

INDEXING



### Aims and Scope

The aim of the Diet Factor is to offer the scientists and researchers an international forum to enable the rapid dissemination of practical and social applications of research at the forefront of food and nutritional sciences as well as the interdisciplinary research that spans these two fields. Diet Factor publishes double blind peer-reviewed articles that covers all aspects of food science, including the interface between production agriculture and food, as well as how food science influences health and nutrition. In all cases, the key findings in multi-disciplinary articles must address some innovative or controversial practices related to food science.

Diet Factor is committed to maintaining the highest standards of professional ethics, accuracy, and quality in all matters related to handling manuscripts and reporting scientific information. The journal welcomes empirical and applied research, viewpoint papers, conceptual and technical papers, case studies, meta-analysis studies, literature reviews, mini reviews and letter to the editors which take a scientific approach to the topics related to health and nutrition.

### Types of Articles

- Research Papers
- Short Communications
- Review and Mini-reviews
- Commentaries
- Perspectives and Opinion
- Meta Analysis
- Case Reports
- Case Studies
- Case Control Studies

Reviews on recent progress in food sciences are commissioned by the editors. The purpose of the Diet Factor is to publish scientific and technical research papers to bring attention of International Researchers, Scientists, Academicians, and Health Care Professionals towards recent advancements in food sciences. The articles are collected in the form of reviews, original studies, clinical studies among others. It may serve as a global platform for scientists in relevant fields to connect and share ideas mutually. This journal is open to all the research professionals whose work fall within our scope. Submissions are welcome and may be submitted here.

✉ [editor@dietfactor.com.pk](mailto:editor@dietfactor.com.pk)

**Title**

The title of the paper should provide a concise statement of the contents of the paper. A good title is very important and will attract readers and facilitate retrieval by online searches, thereby helping to maximize citations. The title should include topical keywords and allude to the interesting conclusions of the paper. A title that emphasizes the main conclusions, or poses a question, has more impact than one that just describes the nature of the study.

**Running Head**

Running head should be added in the header along with the page numbers.

**Type of Article**

Research Article/ Case Report/ Review Article/ Opinion/ Short Communication/ Mini Review/ Letter to Editor

**Running Title:** A short version of the paper title.

**Keywords** The major keywords used in the article have to be mentioned.

**Authors**

List here all author names Author<sup>1</sup>, Author<sup>2</sup> and Author<sup>3</sup>

<sup>1</sup>Author department, University, Country

<sup>2</sup>Author department, University, Country

<sup>3</sup>Author department, University, Country

**\*Corresponding Author**

Author name, Affiliation, Department Name, University Name, Address, City, State, Country, E-mail:

**Abstract**

Abstract should include a brief content of the article. It should be structured not more than 250 words. It should include following sub headings: Objective, Methods, Results, Conclusions.

**Abbreviations**

If there are any abbreviations in the article they have to be mentioned.

**INTRODUCTION**

Provide a context or background for the study (i.e., the nature of the problem and its significance). State the specific purpose or research objective of, or hypothesis tested by, the study or observation; the research objective is often more sharply focused when stated as a question. Both the main and secondary objectives should be made clear, and any pre-specified subgroup analyses should be described. Give only strictly pertinent references and do not include data or conclusions from the work being reported.

**METHODS**

The Methods section should include only information that was available at the time the or plan of the protocol. All information gathered during the conduct of study should be included in the result section.

Study Design, Inclusion / Exclusion Criteria, Data collection Procedure, Statistical analysis.

**RESULTS**

Present your results in logical sequence in the text, tables and illustrations, giving the main or most important findings first.

Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. When data are summarized in the Results section, give numeric results not only as derivatives (for example, percentages) but also as the absolute numbers from which the derivatives were calculated, and specify the statistical methods used to analyze them. Table font should be 10 and caption should be below table and figure.

Data should not be duplicated in both figures and tables. The maximum limit of tables and figures should not exceed more than 4. Mention the findings of the study in paragraph, while mentioning figure and table number in text in sequential order.

### TABLE

Table should not be copy pasted or in picture form

### DISCUSSION

Discuss your findings by comparing your results with other literature

### REFERENCES

References should not be less than 20.

