis* and *E. coli* and their effect is comparable to the antibiotic tetracycline. However these organisms did not have any effect on *Helicobacter* (Table 2).

Lactic acid bacteria exert strong antagonistic activity against many microorganisms including food spoilage organisms and pathogens by producing bacteriocins (Brinkten *et al.*, 1994). Several metabolic compounds produced during lactic acid fermentation (including organic acids, fatty acids, hydrogen peroxide and diacetyl) showed antimicrobial activity. However, bacteriocins are proteinaceous substances that have specific inhibitory activity against pathogens (Ouweland, 1998; Strus *et al.*, 2002; Xiao *et al.*, 2003)

Rodriguez (1996) reported that Nisin, a product of LAB showed inhibitory effect against a wide variety of

Gram-positive food-borne pathogens and spoilage organisms, and also acted against several Gram negative bacteria by disrupting the integrity of their outer membranes (Kordel and Sahn, 1986; Stevens *et al.*, 1991). Nisin was also used to control the growth and spore formation of *Clostridium botulinum* and *Clostridium sporogenes* in cheese (Mattick and Hirsch, 1956). Thus probiotic organisms especially LAB can be used as a preservative as well as antimicrobial agent against human pathogens.

REFERENCE

- Ballongue, J. 2004. *Bifidobacteria and probiotic action, in Lactic Acid Bacteria: Microbiology and Functional Aspects*, 3rd Edition, Revised and Expanded, eds Salminen, S., von Wright, A., Ouweland, A. Marcel Dekker Inc, New York.
- Bernet, M.F., Brassart, D., Neeser, J.R. and Servin, A.L. 1993. Adhesion of human *Bifidobacterium* strains to cultured human intestinal epithelial cells and inhibition of enteropathogen - cell interactions. *Appl. Microbiol.*, 59: 4121-4128.
- Brinkten, B., Minekns, M., Vander Vossen, J.M.B.M., Leer, R.J. and Huisin'tveld, J.H.J. 1994. Antimicrobial activity of lactobacilli. *J. Appl. Bacteriol.*, 77: 140-148.
- Fourniat, J., Djaballi, Z., Maccario, J., Bourlioux, P. and German, A. 1986. Effect of the administration of killed *Lactobacillus acidophilus* on the survival of sucking mice infected with a strain of enterotoxigenic *Escherichia coli*. *Ann. Rech. Vet.*, 17: 401-407.
- Fuller, R. 1989. Probiotics in man and animals - a review. *J. Appl. Bacteriol.*, 66: 365-378.
- Gibson, G.R. and Roberfroid, M.B. 1995. Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics. *J. Nutr.*, 125: 1401-1412.
- Hamilton-Miller, J.M.T., Gibson, G.R. and Bruck, W. 2003. "Some insights into the derivation and early use of the word 'probiotic'". *British Journal of Nutrition* (90): 845.
- Kordel, M. and Sahn, H.G. 1986. Susceptibility of bacterial eukaryotic and artificial membranes to the disruptive action of the cationic peptides peps and nisin. *FEMS Microbiol. Lett.*, 34: 139-144.
- Lilly, D.M. and Stillwell, R.H. 1965. Probiotics: Growth promoting factors produced by micro organisms. *Science* 147: 747-8.
- Mach, T. 2006. Clinical usefulness of probiotics in inflammatory bowel diseases. *J. Physiol. Pharmacol.* 57(9): 23-33
- Mack, D.R., Mihail, S., Wei, S., Dougall, L.M. and Hollingsworth, M.A. 1999. Probiotics inhibit enteropathogenic *E. coli* adherence *in vitro* by



- inducing intestinal muscle gene expression. *Am. J. Physiol. Gastrointest. Liver Physiol.*, 276(4): G941-G950
- Mattick, A.T. and Hirsch, A. 1956. Manufacture and prevention of cheese. U.S. Patent, 2: 744-827.
- Mikelsaar, M., Turi, M., Lencner, H., Kolts, K., Kirch, R. and Lencner, A. 1987. Interrelations between mucosal and luminal microflora of gastrointestinal. *Nahrung* 31, 449-456.
- Midolo, F.D., Lambert, J.R., Hull, R., Luo, F. and Grayson, M.L. 1995. *In vitro* inhibition of *Helicobacter pylori* NCTC 11637 by organic acids and lactic acid bacteria. *J. Appl. Bacteriol.*, 79: 475-479.
- Ouweland, A.C. 1998. Antimicrobial components from lactic acid bacteria. In *Lactic acid bacteria, microbiology and functional aspects* [Salminen, S., Von Wright, A. (eds.)], Marcel Dekker, Inc., New York, pp.139-160.
- Ouweland, A.C. and Vesterlund, S. 2004. Antimicrobial components from lactic acid bacteria, in *Lactic Acid Bacteria: Microbiology and Functional Aspects*, 3rd Edition, Revised and Expanded, eds New York, pp. 375-395
- Rodriguez, J.M. 1996. Antimicrobial spectrum, structure, properties and mode of action of nisin, a bacteriocin produced by *Lactococcus lactis*, *Intl. J. Food Sci. Technol.*, 2: 61-68.
- Rani, B. and Khetarpaul, N. 1998. Probiotic fermented food mixtures: possible applications in clinical anti-diarrhoea usage, *Nutr. Health.*, 12: 97-105.
- Salminen, S., Bouley, C. and Boutron Ruault, M.C. 1998a. Functional food science and gastrointestinal physiology and function, *British J. Nutr.*, 80(Suppl.): 147-171.
- Schullinger, U., Guigas, C. and Holzapfel, H. 2005. *In vitro* adherence and other properties of lactobacilli used in probiotic yoghurt-like products. *International Dairy Journal*, Vol. 15, pp. 1289-1297.
- Shi-Shun Zhong, Zhen-Shu Zhang, Ji-De Wang, Zhuo-Sheng Lai, Wang, Ling-Jia Pan and Yue-Xin Pen, 2004. Competitive inhibition of adherence of enterotoxigenic *Escherichia coli*, enteropathogenic *E. coli* and *Clostridium difficile* to intestinal epithelial cell line love by purified adhesion of *B. adolescentis* 1027, *World J. Gastroenterol.*, 10(11): 3570-3573.
- Stevens, K.A., Sheldon, B.W., Klapes, N.A. and Klaenhammer, T.R. 1991. Nisin treatment for inactivation of *Salmonella* species and other gram-negative bacteria, *Appl. Environ. Microbiol.*, 57: 3613-3615.
- Strus, M., Pakosz, K., Gosciniak, H., Przondo-Mordarska, A., Rozynek, E., Pituch, H., Meisel-Mikolajczyk, F. and Heczko, P.B. 2002. Antagonistic activity of *Lactobacillus bacteric* strains against anaerobic gastro intestinal tract pathogens (*Helicobacter pylori*, *Campylobacter coli*, *Campylobacter jejuni* and *Clostridium difficile*). 2002. *Ann. Italian Med. Intl.*, 17(3): 157-165.
- Tamime, A.Y., Saarela, M., Sondergaard, K.A., Mistry, V.V. and Shah, N.P. 2007. Production and maintenance of viability of probiotic micro-organisms in dairy product, in *Probiotic Dairy Product*, ed, Tamime, A.Y., Blackwell Publishing.
- Xiao, J.Z., Kondo, S., Takahashi, N., Miyaji, K., Oshida, K., Hiramatsu, A., Iwatsuki, K., Kokubo, S. and Hosono, A. 2003. Effect of milk products fermented by *Bifidobacterium longum* on blood lipids in rats and healthy adult male volunteers, *J. Dairy Sci.*, 86: 2452-2461.
- Yan, F. and Polk, D.B. 2006. Probiotics as functional food in the treatment of diarrhea. *Curr Opin Clin Nutr Metab Care*. Nov 9 (6) : 717-21.



R. Birelu

www.stetjournals.com

Principal
Sree Narayana College, Alathur
Palakkad-678 632, Kerala

Formulation of dairy based probiotic drink using the lactic acid bacteria of fermented cereals

<https://doi.org/10.56343/STET.116.011.003.004>
<http://stetjournals.com>

S. Dhiva

Department of Microbiology, S.N. college, Alathur, Palakkad, Kerala 678 682.

Abstract

Probiotics are considered as viable preparations in foods or dietary supplements to improve the health of humans and animals. The aim of this research was to evaluate some probiotic traits of *Weissella confusa* and *Bifidobacterium bifidum* strains previously isolated from fermented cereals. Strains of *W. confusa* and *B. bifidum* were used to prepare probiotic drinks in single and in combination. The formulated probiotic drink was evaluated for the following properties such as pH stability, and shelf life, before releasing them to market. When the data were statistically compared it was found that the corresponding P value of the pH level of test drink did not undergo any significant change. Whereas organoleptic analysis showed a variation among them in their consistency. The determination of Shelf Life showed that there was a notable reduction in the number of CFU after every 7 days of storage, but the Chi-square test revealed that this reduction was also not significant. Thus the results clearly show that there was no marked reduction in the viability and pH of the dairy based probiotic drink and also it showed good shelf life.

Key words: Probiotic, yoghurt, supplements, stability, Shelf life, organoleptic

Received : May 2017

Revised and Accepted : February 2018

INTRODUCTION

Probiotics were defined as microbial derived factors that stimulate the growth of other microorganisms. In 1989 Roy Fuller suggested a definition of Probiotics which states that 'A live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance' which has been widely used. Probiotics were thought to beneficially affect the host by improving its intestinal microbial balance, thus inhibiting pathogens and toxin producing bacteria (Metchnikoff, 1907). In the present day context specific health effects are being investigated and documented including alleviation of chronic intestinal inflammatory diseases (Mach, 2006), prevention and treatment of pathogen-induced diarrhea (Yan and Polk, 2006) urogenital infections, and atopic diseases. The ability of lactobacilli and bifidobacteria to survive in and colonize the gastrointestinal track has been associated with various health promoting properties. The colonization of those bacteria decreased with the increase of age of the host (Ballongue, 2004). In the recent years there has been interest in incorporating these bacteria in live form (called probiotics) into food especially fermented milk to counteract harmful bacteria in the gastrointestinal track and to promote health effect (Schillinger et al., 2005; Tamime et al., 2007). Several criteria have to be met with for selecting

probiotic strains. Those include acid and bile tolerance, survival through the gastrointestinal track, ability to adhere to intestinal surfaces, exhibiting antimicrobial activity against potential pathogenic bacteria and good technological properties (Ouweland et al., 2004).

In the present work strains of *Weissella confusa* and *Bifidobacterium bifidum* were isolated from various fermented cereals using Lactobacillus MRS agar and identified based on Bergy's manual, and the probiotic potentiality was evaluated. They were labeled as S2 (*Weissella confusa*) and S3 (*Bifidobacterium bifidum*) and its combination was labeled as S2S3 (*Weissella confusa* and *Bifidobacterium bifidum*). The isolated organisms were used to prepare probiotic yoghurt.

MATERIALS AND METHODS

Formulation of the Product

Preparation of fermented milk product

For the production of fermented milk, skim milk base (containing 11% skim milk powder, 1% glucose and 0.2% yeast extract) was pasteurized at 90°C for 10 minutes prior to fermentation, cooled to 4°C and then divided into three parts. One portion was inoculated with 1% of S2 culture; another portion with S3 culture and the third portion was inoculated with combination of S2 and S3. Each inoculated mixer was incubated at 37°C until it reaches pH 4.5 and then cooled to 4°C (Xiao et al., 2003). Thus three different fermented milk products (yoghurt) were prepared

*Corresponding Author :
email: dhivasoju@gmail.com

P - ISSN 0973 - 9157

E - ISSN 2393 - 9249

January to March 2018



www.stetjournals.com
Scientific Transactions in Environment and Technovation

Principal
Sree Narayana College, Alathur
Palakkad- 678 682 Kerala.

using the test organisms both individually and in combination.