In text references should be in number style. For Example [1]

Follow the Pubmed Referencing style

Provide the DOI link

#### Example

Cook NR, Rosner BA, Hankinson SE, Colditz GA. Mammographic screening and risk factors for breast cancer. American Journal of Epidemiology. 2009 Dec;170(11):1422-32. doi: 10.1093/aje/kwp304.

If there are more than six authors, write *et al.* after the first six names.

### CONCLUSION(S)

Conclusion should elucidate how the results communicate to the theory presented as the basis of the study and provide a concise explanation of the allegation of the findings.

### ACKNOWLEDGEMENT

Provide the list of individuals who contributed in the work and grant details where applicable

#### Plagiarism policy

Similarity index should be less than 19, and less than 5 from individual sources.

#### Authorship Letter

Signed authorship letter by all authors including their current department, University, City, Country, Email.

#### Declaration Form

Signed declaration form submit by corresponding author.

**The submission of article should include: manuscript according to journal guidelines, authorship letter, declaration form. It should be submitted to the following email id: editor@dietfactor.com.pk**

# DIET FACTOR

JOURNAL OF NUTRITIONAL  
& FOOD SCIENCES



ISSN Online (2789-8105) ISSN Print (2789-8091)

## VOLUME 3

### Editor-in-Chief

**Prof. Dr. Riffat Mehboob, Ph.D**

Lahore Medical Research Center LLP, Lahore, Pakistan  
mehboob.riffat@gmail.com

### Honorary Editor

**Prof. Dr. Aurangzeb, Ph.D**

Lahore Medical Research Center LLP, Lahore,  
Pakistan

### Editors

**Dr. Muhammad Akram Tariq, Ph. D**

Higher Education Department (HED),  
Lahore, Pakistan

### Associate Editors

**Dr. Ammar Ahmad Khan, Ph.D**

University Institute of Food Science and Technology,  
The University of Lahore, Lahore, Pakistan

### Assistant Editor

**Dr. Tabussam Tufail, Ph.D**

University Institute of Diet and Nutritional  
Sciences, The University of Lahore, Lahore,  
Pakistan

### Managing Editor

**Khurram Mehboob**

Lahore Medical Research Center LLP, Lahore,  
Pakistan

### Biostatistician

**Humaira Waseem**

Fatima Jinnah Medical University, Lahore, Pakistan

### Advisory Board

**Prof. Dr. Shahida Parveen, MBBS, M.Phil**

Lahore Medical Research Center LLP, Lahore, Pakistan

### Senior Editor

**Prof. Dr. Muhammad Imran, Ph.D**

University of Narowal, Narowal, Pakistan

**Dr. Hina Mukhtar, Ph.D**

Assistant Professor  
Kohsar University Murree, Murree, Pakistan

**Dr. Anees Ahmed Khalil, Ph.D**

University Institute of Diet and Nutritional Sciences,  
The University of Lahore, Lahore, Pakistan

### Production Editor

**Zeeshan Mehboob**

Lahore Medical Research Center LLP, Lahore  
Pakistan

**Prof. Dr. Muhammad Saleem Rana, Ph.D**

The University of Lahore, Lahore, Pakistan

EDITORIAL TEAM

I  
S  
S  
U  
E  
1



Published by:  
CrossLinks  
International  
Publishers



# DIET FACTOR

JOURNAL OF NUTRITIONAL  
& FOOD SCIENCES

ISSN Online (2789-8105) ISSN Print (2789-8091)

## VOLUME 3

EDITORIAL BOARD

### Advisory Board

**Prof. Dr. Muhammad Mustehsan Bashir, MBBS, Ph.D**  
King Edward Medical University, Lahore, Pakistan

**Prof. Dr. Muhammad Umair Arshad, Ph.D**  
Directorate of Industrial Linkages, GCUF, Pakistan

**Prof. Dr. Fridoon Jawad Ahmad, Ph.D**  
University of Health Sciences, Lahore, Pakistan

**Prof. Dr. Shahzad Anwar, MBBS, FCPS**  
Azra Naheed Medical College, Lahore, Pakistan

### National Members

**Dr. Saz Muhammad, Ph.D**  
Assistant Professor  
GC University, Faisalabad, Pakistan

**Dr. Muhammad Asif Naveed, MBBS, FCPS, Ph.D\***  
Associate Professor  
University of Health Sciences, Lahore, Pakistan

**Dr. Maham Akhlaq, Ph.D**  
Assistant Professor  
University of Health Sciences, Lahore, Pakistan

**Dr. Muhammad Salabat Khan, Ph.D**  
Assistant Professor  
Kohsar University Murree, Murree, Pakistan

**Dr. Asif Nadeem, Ph.D**  
Associate Professor  
Department of Biotechnology, Virtual University of  
Pakistan, Pakistan

**Dr. Shazia Kanwal Malik, Ph.D**  
Senior Scientist  
Lahore Medical Research Center LLP, Lahore,  
Pakistan

**Dr. Shaista Jabeen, Ph.D\***  
Assistant Professor  
The University of Lahore, Lahore, Pakistan

**Dr. Bushra Bashir, MBBS, FCPS, Ph.D\***  
Assistant Professor  
Allama Iqbal Medical College, Lahore, Pakistan

**Dr. Shazia Zahra, Ph.D\***  
Assistant Professor  
Fatima Memorial System and NUR International  
University, Lahore, Pakistan

**Dr. Tania Ahmed Shakoori, MBBS, Ph.D**  
Associate Professor  
Department of Physiology, University of Health  
Sciences, Lahore, Pakistan

**Dr. Sumaira Anjum, Ph.D**  
Assistant Professor  
Kinnaird College for Women University, Lahore,  
Pakistan

**Dr. Humera Kausar, Ph.D**  
Associate Professor  
Kinnaird College for Women University, Lahore,  
Pakistan

ISSUE 1



Published by:  
CrossLinks  
International  
Publishers

# DIET FACTOR

JOURNAL OF NUTRITIONAL  
& FOOD SCIENCES



ISSN Online (2789-8105) ISSN Print (2789-8091)

## VOLUME 3

### National Members

**Dr. M. Anees Ur Rehman, Ph.D**

Assistant Professor  
Food Science and Technology, Ruth Pfau College  
of Nutrition Sciences, Lahore, Pakistan

### International Members

**Dr. Imran Shahid, Ph.D**

Associate Professor  
Umm Al Qura University, Makkah, Saudi Arabia

**Dr. Jaspreet Kaur, Ph.D**

Senior Scientist  
Neuroscience Department, University of  
Copenhagen, Copenhagen, Denmark

**Dr. Muhammad Sulaiman Yousafzai, Ph.D**

Senior Scientist  
National Institute of Health (NIH), USA

I  
S  
S  
U  
E  
1

EDITORIAL BOARD



Published by:  
**CrossLinks  
International  
Publishers**



**Editorial**

**Eating Disorders**

Riffat Mehboob

01

**Guest Editorial**

**Gastroesophageal Reflux Disease (GERD)**

Tabassum Tufail

02

**Letter to Editor**

**Pre-History and History of Legumes to 1900**

Huma Bader ul Ain

03-04

**Review Article**

**Phytochemicals And Nutraceuticals as A Promising Drug Candidate in Autism Spectrum Disorder**

Maria Aslam and Muhammad Barkaat Azam

05-09

**Original Articles**

**Evaluation of Pregnancies with Pre-existing Hypertension and Diabetes**

Hateem Qaiser, Akash John, Abid Ali, Shehr Bano and Nayyar Ashfaq

10-13

**Evaluation of Liver Changes in Type-2 Diabetes Mellitus Patients using Computed Tomography**

Nayyar Ashfaq, Akash John, Abid Ali, Amina Sharif Bhatti and Hateem Qaiser

14-18

**Physical and Sensory Evaluation of Peanut Yogurt**

Misbah Arshad, Zainab Sharmeen, Asad Nawaz and Amir Iqbal

19-23

**Awareness Regarding Colostrum Feeding Among Nursing Females**

Zainab Murtaza Malhi, Faiz-ul-Hassan Shah, Noor ul Huda, Maria Aslam and Misbah Arshad

24-28





# DIET FACTOR

JOURNAL OF NUTRITIONAL  
& FOOD SCIENCES



ISSN Online (2789-8105) ISSN Print (2789-8091)

## VOLUME 3

### Original Articles

---

#### **Chemical Characterization of Tamarind Plum Squash**

Muhammad Yasir Rafique, Misbah Arshad, Zainab Sharmeen, Shahid Bashir,  
Majida Umar Nasib and Noor ul Huda