Evaluation of the formulated product

The formulated products containing probiotic organisms should be evaluated for the following properties before releasing them, which include, stability, shelf life, impact on the consumer with regard to nutritional status, pathogenic microflora, immune status and lactose tolerance ability.

Stability

The stability of the product is governed by its pH, which may affect the organoleptic properties of the product. Hence the formulated probiotic product, which was stored at 4°C, was analyzed for their pH using pH meter. The organoleptic properties which include characteristics like texture, consistency, flavor, etc., were also examined to check the quality of the product.

Shelf life

The shelf life of the product was determined once in a week for a period of one month by using pour plate technique and checking the viable cell count with commercial yoghurt as control. One gram of each yoghurt sample was diluted with 9ml of sterile peptone water. Subsequently serial dilutions were made and the samples were inoculated onto the MRS agar plates and then the plates were incubated at 37°C for 24 h. Plates were examined and colony forming units were recorded (Akalin *et al.*, 2004).

RESULTS AND DISCUSSION

Table.1. Changes in pH of yoghurt

Duration (in days)	S2 yoghurt	S3 yoghurt	S2+S3 yoghurt	Control
0	4.5	4.49	4.51	4.5
7	4.49	4.48	4.49	4.49
14	4.48	4.47	4.48	4.47
12	4.47	4.46	4.47	4.46
28	4.44	4.44	4.44	4.44

Table.1a. ANOVA pH

Group	N	Mean	SD	SE	F Value	P Value
S2	5	4.48	0.02	0.01	0.184	0.906 (NS)
S3	5	4.47	0.02	0.01		
S2S3	5	4.48	0.03	0.01		
Control	5	4.47	0.03	0.02		
Total	20	4.47	0.02	0.05		

S2 - *Weissella confusa*, S3 - *Bifidobacterium bifidum*,
NS - Non-significant

P - ISSN 0973 - 9157
E - ISSN 2393 - 9249

January to March 2018

Table.2. Shelf life of Probiotic Bacteria in the product (Viability) CFU/gm

Product	Number of days				
	0	7	14	21	28
S2 yoghurt(x10 ⁹)	112	80	69	57	45
S3 yoghurt (x10 ⁹)	104	76	61	52	39
S2S3yoghurt (x 10 ⁹)	128	96	82	65	40
	70+58	52+44	45+37	39+26	28+12
	(S2)(S3)	(S2)(S3)	(S2)(S3)	(S2)(S3)	(S2)(S3)
Control (x10 ⁹)	123	78	64	55	42

S2 - *Weissella confusa*, S3 - *Bifidobacterium bifidum*
Overall Chi-square - 82.15, P value - 0.0000, Degrees of freedom 16

Formulation of the product

Consumption of non pathogenic, lactic acid - producing bacteria as part of the diet for their potential beneficial effects has been a dietary practice for centuries and has increased over the past decade. Fermented milk products are a common part of the diet in Asia, Europe and parts of Africa. Tuomola *et al.* (1998) stated that the dominant food vehicles for probiotics remain to be yoghurts and fermented milks, both of which provide a relatively low - pH environment in which the probiotic bacteria must survive.

So yoghurt was prepared by fermented milk using *Bifidobacterium* and *Weissella* both individually and in combination. Similarly, Saavedra *et al.* (2004) in their study used *Bifidobacteria* and *Lactobacilli* as isolated forms and in combination for the preparation of fermented milk. In the present study yoghurt was prepared using S2, S3 and S2S3 cultures, and by inoculating these cultures in to 11% skimmed milk powder. When the pH reached 4.5 the product was taken and stored at 4°C., and used for further analysis

Product evaluation

Stability

The stability of the probiotic yoghurt was checked, using parameters such as pH and organoleptic analysis. The stability of the prepared product was checked by determining the pH of the product when stored at 4°C for the period of 1 month. pH ranged from 4.44 to 4.51 (Table 1), which indicated that pH of the product did not change during storage, and the product was stable. This was confirmed by ANOVA



www.stetjournals.com

Scientific Transactions in Environment and Technovation

R. B. B. B.
Principal -

Sree Narayana College, Palakkad - 678 682, Kerala

(Table 1a). The ANOVA table was constructed for the variables S2, S3, S2S3 and control. From the corresponding P value it is inferred that the pH level does not undergo any significant change.

The initial pH values of the samples were ranged from 4.51 to 4.49. The pH of all samples decreased slightly during storage and did not drop below 4 at the end of storage. There was no major difference in pH values at 4°C for up to 28 days. This could probably be due to low acidifying activity of the yoghurt and probiotic cultures (Table 1). The drop in the pH was similar for all the yoghurt samples (Table 1a).

Shah *et al.* (1995) and Akalin *et al.* (2004) also found that there was a similar decrease in pH values during storage of commercial yoghurt containing *L. acidophilus* and *B. bifidum*, as well as in *B. longum* and *B. animalis* fermented milk. Similarly, the initial pH values in yoghurts containing *L. acidophilus* and *Bifidobacteria* decreased from 4.4–4.3 at day 0 to 4.2 at the end of 35 days of storage (Dave and Shah, 1997). Shah (2000) reported that the pH of the product was 4.5 or lower to meet legal requirements and to produce good quality yoghurt. It has also been reported that the concentrations of acetic acid could vary in the product depending on the extent of growth of probiotic bacteria. In the present study it was found that the pH of the product did not change during storage and the product was stable.

Organoleptic analysis

Organoleptic analysis included the taste, texture, flavour and the consistency of the product. However both of them had a good flavour. Many different strains and dosage patterns for the production of Yoghurt have been reported in various studies. The yoghurt prepared using *Bifidobacterium* was white, thick hard in consistency without much whey and with an excellent flavour, whereas yoghurt produced using *Weissella* was pale white in colour, loose in consistency with whey, and the flavour was also acceptable. In case of combination of yoghurt, it was white, thick and soft in consistency similar to the Bifido yoghurt, and also with good flavour. This could be due to the factor that *Bifidobacterium*, is capable of controlling the whey. Fox *et al.* (1993) stated that the proteolytic and lipolytic properties determine the degradation of proteins and lipids, which have considerable effect on the taste and flavour of dairy products.

Shelf life

A comparative account of change in the viable count of probiotic bacteria in S2, S3 and S2S3 yoghurt during refrigerated storage is presented in Table 2. Shelf life of the product was determined once in a week for a

period of one month, by using pour plate technique, where the viable cells were counted (Table 2). There was a notable variation in the viable count in yoghurts fermented with S2 and S3. The number of viable cells was more in S2 sample (112×10^6 cfu) on 0 day where as it reduced gradually in the subsequent weeks and it was 45×10^6 cfu on the twenty eighth day. In the case of S3 yoghurt, the load of viable cells was less than the S2 sample (104×10^6 cfu) which reduced gradually to 39×10^6 cfu whereas control showed an initial load of 123×10^6 cfu which was lowered during further storage to about 42×10^6 cfu. Chi-square test revealed that this reduction is not significant (Table 2a).

There was a gradual decrease in cfu from 0 day to 28 days in all the product samples. However the level of reduction was not significant enough to affect the product quality as evidenced by chi-square test (Table 2a).

In a similar study on *S. thermophilus* it has been reported that viable count was slightly reduced to around 10-15% during the storage of yoghurts containing *Bifidobacterium* (Medina and Jordano, 1994; Dave and Shah, 1997; Rybka and Fleet, 1997). Akalin *et al.* (2004) found that *Lactobacillus delbrueckii* subsp. *bulgaricus* showed a marked decrease of 97-99% in their number when compared to

S. thermophilus during refrigerated storage. However the survival rate of

S. thermophilus was better than that of both *L. delbrueckii* subsp. *bulgaricus* and *Bifidobacteria*. These observations are in line with those of Kim *et al.* (1993), Medina and Jordano (1994), Lim *et al.* (1995) Dave and Shah (1997).

A number of brands of commercial yoghurts were analyzed in Australia and in Europe by Iwana *et al.* (1993) for *L. acidophilus* and *Bifidobacteria*. However certain reports showed that the viability of probiotic bacteria was affected by inhibitory substances such as lactic acid produced during production and cold storage. During fermentation these organisms produced organic acids but the concentration varied with the organisms (Shah, 2000).

The viability of probiotic bacteria in yoghurt depends on the strains used, interaction between species present, culture conditions, production of hydrogen peroxide due to bacterial metabolism, final acidity of the product and the concentrations of lactic and acetic acid. The viability also depends on the availability of nutrients, growth promoters and inhibitors, concentration of sugars, dissolved oxygen and oxygen permeation through package especially for *Bifidobacterium* spp inoculation levels, incubation temperature, fermentation time and storage temperature (Bertoni *et al.*, 1994).



The main factors for the loss of viability could be decrease in pH of the medium and accumulation of organic acids as a result of growth and fermentation (Shah and Jelen, 1990). *Bifidobacteria* are anaerobic in nature and hence higher oxygen content could affect the growth and viability. The availability of growth factors has also been reported to affect the growth and viability of probiotic bacteria (Shah, 2000).

REFERENCES

- Akalin, A.S., Serap Fenderya and Necati Akbulut. 2004. Viability and activity of bifidobacteria in yoghurt containing fructooligosaccharide during refrigerated storage. *Int. J. Food Sci. and Technol.*, 39: 613-621. <https://doi.org/10.1111/j.1365-2621.2004.00829.x>
- Ballongue, J. 2004. Bifidobacteria and probiotic action, in Lactic Acid Bacteria: Microbiology and Functional Aspects, 3rd Edition, Revised and Expanded, eds Salminen, S., von Wright, A., Ouwehand, A. Marcel Dekker Inc, New York.
- Bertoni, J., Calamary, L., Maiamti, M.G. and Azzoni, A. 1994. Factors modifying the acidification rate of milk. *Lait*, 17: 941-943.
- Dave, R.I. and Shah, N.P. 1997. Viability of yoghurt and probiotic bacteria in yoghurts made from commercial starter cultures. *International Dairy Journal*, 7: 31-41. [https://doi.org/10.1016/S0958-6945\(96\)00046-5](https://doi.org/10.1016/S0958-6945(96)00046-5)
- Fox, P.F., Law, J., McSweeney, P.L.H. and Wallace, J. 1993. Biochemistry of cheese ripening. In Chemistry, Physics and Microbiology [P.F. Fox (ed.)], Chapman and Hall, London, 1: 389-438. https://doi.org/10.1007/978-1-4615-2650-6_10
- Fuller, R. 1989. Probiotics in man and animals - a review. *J. Appl. Bacteriol.*, 66: 365-378. https://doi.org/10.12938/bifidus1982.12.1_39
- Iwana, H., Masuda, H., Fujisawa, T., Suzuki, H. and Mitsuoka, T. 1993. Isolation and identification of *Bifidobacterium* spp. in commercial yoghurt sold in Europe. *Bifidobacteria Microflora*, 12: 39-45.
- Kim, E.R., Lee, K.W., Park, Y.H. and Kwak, H.S. 1993. The study of lactic acid bacteria in yoghurt during delivery and storage. *Korean J. Dairy Sciences*, 14: 260-263.
- Lim, K.S., Huh, C.S., Baek, Y.J. and Kim, H.U. 1995. A selective enumeration medium for bifidobacteria in fermented dairy products. *J. Dairy Sciences*, 78: 2108-2112. [https://doi.org/10.3168/jds.S0022-0302\(95\)76837-0](https://doi.org/10.3168/jds.S0022-0302(95)76837-0)
- Mach, T. 2006. Clinical usefulness of probiotics in inflammatory bowel diseases. *J. Physiol. Pharmacol.* 57(9): 23-33
- Medina, L.M. and Jordano, R. 1994. Survival of constitutive microflora in commercially fermented milk containing bifidobacteria during refrigerated storage. *J. Food Protection*, 56: 731-733. PMID:31121782 <https://doi.org/10.4315/0362-028X-57.8.731>
- Metchni Koff, E. 1908. Prolongation of Life. Putnam, New York.
- Ouwehand, A.C. and Vesterlund, S. 2004. Antimicrobial components from lactic acid bacteria, in Lactic Acid Bacteria: Microbiology and Functional Aspects, 3rd Edition, Revised and Expanded, eds New York, pp. 375-395. PMID:PMID522568 https://doi.org/10.1201/9780824752033_ch11
- Rybka, S. and Fleet, G.H. 1997. Populations of *Lactobacillus delbrueckii* ssp. *bulgaricus*, *Streptococcus thermophilus*, *Lactobacillus acidophilus* and *Bifidobacterium* species in Australian yoghurts. *Food Australia*, 49: 471-475.
- Savedra Jose, M., Adel Abi-Hanna, Nancy Moore and Robert, H. Yolken. 2004. Long-term consumption of infant formulas containing live probiotic bacteria: tolerance and safety. *Am. J. Clin. Nutr.*, 79(2): 261-267. <https://doi.org/10.1093/ajcn/79.2.261> PMID:15157347
- Schillinger, U., Guigan, C. and Holzappel, H. 2005. In vitro adherence and other properties of lactobacilli used in probiotic yoghurt-like products. *International Dairy Journal*, Vol. 15, pp. 1289-1297. <https://doi.org/10.1016/j.idairy.2004.12.008>
- Shah, N.P. and Jelen, P. 1990. Survival of lactic acid bacteria and their lactases under acidic conditions. *J. Food Sci.*, 55: 506-509
- Shah, N.P., Lankaputhra, W.E.V., Britz, M.L. and Kyle, W.S.A. 1995. Survival of *L. acidophilus* and *Bifidobacterium bifidum* in commercial yoghurt during refrigerated storage. *Int. Dairy J.*, 5: 515-521. <https://doi.org/10.1111/j.1365-2621.1996.tb0797.x>
- Shah, N.P. 2000. Symposium: Probiotic bacteria: selective enumeration and survival in dairy foods. *J. Dairy Sci.*, 83: 894-907. [https://doi.org/10.3168/jds.S0022-0302\(00\)74953-8](https://doi.org/10.3168/jds.S0022-0302(00)74953-8)
- Tamime, A.Y., Saarela, M., Sondergaard, K. A., Mistry, V.V. and Shah, N.P. 2007. Production and maintenance of viability of probiotic micro-organisms in dairy product, in Probiotic Dairy Product, ed. Tamime, A.Y., Blackwell Publishing.
- Tuomola Elina, Ross Crittenden, Martinplayne, Erika Isolauro and Seppo Salminen, 1998. Quality assurance criteria for probiotic bacteria. *Am. J. Microbiol.*, 73(2): 393. <https://doi.org/10.1093/ajcn/73.2.393> PMID:11157347
- Xiao, J.Z., Kondo, S., Takahashi, N., Miyaji, K., Oshida, K., Hiramatsu, A., Iwatsuki, K., Kokubo, S. and Hosono, A., 2003. Effect of milk products fermented by *Bifidobacterium longum* on blood lipids in rats and healthy adult male volunteers. *J. Dairy Sci.*, 86: 2452-2461. [https://doi.org/10.3168/jds.S0022-0302\(03\)73829-9](https://doi.org/10.3168/jds.S0022-0302(03)73829-9)
- Yan, F. Polk DB. 2006. Probiotics as functional food in the treatment of diarrhea. *Curr Opin Clin Nutr Metab Care*. 2006. Nov 9 (6) : 717-21. PMID:17053425 <https://doi.org/10.1097/01.mcc.0000247477.02650.51>



Effect of probiotic cultures in improving the health status of the host

S. Dhiva

Department of Microbiology, S.N. college, Alathur, Palakkad, Kerala 678682.

Abstract

Probiotics are nonpathogenic microorganisms which, when ingested, exert a positive influence on the health or physiology of the host. A probiotic food can be defined as functional agent, which provide adequate nutritional effects in a way that is relevant to either the state of well-being and health, or to a reduction in disease incidence. Dairy based yoghurt prepared using two different Lactic acid bacterial strains for the present study, and their mechanisms of action and effects were also studied. This study summarizes and comments on evidence for the positive effects of probiotics in various clinical situations such as improving the nutritional and health status of the host.

Key words: Probiotic, Physiology, Yoghurt, Nutrition, etc.,

Received : June 2017

Revised and Accepted : May 2018

INTRODUCTION

Metchnikoff first hypothesized the importance of lactobacilli for human health and longevity at the beginning of 19th century. He considered the gut microbes as detrimental rather than beneficial and suggested that desirable effects might only be expected from their substitution by yogurt bacteria. Since then attempts have been made, especially during the last two to three decades to improve the health status by modulating the indigenous intestinal microflora by live microbial adjunct, now called "probiotics" (Holzapfel *et al.*, 1998). The word "probiotic" was derived from the Greek word which means "on behalf of". The concept was introduced by Lilly and Stillwell (1965) and was intended to stimulate substances produced by one microorganism to enhance the growth of another. Probiotic therefore is the exact opposite of antibiotic. The word probiotic was used later to refer to animal feed supplements and was defined as a live microbial feed supplement, which beneficially affects the host animal by improving its intestinal microbial balance (Fuller, 1989). The word probiotic was used later to refer to animal feed supplements and was defined as a live microbial feed supplement, which beneficially affects the host animal by improving its intestinal microbial balance (Fuller, 1989). The health and nutritional benefits ascribed to probiotics can be generalized under the following categories: maintenance of normal intestinal microflora balance in infant and old age, improvement of lactose tolerance and digestibility of the milk products, anti tumorigenic

activity, reduction of serum cholesterol levels, synthesis of B-complex vitamins, and absorption of calcium (David and Dauas, 1991).

In the present work strains of *Weissella confusa* and *Bifidobacterium bifidum* were isolated from various fermented cereals and evaluated for their potentiality to be used as a Probiotic. The isolated organisms were used to prepare probiotic yoghurt. Yoghurt samples were analysed for their ability to improve nutritional and health status of the consumers.

MATERIALS AND METHODS

Impact on the consumer

Since the probiotic products are meant for improving nutritional and health status of the individual consumers, studies relating to these aspects were carried out *in vivo* using experimental animal (rats).

Nutritional Status

Common fact regarding the probiotic food is that, it improves the nutritional status of the individual, which was studied by inoculating 5ml of prepared yoghurt containing 10^6 cells/ml to the experimental rats twice a day along with the feed orally for a period of two weeks. The parameters such as body weight and blood chemistry were checked (Akalin *et al.*, 1997).

Body weight

It was detected by using standard weighing balance.

Blood chemistry

Blood samples were collected by vein puncture method for the determination of serum cholesterol (Cholesterol Oxidase peroxidase method) (Akalin *et al.*, 1997), HDL-

*Corresponding Author :

email: dhivasofu@gmail.com

P - ISSN 0973 - 9157

E - ISSN 2393 - 9249

April to June 2018



www.stejournals.com

Scientific Transactions in Environment and Technovation

Principal

Sree Narayana College, Alathur
Palakkad, 678 682, Kerala

Cholesterol (Immuno inhibition method) (Kiessling *et al.*, 2002), LDL-cholesterol (Enzyme Selective protection method), Triglycerides (GPO-PAP - One Step Method. (Wiebe and Smith 1985)

Table.1. Body Weight

S. No.	Weeks	Body weight in gms			
		S2	S3	S2S3	Control
1	1 st Week	152	155	153	155
2	2 nd Week	157	160	158	155
3	3 rd Week	168	180	175	158
4	4 th Week	199	210	201	158
5	5 th Week	201	216	205	163
6	6 th Week	204	222	212	163

S2 - *Weissella confusa*, S3 - *Bifidobacterium bifidum*, S2S3 - *Weissella confusa* + *Bifidobacterium bifidum*.

Table.1a. Body Weight -Karl Pearson Correlation Analysis

Variables	S2	S3	S2S3	Control
S2	1	0.995**	0.994**	0.877**
S3	0.995**	1	1.000**	0.909**
S2S3	0.994**	1.000**	1	0.905**
Control	0.877*	0.909*	0.905*	1

** Correlation is significant at the 0.01 level (Highly Significant)

* Correlation is significant at the 0.05 level (Significant)

Table.2 Total cholesterol (mg/dl)

Samples	1 st Week	6 th Week
S2 yoghurt	96	87
S3 Yoghurt	95	83
Control	98	110

S2 - *Weissella confusa* , S3 - *Bifidobacterium bifidum*

Table.2a. t-test Total cholesterol

Groups	N	Mean	SD	t-value	P Value
1 st week	3	96.33	1.52	0.397	0.729 (NS)
6 th week	3	93.33	14.6		

NS - Non-significant

P - ISSN 0973 - 9157

E - ISSN 2393 - 9249

April to June 2018

Table.3a. t-test HDL (mg/dl)

Groups	N	Mean	SD	t-value	P Value
1 st week	3	29.67	1.5	9.5	0.011 (S)
6 th week	3	36	2.7		

S - Significant

Table. 4. LDL (mg/dl)

Samples	1 st Week	6 th Week
S2 yoghurt	45	39
S3 Yoghurt	44	37
Control	47	51

S2 - *Weissella confusa* , S3 - *Bifidobacterium bifidum*

Table.4a. t-test LDL

Groups	N	Mean	SD	t-value	P Value
1 st week	3	45.33	1.5	0.854	0.483 (NS)
6 th week	3	42.33	7.6		

NS - Non-significant

Table.5. Triglycerides (mg/dl)

Samples	1 st Week	6 th Week
S2 yoghurt	70	77
S3 Yoghurt	69	81
Control	72	75

S2 - *Weissella confusa* , S3 - *Bifidobacterium bifidum*

Table. 5a. test Triglycerides

Groups	N	Mean	SD	t-value	P Value
1 st week	3	70.33	1.53	2.817	0.106 (NS)
6 th week	3	77.67	3.06		