**29-32**

TABLE OF CONTENTS

ISSUE 1



Published by:  
**CrossLinks  
International  
Publishers**



# DIET FACTOR

Journal of Nutritional & Food Sciences  
<https://www.dietfactor.com.pk/index.php/df>  
Volume 3, Issue 1 (Jan-Jun 2022)



## Editorial

## Eating Disorders

### Riffat Mehboob<sup>†</sup>

<sup>†</sup>Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan

\*[mehboob.riffat@gmail.com](mailto:mehboob.riffat@gmail.com)

## ARTICLE INFO

### How to Cite:

Mehboob, R. (2022). Eating Disorders. DIET FACTOR (Journal of Nutritional & Food Sciences), 3(1). <https://doi.org/10.54393/df.v3i1.51>

A much discussed and worrisome topic today is growing ratio of eating disorders among people especially youth. Eating disorders are characteristic behavioral disorders which present persistent disturbances in eating behavior with body weight, body image and body shape continuously preoccupying an individual's mind. These behavioral disorders affect a person's social life along with affecting physical and psychological health. Excessive food intake, compulsive strenuous exercise, food restriction, starvation, use of laxatives, vomiting immediately after eating, bingeing and purging are some behaviors which depict the presence of an eating disorder. Collectively, up to 5% population, mostly adolescents and young adults suffer from eating disorders. Usually both male and female of any age and ethnicity are at equal risk of having an eating disorder but generally women suffer more as compared to men. Of eating disorders, anorexia and bulimia nervosa are common among females but can also occur in males. Psychiatric problems also occur hand in hand with eating disorders such as disproportionate mood swings, OCD, anxiety and panic attacks and different drugs abuse. Treatment of eating disorders involves treating psychological as well as physical complications along with addressing malnutrition, GERD and other gastrointestinal problems. Out of other eating disorders bulimia nervosa has shown increasing trends among youth. Binge eating or Bulimia nervosa is eating larger quantity of foods in shorter time span. A binge eater firstly binges on food, feels ashamed of his/her action and weight, purges secretly and also feels guilty for eating too much. While bingeing is done with consuming large quantity of food or filling up to the throat within short time, associated discomfort, nausea and vomiting source the purging phase. Occurrence of bulimia nervosa among young females and adolescents is high but statistics also indicate increasing ratios in young adolescent males. Although bulimia is common among youth, it can affect individuals of all ages and gender having low, normal or high weight. Adolescents and young adults suffering from bulimia nervosa are often those who are mentally preoccupied with weight issues, fear to gain weight, have a dreadful urge to lose weight, are super conscious and discontented with their body image, size and shape. An emblematic case of an individual with bulimia nervosa is often an adolescent to young adult female or male having an enthusiastic, goal oriented, perfectionist, and diligent, introverted and stubborn personality. Such individuals are also awful self-critics and tend to have low self-esteem based on body image distortion. Regardless of the physical parameters, bingeing on large quantities of food and then purging them out gives the person a sense of satisfaction by eating the desired type of food in hefty amounts along with a sense of control and relief by throwing up or excreting it out as an attempt to maintain weight. Generally, the affected individuals do this to eat whatever they want while maintaining or losing weight upon wish. This mechanism also relieves stress, anxiety and reduces negative moods for them, keeping them calm and composed by giving the person a sense of control in at least one aspect of his/her life, which largely explains reason for the increased ratios of bulimia among youth who are constantly subjected to body shaming, peer pressure, fear of being left out, sky rocketing pressure from social media to be and look perfect and to be up to the mark with the societal beauty standards.



## Guest Editorial

### Gastroesophageal Reflux Disease (GERD)

Tabassum Tufail<sup>1\*</sup>

<sup>1</sup>University Institute of Diet and Nutritional Sciences, The University of Lahore, Lahore, Pakistan

\*[tabussam.tufail@dnsc.uol.edu.pk](mailto:tabussam.tufail@dnsc.uol.edu.pk)

## ARTICLE INFO

### How to Cite:

Tufail, T. (2022). GASTROESOPHAGEAL REFLUX DISEASE . DIET FACTOR (Journal of Nutritional & Food Sciences), 3(1). <https://doi.org/10.54393/df.v3i1.31>