NS - Non-significant

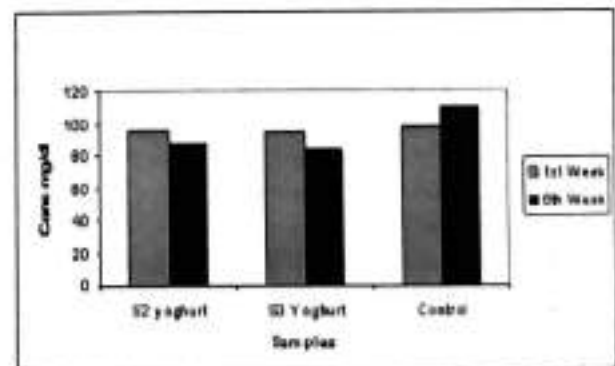


Fig.1. Total Cholesterol



www.stetjournals.com
Principal
Sree Narayana College
Palakkad-678 002, Kerala

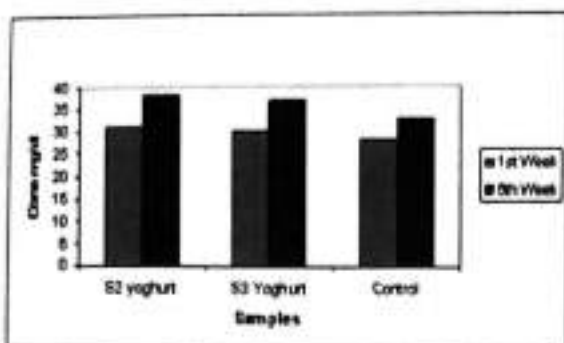


Fig.2. Serum HDL

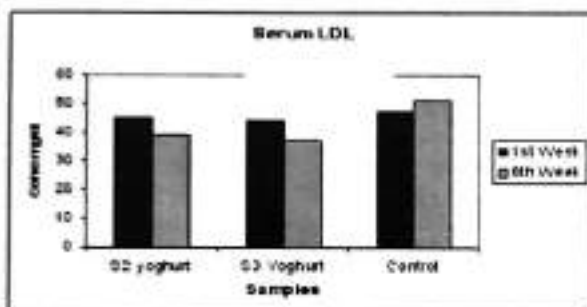


Fig.3. Serum LDL

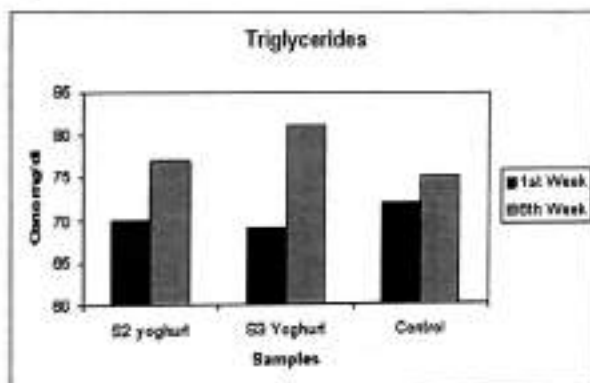


Fig.4. Triglycerides

RESULTS

Impact on the consumers

Nutritional status

Definition of probiotics itself clearly states that it is a viable preparation in the form of food or dietary supplements to improved the health of humans or animals. So the probiotic organisms *Bifidobacterium* and *Weissella* in the form of yoghurt were ingested into laboratory experimental animals

Ten ml of yoghurt per day with a bacterial concentration of 10^8 cells per ml was given orally to the animals for a period of 6 weeks as suggested by Robinson (1987). Quantity and concentration of

probiotic organisms actually are responsible for getting desired therapeutic effects from probiotic products (Shah, 2000). It has been (Anonymous, 1992) reported that these organisms should be present in a food to a minimum level of 10^6 cfu/g or daily intake should be about 10^6 cfu/g. Xiao *et al.* (2003) also reported the intake of probiotic organisms at a concentration of 10^6 cfu/g. Such high numbers could have been suggested to compensate the possible reduction in the numbers of the probiotic organisms during passage through the stomach and the intestine (Shah, 2000).

The effect of fermented milks on rats was checked by body weight gain and blood chemistry analysis.

Body Weight

In the present study, body weight of the rats gained gradually and increased from the first week to the sixth week, in all the cases (Table 1). During the first two weeks there was a slow increase in weight which might be due to the time taken for adaptability of these organisms into the intestine of the animals where they might compete with the other organisms for colonization, nutrition, etc.. During the subsequent weeks, there was an excellent improvement in the weight gain by the animals approximately of 10g / week in case of *Weissella* and 20g/week in case of *Bifidobacterium* and the weight gain was more or less similar in the case of combination (Table 1). But in the case of control there was a little increase in the body weight. In a similar study Xiao *et al.* (2003) found that 20gms of feed / day inoculated with *Bifidobacterium*, showed an increase in body weight by 7.2 ± 1.1 g/d.

Blood Chemistry analysis

The blood chemistry parameters such as serum cholesterol, serum protein, serum phosphorus, calcium and glucose were checked. Blood samples were collected at the end of each week and all the parameters were checked.

Serum Cholesterol

When the serum cholesterol level was considered, the results of the present study revealed that the *Bifidobacterium* yoghurt (S3) and *Weissella* yoghurt (S2) were more effective in controlling serum lipids in rats than the control. In comparison with the control, S2 (yoghurt) and S3 has reduced significantly the levels of serum total cholesterol, LDL cholesterol and triglycerides (Fig.1-4).

Bifidobacterium fermented milk is more efficient in lowering the serum total cholesterol concentration in rats than *Weissella*. This lends support to other studies involving various milk products containing selected strains of lactic acid bacteria, Akalin *et al.* (1997)



demonstrated that yoghurt fermented with *L. acidophilus* significantly reduced the serum total cholesterol concentration in milk, whereas yoghurt fermented with ordinary yoghurt starters containing *S. thermophilus* and *L. delbreuckii*, did not show any reduction.

In experiments with rats, Beena and Prasad (1997) demonstrated that bifidus yoghurt fortified with condensed whey lowered the cholesterol level, more than the ordinary yoghurt fortified with condensed whey. Reduction of serum total cholesterol and triglycerides were observed with selected strains including *L. acidophilus* (Danielson *et al.*, 1989), *L. reuteri* (Taranto *et al.*, 1998, De Roos *et al.*, 1999), *L. casei* (Hashimoto *et al.*, 1999), and *L. gasseri* (Usman and Hosono, 2000) in the experimental animal.

In the present study with animal indicated a slight non-significant decrease in the concentration of LDL-cholesterol but a significant increase in the concentration of HDL-cholesterol in both S2 and S3 yoghurt in comparison with the control yoghurt. A decrease in total cholesterol was found with a simultaneous increase of HDL-cholesterol in some studies (Taranto *et al.*, 1998; Hashimoto *et al.*, 1999).

From these results it is obvious that serum total cholesterol is reduced by inhibiting absorption in the intestine as a result of the assimilation and binding of cholesterol as well as bile acids by lactic acid bacteria. It is known that the serum cholesterol level decreases when a component suppresses resorption of bile acid in the intestine because the catabolism of cholesterol is promoted in the liver (Xiao *et al.*, 2003)

Serum Protein, Calcium, Phosphorus and Blood glucose

The level of serum protein showed a slight decrease in the second week, but during the subsequent weeks, it was increased in all the treatments. *Bifidobacterium* (S3) yoghurt showed more increase in the level of serum protein than *Weissella* yoghurt (S2) and even the combination (S2S3 yoghurt) also showed an increase in the level of serum protein (Table 1). The change in the level of serum calcium, serum phosphorus and blood glucose was almost comparable with that of serum protein. All these reports are indirectly corresponding to the results of the body weight of the animals because protein and other nutrients are essential for the body weight gain, and in the body weight gain of animals also the drastic increase in the weight occurred only after 2nd week.

REFERENCES

Akalin, A.S., Gene, S. and Duzel, S. 1997. Influence of yoghurt and acidophilus yoghurt on serum cholesterol levels in mice, *J. Dairy Sci.*, 80: 2721-2725.

P - ISSN 0973 - 9157

E - ISSN 2393 - 9249

April to June 2018



- Anonymous, 1992. Yoghurt and probiotics, *Choice*, 11: 32-35.
- Beena, A. and Prasad, V. 1997. Effect of yoghurt and bifidus yoghurt fortified with skim milk powder, condensed whey and lactose hydrolysed condensed whey on serum cholesterol and tri acyl glycerol levels in rats, *J. Dairy Res.*, 64: 453-457.
- David, B.H. and Dauas, G.H. 1991. Bifidobacteria their potential for use in American dairy products, *Food Technol.* 45 (4): 74-80.
- De Roos, M.M., Schouten, G. and Katan, M.B. 1999. Yoghurt enriched with *Lactobacillus acidophilus* does not lower blood lipids in healthy men and women with normal to borderline high serum cholesterol levels, *European J. Clin. Nutr.*, 53: 277-280.
- Fuller, R. 1989. Probiotics in man and animals - a review, *J. Appl. Bacteriol.*, 66: 365-378.
- Hashimoto, H., Yamazaki, K., He, F., Kawas, M., Hosoda, M. and Hosono, A. 1999. Hypocholesterolemic effects of *Lactobacillus casei* sub sp. *casei* TMC 0409 Swain observed in the rats fed cholesterol contained diets, *Anim. Sci. J.*, 72: 90-97.
- Holzappel, W.H., Haberer, P., Snel, J., Schillinger, U. and Huis Int Veld, J. 1998. Over view of gut flora and probiotic, *Int. J. of Food Microbiol.* 41 (2): 85-101.
- Kiessling, G., Schneider, J. and Jahreis, G. 2002. Long-term consumption of fermented dairy products over 6 months increases HDL cholesterol, *European J. Clin. Nutr.*, 56(9): 843-849.
- Lilly, D.M. and Stillwell, R.H. 1965. Probiotics: growth promoting factors produced by microorganisms, *Sci.*, 147: 747-748.
- Metchnikoff, F. 1908. The prolongation of life. In: N.P. Shah, 1994. *Lactobacillus acidophilus* and lactose intolerance. A review, *Asian Food Journal* 9(2): 47-54.
- Taranto, M.P., Medici, M., Perdigon, G., Perdigon, Ruix Holgado, A.P. and Valdez, G.F. 1998. Evidence for hypocholesterolemic effect of *Lactobacillus reuteri* in hypercholesterolemic mice, *J. Dairy Sci.*, 81: 2336-2340.
- Usman and Hosono, A. 2000. Effect of administration of *Lactobacillus gasseri* on serum lipids and fecal steroids in hypercholesterolemic rats, *J. Dairy Sci.*, 83: 1705-1711.
- Wiebe and Smith, 1985. HDL Cholesterol: Serum High density lipoprotein Cholesterol is estimated using the method of Wiebe and Smith.
- Xiao, J.Z., Kondo, S., Takahashi, N., Miyaji, K., Oshida, K., Hiramatsu, A., Iwatsuki, K., Kokubo, S. and Hosono, A., 2003. Effect of milk products fermented by *Bifidobacterium longum* on blood lipids in rats and healthy adult male volunteers, *J. Dairy Sci.*, 86: 2452-2461.

www.stetjournals.com

Scientific Transactions in Environment and Technovation

Principal
Sree Narayana College, Alathur
Pattakkad- 678 652

Studies on the role of probiotic cultures in the maintenance of gastrointestinal health

<https://doi.org/10.56343/STET.116.011.003.010>
<http://stetjournals.com>

S. Dhiva

Assistant Professor and Head, Department of Microbiology, Sree Narayana College, Alathur, Palakkad, Kerala - 678 682

Abstract

Probiotics have been used for many years to enhance the intestinal health. Probiotics are traditionally defined as viable microorganisms that have a beneficial effect in the prevention and treatment of specific pathologic conditions when they are ingested. There are many literatures highlighting the use of probiotics to prevent or treat intestinal disorders in the present study probiotics selected were the lactic acid bacteria, particularly *Weissella confusa* and *Bifidobacterium* sp. isolated from fermented ragi. They were examined for their effectiveness in lactose intolerance. Lactose intolerance is the occurrence of symptoms in lactose maldigestors who consume too much of lactose. The present investigation proves that the fermented cereals containing probiotic cultures have the highest β -galactosidase activity, which probably accounts for the good digestion. Probiotics represented an exciting prophylactic and therapeutic effect by increasing the lactose digestion.

Key words: Probiotics, symptoms, therapy, Lactose intolerance, β - galactosidase activity

Received : July 2017

Revised and Accepted : March 2018

INTRODUCTION

Lactose intolerance refers to symptoms resulting from consuming too much lactose (milk sugar) compared to the ability to break it down by the intestinal enzyme, lactase. Fermented products have beneficial effects in case of lactose intolerance, viral diarrhea or antibiotic-associated diarrhea. Bacterial lactase improves the absorption of lactose, and the fermented products slow down the intestinal transit facilitating the action of residual intestinal lactase (De Vrese *et al.*, 2001). The transient passage of lactic acid bacteria in the digestive tract may represent a microbial barrier against the development of pathogenic bacteria, probably due to the release of compounds, contributing to the maintenance of colonization resistance to pathogens (Heyman Martine, 2000). *Lactobacillus* supplementation could enhance lactose fermentation and thus improves symptoms of lactose intolerance, reduce the activity of fecal bacterial enzymes including β -glucuronidase, nitroreductase and azoreductase (Jiang and Savaiano, 1997). Probiotics are considered as "viable preparations in foods or dietary supplements to improve the health of humans and animals (Salminen *et al.*, 1998). Probiotics may have interesting positive effects on intestinal function but there is presently a lack of well conducted clinical trials demonstrating any significant benefits of probiotics in humans with the exception of diarrhea. The present

article deals with the evaluation of probiotic traits of *Weissella confusa* and *Bifidobacterium bifidum* strains previously isolated from fermented cereals and the probiotic product as food or food supplement, and the results are discussed.

MATERIALS AND METHODS

Preparation of fermented foods

Fermented foods are the main source of beneficial microorganisms with potential for use as probiotics. So the present investigation was started with the production of fermented products using different food sources such as grains.

Fermented Grains

Lactic acid fermentation of cereals is a long - established processing method in Asia. Ragi, was soaked in clean water for 2 days and ground well to make slurry. They were allowed to ferment for 1-3 days at room temperature. Fermented samples were taken for further study (Charalampopoulos *et al.*, 2002). The prepared fermented foods were subjected to biochemical and microbiological analysis, to study their nutritive content and microbial load.

Isolation of Bacteria

Fermented food samples were serially diluted in sterile distilled water. 10^4 , 10^7 , 10^8 dilutions were taken for bacterial isolation. Serially diluted samples were inoculated in MRS AGAR (Man, Rogosa and Sharpe Agar), and the bacteria were isolated.

*Corresponding Author :
email: dhivasoju@gmail.com

P - ISSN 0973 - 9157
E - ISSN 2393 - 9249

January to March 2018



www.stetjournals.com

Scientific Transactions in Environment and Technovation

Principal

Sree Narayana College, Alathur
Palakkad-678 682, Kerala

In the present work strains of *Weissella confusa* and *Bifidobacterium bifidum* were isolated from various fermented cereals, and evaluated for their potentiality to be used as a probiotic. The isolated organisms were subjected to Enzyme Supplement test.

Enzyme supplement Test

Lactose intolerance test

Probiotic organisms act as an enzyme supplement, improves the lactose digestion through the production of enzyme β -galactosidase. It was demonstrated by cultivating the organism in the media containing either lactose or lactose analog such as isopropyl thio-galactoside (IPTG) and trimethyl galactoside (TMG). 20ml of Luria bertonie agar was taken; 40 μ l of x-gal and IPTG were added to the medium. These mixtures were poured on to the Petriplates, cultures such as S2 and S3 were serially diluted and 0.1ml of each culture was separately inoculated into IPTG X-gal medium by spread plate method (Bao *et al.*, 2009).

RESULTS AND DISCUSSION

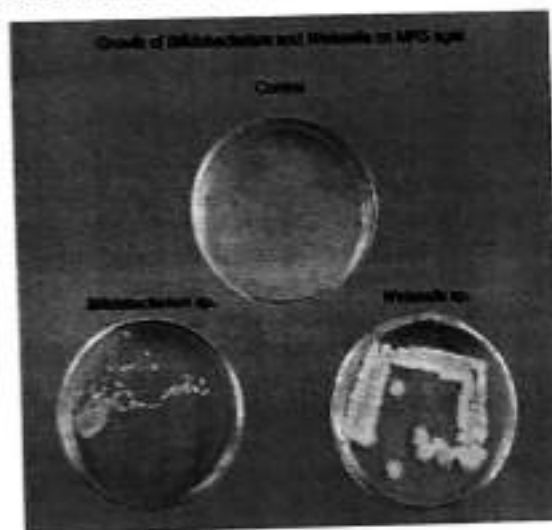


Fig. 1. Growth of Bifidobacterium and Weissella on MRS agar

Table.1.

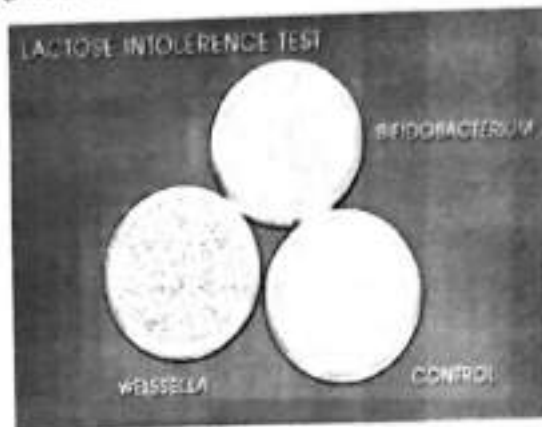
**Enzyme supplement
Lactose intolerance test**

S. No.	Strain	No. of Colonies		
		5-Oct	6-Oct	7-Oct
1	<i>Weissella</i>	169	60	5
2	<i>Bifidobacterium</i>	TNTC	120	14

TNTC - Too numerous to count



Fig. 2. Lactose Intolerance Test



Among the bacterial species isolated, 2 lactic acid bacteria (Fig 1) *Bifidobacterium bifidum* and *Weissella confusa* were identified using Bergey's manual based on morphological and biochemical characteristics and were subjected to further study Possible application of cereals or cereal constituents in functional food formulations as fermentable substrates for the growth of probiotic microorganisms especially *Lactobacillus* and *Bifidobacteria* was reported by Charampopoulos *et al.* (2002).

Nokuthula *et al.* (2000) isolated about 180 strains of LAB from fermented Sorghum powder and reported that *Lactobacillus plantarum* and *Leuconostoc mesenteroides* were the dominant strains during the fermentation process. Daley and Davis (1998) stated that microorganisms of genera *Lactococcus*, *Lactobacillus*, *Leuconostoc*, *Streptococcus* and *Pediococcus* are involved in fermentations, and exert a positive effect on human health.

Probiotic organisms, improves lactose digestion with the production of enzyme β -galactosidase, which was indicated by the appearance of blue colour colonies on the IPTG X-gal medium (Fig 2; Table 1). These plates were incubated at 37°C for 24 h. Next day the plates were examined for breakdown of lactose and the appearance of blue colour colonies indicates lactose breakdown by the activity of the enzyme β -galactosidase. The number of blue colour colonies were recorded.

De Vrese *et al.*, (2001) stated that Yoghurt and other probiotic bacteria in the fermented milk products improved lactose digestion and eliminated symptoms of intolerance in lactose maldigestors. These beneficial effects are due to microbial β -galactosidase in the fermented milk product Thus the fermented products can also function as enzyme supplements.

In the present study, both the cultures produced blue colour colonies on X-gal IPTG media, which indicates the production of enzyme for the breakdown of IPTG.

The by product of cleared IPTG in combination with the indicator bromocresol blue produced, blue colour on the medium (Plate I; Table 1).

Among the two strains tested, *Bifidobacterium* produced more number of blue colonies than *Weissella*. A similar study was done on *B. longum* by Tuula *et al.* (2000), who stated that fermented milk containing

B. longum had the highest β -galactosidase activity, which probably accounted for the good digestion.

CONCLUSION

Lactic acid bacteria, *Weissella confusa* and *Bifidobacterium bifidum* isolated from fermented ragi showed Beta galactosidase activity which would be greatly beneficial for lactose intolerance patients. This study clearly indicates that presence of lactic acid bacteria like *Weissella confusa* and *Bifidobacterium bifidum* in the traditional Indian foods would have added beneficial effect in degrading lactose and improve the digestion in intestinal tract their by providing lot of positive effects and enhancing Intestinal function.

REFERENCES

Bao, R., Huo, Roger Jen, Petra Loll e and Derek To, 2009. Analysis and Comparison of β -galactosidase Production in *Escherichia coli* BW25993 and MG1655 Mutants During Conditions of Growth and Catabolite Repression. *Journal of Experimental Microbiology and Immunology (JEM)*, Vol. 13:79-82.

Charalampopoulos, D., Wang, R., Pandiella, S.S. and Webb, C. 2002. Application of cereals and cereal components in functional foods: a review, *Int. J. Food Microbiol.*, 79: 131-141.
[https://doi.org/10.1016/S0168-1605\(02\)00187-3](https://doi.org/10.1016/S0168-1605(02)00187-3)

Daley, C. and Davis, R. 1998. The biotechnology of lactic acid bacteria with emphasis on application in food safety and human health, *Agriculture Food Science in Finland*, 7(2): 251-264.
<https://doi.org/10.23986/afsci.72862>

De Vrese, Michael, Anna Stegelmann, Bernd Richter, Susanne Fenselau, Christiane Laue and Jurgen Schrezenmeir, 2001. Probiotics - Compensation for lactase insufficiency, *Amer. J. Clin. Nutr.*, 73(2): 421S-429S. PMID:11157352
<https://doi.org/10.1093/ajcn/73.2.421s>

Heyman and Martine, 2000. Effect of lactic acid bacteria on diarrhoeal diseases, *J. Am. Coll. Nutr.*, 19(2): 137S-146S. PMID:9237942
<https://doi.org/10.1093/ajcn/127.8.1489>

Jiang, T. and Savaiano, D.A. 1997. *In vitro* lactose fermentation by human colonic bacteria is modified by *Lactobacillus acidophilus* supplementation, *J. Nutr.*, 127: 1489-1495.

Nokuthula, F., Kunene, I.F., Genia Geornaras, Alexander Von Holy and John W. Hastings, 2000. Characterisation and determination of origin of lactic acid bacteria from a sorghum-based fermented weaning food by analysis of soluble proteins and amplified fragment length polymorphism finger printing, *Appl. Environ. Microbiol.*, 66(3): 1084-1092.
PMID:10993775 PMCID:PMC19965 <https://doi.org/10.1128/AEM.66.3.1084-1092.2000>

Salminen, S., Deighton, M.A., Benno, Y. and Gorbach, S.L. 1998. Lactic acid bacteria in health and disease. *In Lactic acid Bacteria: Microbiology and Functional Aspects*. 2nd ed. (S. Salminen and A. Von Wright (eds.)), Marcel Dekker Inc., New York, pp.211-253.

Tuula, H., Vesa, Philippe Marteau and Riitta Korpela, 2000. Lactose Intolerance, *J. Amer. College of Nutr.*, 19(2): 165S-175S. PMID:10759141
<https://doi.org/10.1080/07315724.2000.10718088>



ISSN 2319-7129

Vol. XII
Number-24

(Special Issue) April, 2018

UGC Notification No. 62981



EDU WORLD

**A Multidisciplinary International
Peer Reviewed/Refereed Journal**

APH PUBLISHING CORPORATION

ISSN : 2319-7129

EDU WORLD

A Multidisciplinary International
Peer Reviewed/Refereed Journal

Vol. XII, Number - 24

April 2018

(Special Issue)

Chief Editor

Dr. S. Sabu

Principal, St. Gregorios Teachers' Training College, Meenangadi P.O.,
Wayanad District, Kerala-673591. E-mail: drssbkm@gmail.com

Co-Editor

S. B. Nangia

A.P.H. Publishing Corporation

4435-3611, Ansari Road, Darya Ganj,
New Delhi-110002



R. Binu

Principal

Sree Narayana College, Alathur,
Palakkad- 678 682, Kerala

EDU WORLD

**A Multidisciplinary International
Peer Reviewed/Refereed Journal**

SUBSCRIPTION FEE

	<i>1 year</i>	<i>2 years</i>
India	Rs. 1600/-	Rs. 3000/-
Foreign	US \$ 75.00	US \$ 150.00

Subscription(s) may be sent in form of Cheque/Demand Draft in favour of
APH PUBLISHING CORPORATION payable at New Delhi to the following address:

Authors are solely responsible for the contents of the papers compiled in this volume. Editor or Publisher does not take any responsibility for the same in any manner. Errors, if any are purely unintentional and readers are requested to communicate such errors to the editor or publisher to avoid discrepancies in future.