Gastroesophageal reflux disease (GERD) is a chronic disease usually caused by the reflux of acidic gastric and duodenal contents into the distal esophagus. Major symptoms of GERD are acidity, heartburn, acid regurgitation, and chest pain. It is a digestive disease with the direct medical costs estimated around 9.3 billion dollars annually, and with the symptoms portending a low quality of life. The most common and known phenotype of GERD is Reflux esophagitis (RE). Many countries has a high prevalence of GERD, Especially in USA, about 44% of Americans suffer from GERD symptoms at least once monthly, 17% once weekly, and 7% once daily. Traditionally, GERD is less common in Asians. The overall prevalence of RE in Japanese adults is about 16%. Aging causes various physiologic changes in GIT that may increase the risk of developing complications such as GERD. Age-related changes in the physiology of the esophagus can be divided into two categories: motility and sensory. In general, changes in esophageal motility are mild and tend to be quiet in an older patient. It is possible that both the motility and nerve changes observed in the esophagus of older patients, combined with lower comorbidities and medication use, lead to a higher risk of esophageal mucosa to reflux and cause inflammation and development of GERD-related problems. Previously, it was thought that gastric acid release decreased with age, but further research revealed that the underlying mechanism may have been *Helicobacter pylori* infection that eventually developed atrophic gastritis. As the prevalence of *Helicobacter pylori* infection has decreased over the last 3-4 decades, more recent studies have shown that gastric acid secretion is maintained normally in more than 80% of elderly subjects. Comorbidity and commonly used drugs can reduce esophageal sphincter tone, esophageal clearance mechanisms, and saliva production.

A low-fat diet likely contributes to a more favorable stomach distribution. Male gender, civil servant, smoking, strong tea, alcohol consumption, meat diet and body mass index (BMI) are risk factors associated with GERD. In many countries, dietary fat, cholesterol, saturated fatty acid (SFA), dietary fiber, and other nutrients are associated with GERD. An epidemiological study showed a link between high fat intake and GERD. Also, dietary fiber, particularly cereal fiber, has been found to reduce the risk of adenocarcinoma of the esophagus and stomach, of which GERD is a well-known risk factor. The mechanism may be that dietary fiber reduces the intake of gastric nitrites, which is thought to promote reflux by relaxing the lower esophageal sphincter (LES). A high-fiber diet has played a protective role in GERD. However, dietary fiber reduced the number of gastroesophageal refluxes, but increased their duration, and had no significant effect on gastric emptying and gastric acid secretion. Diet plays an important role in controlling acid reflux symptoms and is the first line of treatment used for people with GERD. Foods high in fiber make you feel full, so you're less likely to overeat, which can contribute to heartburn. So get healthy fiber from these foods, such as whole grains like oatmeal, couscous, and brown rice, root vegetables like sweet potatoes, carrots, and beets, and green vegetables like asparagus, broccoli, and green beans. Lemon juice is generally considered very acidic, but a small amount of lemon juice mixed with warm water and honey has an alkalizing effect, neutralizing stomach acid. In addition, honey has natural antioxidants that protect the health of cells. On the other hand, Ginger is another top digestive aid due to its medicinal properties. It is alkaline in nature and anti-inflammatory, which eases irritation in the digestive tract. Try sipping ginger tea whenever you feel heartburn. The goal is to create a diet based on a healthy variety of foods, including fruits and vegetables, lean protein sources, complex carbohydrates, and healthy fats. If you suspect that food may be triggering or worsening your GERD symptoms, try keeping a daily, weekly diary.



## Letter to Editor

### Pre-History and History of Legumes to 1900

Huma Bader ul Ain<sup>†</sup>

<sup>†</sup>University Institute of Dietetics and Nutritional Sciences, The University of Lahore, Lahore, Pakistan

## ARTICLE INFO

### How to Cite:

Badar Ul Ain, H. . (2022). Pre-History and History of legumes to 1900. DIET FACTOR (Journal of Nutritional & Food Sciences), 3(1). <https://doi.org/10.54393/df.v3i1.35>

Legumes are thought to be one of the earliest human-domesticated plants. We know from Bible that Lentils were also the ingredient of the cultivation and food of ancient Egypt. In Turkey, fossilized seeds of pea, lentils and other leguminous plants have been discovered from the fire places of Neolithic age, approximately 7000 to 8000 years B. C. ago. The human population inhabiting around the lakes during 4000-5000 B.C. in Switzerland, grew peas and a dwarf field bean. Farmers in China started to cultivate soy bean during 2000-3000 B.C. These crops were introduced and then started to cultivate in America and Asia nearly 3,000 years ago.