APH Publishing Corporation

4435-36/7, Ansari Road, Darya Ganj, New Delhi-110002 (INDIA)
Phones: 011-23274050 FAX: 011-23274050

E-mail: aphbooks@gmail.com

The subscriber will receive a hard copy of every issue of Journal for the subscribed period.

Printed at

Balaji Offset

Navin Shahdara, Delhi-32



R. Binu

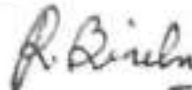
Principal

Sree Narayana College, Palakkad
Palakkad- 678 002, Kerala

CONTENTS

Emerging Indian Financial Markets Smt. G. Sujatha	1
Impact of Globalization on Teacher Education Prof. (Dr.) Uttam Kumar Samanta	7
Rural Migration and Sociological Impact on Lakhisarai District of Bihar Kamini Sinha	14
भारतीय राजनीति में जयप्रकाश नारायण का अवदान: एक मूल्यांकन डॉ. रणवीर कुमार	17
पर्यावरण संकट : कारण एवं निवारण डॉ. सन्वीर सिंह	26
Culture, Education and Their Interrelationship Dr. Ekta Bhatia	32
A Study on Health and Education in Socio-Economic Development of Telangana State-An Overview Dr. Shyam Ganta	36
Ecology and Folklore: Tracing the Lost Tradition in the Poetry of Desmond Kharmawphlang Dr. Monalisa Borgohain	43
Auditing Journal Usage by Education Scientists in Mumbai, India Shakuntala S. Nighot	47
The Problem and Performance of Power Loom Sector in Telangana State - An Empirical Study Chilusan Raju	58
To Study the Reaction of Teachers of D.Ed. (Special) Programme in Bareilly Region Towards Inclusion of ICT Tool in Special Education Dr. Manveer Singh and Urvashi Gangwar	67
Understanding the Economics of Type 2 Diabetes Gousia Karim and Dr. Syed Hasan Qayed	74
ESR Hyperfine Coupling Constants of Some Radical Anions Exhibiting Restricted Rotation About C-C Bond and Aliphatic Semidiones: Part III Sunita Bansal and Renu Parashar	79
Impact of Parental Involvement on Study Habit of Secondary Level School Students With Respect to Their Gender Mr. Prasanna Kumar Gouda, Dr. Minati Rani Mohapatra and Dr. Dibakar Sarangi	94
Demonetisation Policy: An Overview	98




 Principal
 Sree Narayana College, Alathur
 Palakkad- 679 632, Kerala

Regeenamma Joseph	
A Regional Dialect of Assamese Language	101
Dr. Harish Das	
Sexual Frustration and the Concept of Love in the Poetry of Kamala Das: A Brief Study	104
Chandra Prasad Ghimire	
Trauma of Female Psyche in Bharati Mukherjee's Jasmine	108
Rekha Sarraf	
समकालीन हिन्दी आलोचना	110
Dr. Sheela.T. Nair	
आतंकवाद, राष्ट्रीय सुरक्षा और मानवाधिकार	114
डॉ. दिग्विजयनाथ पाण्डेय	
Harnessing Innovative Teaching Skills for 21 st Century Learners	122
Sumita Sikka	
राष्ट्रवाद और उसके घटकों के उग्र रूप को नजरअंदाज करता भारतीय समाज	128
पूनम वर्मा	
मो. आरिफ के कहानी संग्रह "फूलों का बड़ा" में समसामयिक समाज का यथार्थ	131
शालु जमोरिया	
श्रीमद्भगवद्गीता के आधार पर आहार योजना	138
डॉ. राजेन्द्र कुमार	
प्राथमिक स्तरावर इतिहास अध्यापनासाठी नाविन्यपूर्ण पद्धतीच्या परिणामकारकतेचा अभ्यास	142
श्रीमती लता कारभारी विधाटे	
Sickness of Small Scale Industries in Bihar : A Study	158
Dr. Arun Kumar Ray	
Regional Imbalances and Primary Sector in India : Analytic Study	163
Dr. Arun Kumar Ray	
Emerging Patterns of Socio-Political Changes Among Dalits	170
Dr. Ranjeet Kumar	
Comparative Literature	174
Dr. Syed Mohd. Abid Rizvi	
प्राथमिक शिक्षा में गुणात्मक सुधार: नई राष्ट्रीय शिक्षा नीति 2020 के मसौदे के सन्दर्भ में।	180
डॉ. नाहर सिंह	
NGT and Sustainable Development: A Futuristic Approach	186
Tarun Kumar Kaushik and Dr. Anurag Singh	
Social Change and Responsibility of Education	193



R. Binu
Principal
Sree Narayana College, Alathur
Palakkad- 678 632, Kerala

Dr. Ekta Bhatia

Effectiveness of E-Games Based Strategy for Learning
Hindi at Upper Primary Level 196

Dr. Bindu D. and Gopika Devi S. R.

Factors of Buying Behavior in Food and Grocery Sector: A
Study of Demographic Influence 202

Dr. Jagdeep Singh

Role of Seed Programme In Enhancing Environmental Awareness
Among Students at Secondary Level 212

Dr. Rachel George M.

A stiff Anti-Colonial Resistant Against Christian Missionary and
British Rule: An Overview from Nadia Muslim Community 219

Mr. Kutubuddin Biswas

प्राथमिक स्तर पर योग क्रिया के सकारात्मक पक्षों का अध्ययन 225

बसुधा अदलखा

Edward Said and the Problem of Representation 229

Dr. Prabin Sinha

भारतीय लोकतंत्र की नई दिशा और समाज 233

डॉ. राजेन्द्र सिंह खीची

Demanding Role of Teachers for Effective Classroom Teaching 239

Dr. Anoop Kumar

Evolution of Soccer 244

Dinesh Prasad

Dielectric Relaxation Phenomenon in a Nematic Mixture ZLI 2687 252

Anuj Agarwal and Mukul Kishore

Risk Behavior of PLHA-A Study of Person Living with HIV /
AIDS in India 257

S. S. Dhaor

The Role of India's Iron Ladies in the Freedom Struggle 267

Dr. Farha M. Rizvi

कक्षा में कला एकीकृत शिक्षण अध्यापन को अपनाने के संबंध में संसाधन
व्यक्तियों की धारणा का अध्ययन 274

डॉ. लवली पुरी, सुरिंदर सिंह और पवन कुमार

Assessment of Bacteriological Quality of Street Vended Cold
Drinks Available in the Local Market 283

Dr. S. Dhiva and Dr. R. Bindu

Guidelines for Contributors 289



R. Bindu

Principal
Sree Narayana College, Alathur
Palakkad-678 582, Kerala



The known and unknown facts on probiotics – A review

S.Dhiva

Assistant Professor and Head, Department of Microbiology, S.N College, Alathur, Palakkad, Kerala - 678 682

Abstract

Micro organisms are ubiquitous and play a vital role in the sustenance of life. Various biogeochemical cycles are mediated by the microorganisms. Similarly the animals including human beings harbour millions of micro organisms. The microbiota of the gastrointestinal tract influences health and well being of human and animals. The beneficial microorganisms are called probiotics. The probiotic microorganisms include Lactobacillus, Biofidobacterium, Exterococcus, Leuconostoc and Lactococcus, etc., such organisms should have the specific properties to survive in the gut environment and should have beneficial effect and should not cause any harm to the host.

Key words: Biofidobacterium, Exterococcus, Gut, Intestinal tracts, Microorganism, Probiotics, Leuconostoc and Lactococcus

Received : March 2018

Revised and Accepted : January 2019

INTRODUCTION

Many microorganisms are non-pathogenic and are useful and even essential for the existence of life on earth. One such group of beneficial microorganisms are those which inhabit the gastrointestinal tract of animals. The microbiota of the gastrointestinal tract influences health and well-being of humans and animals. A beneficial association of microorganisms on the human host was probably first suggested by Doderlein *et al.* (1892) who proposed that vaginal bacteria produced lactic acid from sugars to prevent or inhibit the growth of pathogenic bacteria. Such lactic acid bacteria were also found in association with fermented milk products and were advocated for their health benefits by Metchnikoff in 1908.

It has been considered that the long life span and good health of the Bulgarian people to be related to their intake of fermented milk products which could prevent "fouling" in the large intestine and as a result, if consumed regularly, would lead to a longer and healthier life (Metchnikoff, 1908). The author suggested that the substitution of gut microbes by Yoghurt bacteria might be beneficial to the human. This paved the idea of using microbes to promote good

health and to prevent diseases. These friendly microorganisms are called 'probiotics', meaning 'for life'.

Elie Metchnikoff, a Russian physiologist and Nobel Prize winner is credited for inventing probiotics in 1907. This concept was developed further through the decades, and today, especially in Europe and Japan probiotic-focused research, product development and marketing are at an all-time high.

Before knowing about how probiotics works, it is important to know about the microbiology and physiology of human gastrointestinal tract. It has been estimated that there are about 10^{14} bacterial cells that make their homes in humans, especially 400 different species of bacteria are found in the gut. In fact it even exceeds the human population, Based on this fact it is very clear that the microbes have been found to play an important role in human health.

Most of these bacteria are not harmful and it facilitates the normal human growth and development. But some of these bacteria can have negative effects on the host. So it is important to maintain the balance of microbes to favour the beneficial bacteria over the potentially, harmful one. The composition of gut microflora varies with age, diet, environment, stress and medication of the host.

The microbes present in the gut provides various benefits to the host such as bringing out the complete digestion of any food components that are not digested in the small intestine, such as lactose in lactose

*Corresponding Author :
email: ebasanar@gmail.com



intolerant people or fibers resistant to the enzymes they encounter in the small intestine.

Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or the activity of one or a limited number of bacteria in the colon (Gibson and Roberfroid, 1995).

Similarly some intestinal microbes produce vitamins, such as biotin, pantothenic acid and vitamin B12 and it is important for the maturation of the immune system, the development of normal intestinal morphology and in order to maintain a chronic and immunologically balanced inflammatory response. It also helps in the prevention of the attachment of pathogenic microorganisms and the entry of allergens to the gut.

Probiotics is originally defined as "Microorganism promoting the growth of other microorganism" (Lilly and Stillwell, 1965). Probiotics according to present day interpretation refers to viable microorganisms that promote or support a beneficial balance of the autochthonous microbial population of the gastrointestinal tract (GI). Such microorganisms may not necessarily be constant inhabitants of the GI, but they should have beneficial effect on the general and health status of man and animal (Parker 1974; Fuller, 1989).

In the recent years, Probiotics have been defined more precisely as "mono or mixed cultures of live microorganisms which, when applied to animals or humans beneficially affect the host by improving the proportion of the indigenous microflora (Havenaar *et al.*, 1992). In relation to food, Probiotics are considered as "viable preparations in foods or dietary supplements to improve the health of humans and animals (Salminen *et al.*, 1998).

According to these definitions an impressive number of microbial species and genera are considered as probiotics. However only those strains that are classified as Lactic acid bacteria (LAB) are considered of importance with regard to food and nutrition. Among the numerous intestinal microbes, those that are expected to beneficially affect the host by improving the intestinal microbial balance, and hence are selected as probiotics and include species of genera *Lactobacillus*, *Bifidobacterium* and *Enterococcus* (Fuller 1991, Goldin *et al.*, 1992). *Bifidobacterium* sp. that specifically inhabits the intestinal tracts of animals such as *Bifidobacterium thermophilum* and *Bifidobacterium pseudolongum*, are used in animal probiotics (Abe *et al.*, 1995). Some bacteria that do not normally inhabit the intestinal tract may also come under the category of probiotics. They are used as starters in dairy products and include mainly *Lactobacillus bulgaricus*, *Streptococcus thermophilus* and

Leuconostoc and *Lactococcus* sp. However, these bacteria do not colonize the intestinal tract and their effect on intestinal microbial balance is expected to be small (Alm, 1991).

Organism other than lactic acid bacteria, which are being used in probiotic preparations, include *Bacillus* sp. Yeasts (*Saccharomyces cerevisiae*, *S. boulardii*) and filamentous fungi (*Aspergillus oryzae*) (Green *et al.*, 1999).

According to Steinkraus (1995) the traditional fermented foods contain high nutritive value and developed a diversity of flavors, aromas and textures in food substrates.

Probiotic preparations may be presented in the form of powders, tablets, capsules, pastes or sprays. Most probiotic foods in the markets worldwide are milk based and very few attempts are made for the development of probiotic foods using other fermentation substrates such as cereals. The development of non-dairy probiotic products is a challenge to the food industry, to utilize the abundant natural resources such as dietary fibre, proteins, energy, minerals and vitamins, for producing high quality functional products. But now a days Cereals such as malt, rice, corn, wheat, sorghum, milk, oats and soya are used as substrate for lactic acid fermentation based on their availability of nutrients such as carbohydrates, amino acids, peptides, salts, vitamins, minerals, etc., as these nutrients are required for the growth of probiotic microbes. Other than the cereals, brined olives, salted gherkins and sauerkraut contain high concentration of *Lactobacilli* (Molin, 2001).

Currently, there are wide ranges of probiotic products commercially available to consumers. Such products are, animal feeds, dairy foods, infant and baby foods, fruit juice based products, cereal based products and pharmaceuticals.

Probiotics must meet several basic requirements for the development of marketable probiotic products. The most important requirements include (i) The organism should survive in sufficient number in the product. (ii) Their physical and genetic stability during storage of the product be guaranteed, (iii) all of their properties essential for expressing their health benefits after consumption be maintained during manufacture and storage of the product, (iv) it should not have adverse effects on the taste or aroma of the product and, (v) it should not enhance acidification during the shelf life of the product.

Microbial probiotics should have a beneficial effect and shouldn't cause any harm to the host. So all the strains have to be checked prior to use in humans or animals and thus are given GRAS (Generally Regarded



Every strain which is going to be used as probiotics should undergo safety evaluation test such as ability of the cells to produce metabolites and enzymes, interactions with host, especially in pathogenicity, resistance to gastric acidity and bile toxicity, adhesion to gut epithelial tissue, ability to colonize the gastrointestinal tract, production of antimicrobial substances and ability to modulate immune response, viability etc.,

Eventhough probiotics have a lot of beneficial effects on humans, on rare occasions, they may develop a pathogenic relationship with a host, and illness or death of the host can result. Negative influences on human health occurs only when there is an abnormality in the host such as chemotherapy, lower immunity, imbalance in the normal flora, presence of excessive amount of Lactobacilli, etc., So proper care must be taken to maintain the balance of microflora for the beneficial effects and to prevent the negative impacts.

References:

Abe, F., Ishibashi, N. and Shimamura, S. 1995. Effect of administration of Bifidobacteria and lactic acid bacteria to new borne calves and piglets, *J. Dairy Sci.*, 78: 2838-2846.

Achi, O.K. 2005. The potential for upgrading traditional fermented foods through biotechnology, *African J. Biotechnol.*, 4(5): 375-380.

Alm, L. 1991. The therapeutic effects of various cultures - an overview. In: Therapeutic Properties of fermented milks [R.K. Robinson (ed.)], Elsevier Science, Barking, England, P.45-64.

Campbell-Platt, G. 1994. Fermented foods - a world perspective, *Food Res. Intl.*, 27: 253.

Doderlein, A., Scheidensekret, D. and Seine Bedeutung Fur Das, 1892. Puerperal fieber (The vaginaltranssudate and its significance for child bed-fever), *Central blatt fur Bacteriologie*, 11: 699-700 (in German).

Fuller, R. 1989. Probiotics in man and animals - a review, *J. Appl. Bacteriol.*, 66: 365-378.

Fuller, R. 1991. Probiotics in Human Medicine, *Gut*, 32: 439-442.

Gibson, G.R. and Roberfroid, M.B. 1995. Dietary modulation of the human colonic microbiota: introducing the concept of prebiotics, *J. Nutr.*, 125: 1401-1412.

Green, D.H., Wakeley, P.R., Page, A., Barnes, A., Baccigalupi, L., Ricca, E. and Witting, S.M., 1999. Characterisation of two *Bacillus* probiotics, *Appl. Environ. Microbiol.*, 65: 4288-4291

Goldin, B.R., Gorbach, S.C., Saxelin, M., Baraleat, S., Gualtieri, L. and Salminen, S., 1992. Survival of *Lactobacillus* sp. (Strain GG) in human gastrointestinal tract, *Dig. Dis. Sci.*, 173: 121-128.

Havenaar, R., 1992. Ten brink B. Huisint veld JHJ. Selection of strains for probiotic use. In: The Scientific Basis [R. Fuller (ed.)], Chapman and Hall, London, P.209-224.

Lilly, D.M. and Stillwell, R.H., 1965. Probiotics: growth promoting factors produced by microorganisms, *Sci.*, 147: 747-748.

Metchnikoff, E. 1908. Prolongation of Life. Putnam, New York.

Molin Goran, 2001. Probiotics in foods not containing milk or milk constituents with special reference to *Lactobacillus plantarum* 299, *Am. J. Clin. Nutr.*, 73(Suppl.): 380S-385S.

Parker, R.B. 1974. Probiotics, the other half of the antibiotic story, *Anim. Nutr. Health.*, 29: 4-8.

Salminen, S., Deighton, M.A., Benno, Y. and Gorbach, S.L. 1998. Lactic acid bacteria in health and disease. In Lactic acid Bacteria: Microbiology and Functional Aspects. 2nd ed. [S. Salminen and A. Von Wright (eds.)], Marcel Dekker Inc., New York, P.211-253.

Steinkraus, K.H., 1995. Handbook of indigenous fermented foods. Marcel Dekker, Inc., New York, P. 776.



Dr. N. S. Rajendran
Assistant Professor
Dept. of Biochemistry







List of publications and presentations

Sl. No.	Month and year	Publication - international	Presentation
1	November 2018		International seminar- Hyderabad
2	September - 2019	Carpathian Journal of Food science and technology	
3	February 2019		International seminar , Sree Krishna College, Guruvayur
4	February 2019		National seminar – Sree Narayana College, Alathur
5	January 2021	Journal of Food processing and preservation	
6	March 2021	Ukrainian Food Journal	
7	February 2023	ACS Journal of food science and technology	

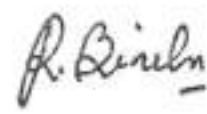


R. Birelu

Principal
Sree Narayana College, Alathur
Palakkad- 678 682, Kerala

Sl. No.	Description	Document
	<p>Paper presentation during International seminar, at National Institute of Nutrition, Hyderabad</p>	<div style="text-align: center;">  <p>50th Annual International Conference of NUTRITION SOCIETY OF INDIA Theme: India's Transition from Food Security to Nutrition Security</p> <h2>Certificate</h2> <p>This is to certify that</p> <p>Dr./Mr./Ms. <u>Rajendran N.S.</u></p> <p>has presented a paper in the Poster Session in <u>Food Science Nutrition</u></p> <p>during the 50th Annual International Conference of the Nutrition Society of India held on 15-17 November 2018 at ICMR-National Institute of Nutrition, Hyderabad Telangana State, INDIA</p> <p>Title of the paper <u>Protein From Banana Waste</u></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Secretary </div> <div style="text-align: center;">  President </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">    </div> </div>




 Principal
 Sree Narayana College, Alathur
 Palakkad- 678 682, Kerala

2 Article published in Carpathian Journal of Food science and technology

EXTRACTION AND CHARACTERISATION OF PECTIN FROM BANANA PEEL

N. S. Rajendran¹ and B.S. Harikumar Thampi²

¹Research Scholar in Biochemistry, Department of Life Sciences, University of Calicut, Kerala, India

²Department of Life Sciences, University of Calicut, Kerala, India

*brahmgub07@yahoo.co.in

<https://doi.org/10.54387/2019.11.4.4>

Article history,

Received,

29 April 2019

Accepted,

18 September 2019

Keywords,

Agriculture waste,

Value-added products,

Pectin.

ABSTRACT

Pectin is extracted from peel of banana (*Musa sapientum*). Its structural, rheological and textural features are studied. Optimum conditions of extraction upon yield was also examined. There was significant yield under the given set of experimental conditions. Degree of methylation was about 67 while percentage of acetylation was slightly above 7%. Galactose, galactosamine and rhamnose monomers and other sugars were found to be present in it. This pectin was found to be more effective in increasing the viscosity of sugar solution compared with citrus pectin. Also, banana pectin was used to prepare pineapple jam. Pineapple jam made with banana pectin was found to have more than double viscosity compared with the pineapple jam made with citrus pectin.

1. Introduction

A vast majority of the people in India depend upon agriculture as their major source of income. Increasing cost of production, lack of deserving price of the products, crop failure due to biotic and abiotic stress, natural calamities etc. are making agriculture in India a loss for the common farmer. Therefore, educated youth do not consider agriculture as a viable employment. To make agriculture more attractive, production of alternate and non-conventional value-added products from the waste materials thrown away in the farm is a solution for this problem.

According to the data published by the Horticulture Statistics Division, Ministry of Agriculture & Farmers' Welfare, Govt. of India, India is the largest producer of banana in the world, with an annual production of over 2,91,63,000 metric tonnes in 2016-17 from a total of about 8,58,000 hectare of land area spread all over the country (Pattanayak 2017). In banana cultivation rain, wind and other natural calamities cause loss for the farmer even before

harvesting. Pest infestation is another factor for the loss. After proper harvesting, the bulk of the plant body is left in the farm as waste while only the fruit bunch is commonly collected. From that fruit also, peel is thrown away as waste. The overall quantity of waste left over is much more than the economically used parts in banana cultivation.

Pectin is a plant-derived heteropolysaccharide, widely used as a gelling stabilising agent in food and pharmaceutical industries. Owing to its versatile structure and composition which ultimately determine its applications, thousands of tonnes of this soluble dietary fibre is produced globally every year and used for a variety of purposes (Willats, Knox, and Mikkelsen 2006). Being a component of cell wall of almost every land plant, it can be extracted from different types and parts of plants at different developmental stages. The structure and composition of the extracted pectin depends upon conditions used for extraction, source



R. Binu

Principal

Sree Narayana College, Alattur
Palakkad- 678 682, Kerala



Carpathian Journal of Food Science and Technology

Print : ISSN 2066-6845
Online : ISSN 2344-5459
ISSN-L 2066-6845

Vol. 10, Nr.(1) 2018



***Technical University of Cluj Napoca
U.T. Press Publishing House***

3

Paper presented during International seminar, Sree Krishna College, Guruvayur



P. Bireba

Principal
Sree Narayana College, Alathur
Palakkad - 673 602, Kerala

4

Paper presented during National seminar - Sree Narayana College, Alathur



Dept. of Botany
Sree Narayana College
Alathur, Palakkad
in collaboration with
Kerala Forest Research Institute (KFRI)



Certificate

This is to certify that M.A. Rajendran, Asst. Prof., Department of Botany, S.N. College, Alathur presented a paper titled "Benzoin Resin - Extraction from Peel and Characterisation"

at National Seminar on "Sustaining Ecological Conservation: Emerging Perspectives and Approaches" organised by the Department of Botany, Sree Narayana College, Alathur in collaboration with KFRI, Kerala Forest Research Institute, Palakkad.

Dr. Suresh Kumar
Principal, KFRI, Palakkad



Dr. E.N. Jacobson
Principal, Sree Narayana College, Alathur



R. Bireesh

Principal
Sree Narayana College, Alathur
Palakkad-675 932, Kerala

Pectin-Extraction from underground stem of banana and its structural, rheological, and textural analyses and grading

N. S. Rajendran¹ | R. S. Harikumar Thangai²

¹Department of Food Science and Technology, Tamil Nadu Veterinary, Animal and Fisheries Sciences University, Karaikal, India

Abstract
Pectin was extracted from underground stem of banana (Musa sapientum) through sequential extraction using different solvents. The extracted pectin was analyzed for its physicochemical properties. The pectin was characterized by its molecular weight, degree of substitution, and other properties. The pectin was used for the preparation of hydrogel. The hydrogel was used for the immobilization of bacteria. The pectin was used for the preparation of hydrogel. The hydrogel was used for the immobilization of bacteria. The pectin was used for the preparation of hydrogel. The hydrogel was used for the immobilization of bacteria.

1 | INTRODUCTION

Pectin is a natural polysaccharide found in the cell walls of plants. It is a linear chain of D-galacturonic acid units linked by α 1,4-glycosidic bonds. Pectin is a natural polysaccharide found in the cell walls of plants. It is a linear chain of D-galacturonic acid units linked by α 1,4-glycosidic bonds. Pectin is a natural polysaccharide found in the cell walls of plants. It is a linear chain of D-galacturonic acid units linked by α 1,4-glycosidic bonds.

Pectin is a natural polysaccharide found in the cell walls of plants. It is a linear chain of D-galacturonic acid units linked by α 1,4-glycosidic bonds. Pectin is a natural polysaccharide found in the cell walls of plants. It is a linear chain of D-galacturonic acid units linked by α 1,4-glycosidic bonds. Pectin is a natural polysaccharide found in the cell walls of plants. It is a linear chain of D-galacturonic acid units linked by α 1,4-glycosidic bonds.

Correspondence: N. S. Rajendran, Department of Food Science and Technology, Tamil Nadu Veterinary, Animal and Fisheries Sciences University, Karaikal, India. Email: rajendran@vafsu.ac.in

Received: 15 October 2011; Accepted: 15 November 2011; Published online: 15 December 2011

Journal of Food Processing and Preservation - Wiley Online Library

Journal of Food Processing and Preservation 

Edited by Charles Brennan and Brjesh K. Tiwari
Impact Factor: 1.415
2011 Journal Citation Reports (Clarivate Analytics): 152/136 (Food Science & Technology)
Online ISSN: 1745-4549
© Wiley Periodicals, Inc.

Manuscript Transfer Program



This journal works together with Wiley's Open Access journals, *Food Science & Nutrition* and *Legume Science* to enable rapid publication of good quality research that is unable to be accepted for publication by our journal. Authors will be offered the option of having the paper, along with any related peer reviews, automatically transferred for consideration.



R. Binu
Principal
Sree Narayana College, Alathur
Palakkad- 678 682, Kerala

Extraction, rheological and textural analyses and grading of pectin from stem pith of banana

Rajendran Narayathu Sivan,
Balakrishnan Naraswathy Harikumar Thangai

University of Calicut, Kerala, India

Keywords:

Banana
Pectin
Extraction
Rheology
Texture
Grading

Article history:

Received 28 09 2020
Revised in revised form 17 01 2021
Accepted 21 08 2021

Corresponding author:

Dr. S.S.
Harikumar Thangai
Email:
dthangai@uic.ac.in

DOI: 10.24205/2004-094X.2021.16-0-11

Abstract

Introduction: Purpose of the work - to identify suitable conditions for the extraction of pectin from stem pith of banana and to investigate how it affects rheological and textural properties of fruit jams.

Materials and methods: Stem pith of local banana cultivar Pectin extracted using hot water acidified with citric acid. Yield was studied and expressed as percentage of dried raw material used. Degree of methylation was studied using methanol method, monomer composition was studied using high performance size exclusion chromatography with pulsed amperometric detection. Effect of banana pectin upon firm texture and sensory characteristics of the pineapple jam prepared with it was studied using rheometer. The pectin was graded using modified line spread method.

Results and discussion: 21.81% of yield was obtained. All independent variables were found to affect the yield in varying degrees. Temperature and pH were found to be the most important conditions affecting yield, while time of heating and SSF (time of heating and solid to liquid ratio) were also found to be affecting the yield, but to a lesser extent. The highest of the yield was at a SSF of 10, pH of 1.1, temperature of 82°C and a time of heating of 12.1 minutes.

Degree of methylation was found to be 47% with a composition similar to that of pectin from other sources reported by other workers.

Banana pectin was found to be affecting the rheological and textural properties of pineapple jam. Yield stress of pineapple prepared using banana pectin was found to be 131 Pa, compared with 90 Pa for control. At the same time highest shear modulus for the jam was 84 Pa, against a value of 60 Pa for the control. While banana pectin was found to be affecting the strength of pineapple jam, more of it was required to make a jam firm, indicating a higher yield stress compared with citrus pectin.

Textural properties of the jam were affected by the addition of banana pectin. Hardness was reduced from 8.18 for the control to 7.2 for the jam while cohesiveness was reduced from 1.1 for control to 1.04 for jam. At the same time springiness was increased from 0.21 to 0.22. Gels banana pectin was found to be 90.9.

Conclusions: Stem pith of banana is a potential alternate raw material for the extraction of pectin and the pectin so extracted is suitable to use as a gelling agent in food materials.



R. Binu
Principal
Sree Narayana College, Alathur
Palakkad-678 662, Kerala

ISSN 2313-5891 (Online)
ISSN 2304-974X (Print)

Ukrainian Food Journal

Volume 10, Issue 1
2021

Київ

2021

Квітень



R. Binu
Principal
Sree Narayana College, Alathur
Palakkad- 678 6S2, Kerala

Synergistic Effect of Leaf-Pectin from *Anisochilus carnosus* (L.f.) Wall, Citric Acid, and Lysine Monohydrochloride as a Modulator on Apparent Viscosity of Sucrose-Based Multicomponent Gels

Rajendran Naravathu Sivan*

Cite This: <https://doi.org/10.1021/acsfoodscitech.3c00433>

Read Online

ACCESS |

Metrics & More

Article Recommendations

Supporting Information

ABSTRACT: Pectin was extracted from the leaves of *Anisochilus carnosus* (L.f.) Wall. Various conditions affecting the yield were analyzed. Pectin sucrose gels were prepared using leaf-pectin, and their apparent viscosity was modified using lysine monohydrochloride as a modulator. The mechanism of formation and modification of gels was analyzed using FTIR spectroscopy. The addition of 1.5% of lysine monohydrochloride, about the concentration of pectin, resulted in the gels' highest average apparent viscosity. Major changes were observed in the FTIR spectra of pectin upon the formation of gels. 0.00% of citric acid in the finished product resulted in the highest average apparent viscosity. There was a significant increase in the apparent viscosity of the sucrose gels with the use of leaf-pectin and lysine monohydrochloride with the appropriate concentration of citric acid.

KEYWORDS: leaf-pectin, lysine monohydrochloride, citric acid, modulator, apparent viscosity, multicomponent gels

1. INTRODUCTION

Pectin is an anionic heteropolysaccharide extracted from plants.¹ It is traditionally used as a gelling and thickening agent in the food and pharmaceutical industries. Apart from its known health benefits,² novel applications such as preparation of food matrices containing added nutrients,³ preservatives,⁴ modification of viscosity of other carbohydrates,⁵ food preservation and packaging,⁶ emulsion stabilizer,⁷ bismersion,⁸ targeted drug delivery,⁹ controlled drug release,¹⁰ preparation of drug-encapsulated emulsion gels,¹¹ and nanoparticles,¹² wound healing,¹³ tissue engineering,¹⁴ bioprinting,¹⁵ energy storage,¹⁶ etc. have been developed using pectin-based composites.

Traditionally, pectin is extracted as a value-added product from waste materials in the agricultural sector.¹⁷ Since new applications are evolving for pectin every day, it is necessary to search for alternate, unconventional, more consistently available sources for its extraction.¹⁸ This work is a part of a series of studies that intend to extract food-grade pectin from the leaves of plants, not just agricultural wastes. Pectin has been extracted from the leaves of plants by other authors in the past.¹⁹ In this article, the author reports the use of leaves of *Anisochilus carnosus* (L.f.) Wall, of Family Lamiaceae, Order Lamiales, Class Magnoliopsida, and Phylum Tracheophyta, as potential sources of food-grade pectin.

The most common method of extraction used by other authors is heating the biomass in the presence of acid²⁰ or enzyme in an open vessel under constant temperature. Recently, microwave extraction has also been experimented with as it reduces the consumption of resources.²¹ High-temperature high-pressure extraction is another recent development in this field.²² In this work, three methods of extraction—open vessel extraction, high-temperature high-pressure extraction, and microwave extraction—using an ammonium sulfate/oxalic acid mixture²³ were compared for yield, degree of methyl

esterification, galacturonic acid content, and FTIR spectra of extracted pectin. The pectin was transformed into a suspension in water, and apparent viscosity was measured and compared with that of standard citrus pectin. Some authors have reported earlier that the temperature and concentration of the polymer are important parameters in deciding the viscosity of its suspensions.²⁴ Therefore, these two parameters were kept constant throughout this work.

The role of sucrose in the formation of biopolymer-based gels has already been explained by some authors,²⁵ and there are reports that increasing the concentration of sucrose strengthens the gel network in such systems.²⁶ While low methyl pectin is used to prepare jam with less sucrose, high methyl pectin is used to prepare jams containing more sucrose.²⁷ Since the extracted leaf-pectin was found to be high methyl pectin, it was used to prepare sucrose gels. Gel formation is reported to involve weak interactions such as hydrogen bonds and electrostatic interactions between the different components of the gel.²⁸ To identify any such interactions during gel formation, the components were analyzed using FTIR spectroscopy before and after the formation of the gel. The apparent viscosity of the gels was measured to study the effect of leaf-pectin on the viscosity of the gels.

The applicability of any gelling agent is limited by its gelling capability (gelling is the result of a multitude of weak interactions among the components, resulting in a three-

Received: December 13, 2022
Revised: January 20, 2023
Accepted: January 30, 2023
Published: February 10, 2023

ACS Publications

© 2023 American Chemical Society

<https://doi.org/10.1021/acsfoodscitech.3c00433>
ARTICLE IN ADVANCE



R. Binil
Principal
Sree Narayana College
Palakkad- 678 002, Kerala