For soil improvement Romans used used legumes in pastures dating 37 B. C. [1]. In Finland, pea cultivation has been documented since the 17th century it was common in the southwest, where soils contained enough clay and arable fields were available, and spread slowly throughout the country [2]. In Sub-Saharan Africa regarding the trends in production, distribution, trade of legumes, the approximate used area for total harvesting of all the leguminous crops was 20 million ha in 2006-2008, which is 28% of total area used for cultivating crops worldwide. From this area, 54% of the area was used for cow peas, 28% for dry beans and 18% for all other lentils. West and Central Africa produced estimated 2.6 million tons of cowpeas on 7.8 million ha per annum in 1990s, which was about 69% of the global production and harvesting [3].

There is an estimated 10% of pulse contributions to protein intake and the top 16 developing countries out of 28, that are producing these crops, are from Sub-Saharan Africa. The top 5 countries in this list (Brazili, Rwanda, Uganda, Kenya, Comoros) are also in Sub-Saharan Africa. For the production of lentils in Sub-Saharan Africa, the area specified for this purpose is 17% while it is 10% in rest of the world [4]. The land required for the cultivation of legumes is of poor quality, meaning that there are no strict criteria for land and can be grown easily on any type of land. On the other hand, cereals such as wheat, maize, rice, barley requires fertilized land, temperature and humidity-controlled conditions for proper growth and they are also very sensitive crops. Legumes can be grown in areas with scarcity of water and are resistant to tough weather and land conditions. Unfortunately, the pulses and legumes do not get investment, resources and the Governments in most of the countries do not pay much attention to these crops as they are mostly consumed as secondary food while cereals are mostly assumed as priority attention crop. Cereals are considered as food security crops and policies are devised for their growth and protection [5].

The proportions of cultivated legumes have great differences across the world. The cultivation of legumes uses 16% of total cultivated land globally and the soybean crop among these is the most important crop in America in terms of food choice, trade and financial impact. In Europe the area of grain legumes is about 4 million, in this area 8 million t legume seeds are

produced. Pea is the dominant legume seed in Europe, which is cultivated on about 1 million ha [6]. Regular consumption of legumes are highly recommended due to their nutritional value among the food stuffs. In Middle Ages, they were one of the most important sources of energy (starch) and protein in the human diet. But now legumes have been replaced by potatoes, food of animal origin or cereals by their role [7]. However, attitudes towards legumes have been improving for some time now, and they are no longer consistently viewed as old-fashioned. The reasons for this are health benefits of legumes are being increasingly recognized and acknowledged [8].

## REFERENCES

- [1] Allen ON, Allen EK. *The Leguminosae, a source book of characteristics, uses, and nodulation*. Univ of Wisconsin Press; 1981.
- [2] Grotenfelt, G. 1992. *Suomalainen peltokasviviljely* Lys. IV. Eri peltokasvein viljelys. Otava, Helsinki. 517 p. (In Finnish).
- [3] Langyintuo AS, Lowenberg-DeBoer J, Faye M, Lambert D, Ibro G, Moussa B, Kergna A, Kushwaha S, Musa S, Ntoukam G. Cowpea supply and demand in West and Central Africa. *Field crops research*. 2003 May 1;82(2-3):215-31.
- [4] Akibode CS, Maredia MK. Global and regional trends in production, trade and consumption of food legume crops. 2012 Oct 15.
- [5] Byerlee D, White R. Agricultural systems intensification and diversification through food legumes: technological and policy options. In *Linking research and marketing opportunities for pulses in the 21st century 2000* (pp. 31-46). Springer, Dordrecht.
- [6] Hedley CL, editor. *Carbohydrates in grain legume seeds: improving nutritional quality and agronomic characteristics*. CABI; 2001.
- [7] Deutsche Gesellschaft für Ernährung (Hg). 13. Ernährungsbericht. Köllen Druck und Verlag GmbH, Bonn (2016)
- [8] Sirtori CR, Triolo M, Bosisio R, Bondioli A, Calabresi L, De Vergori V, Gomaraschi M, Mombelli G, Pazzucconi F, Zacherl C, Arnoldi A. Hypocholesterolaemic effects of lupin protein and pea protein/fibre combinations in moderately hypercholesterolaemic individuals. *British Journal of Nutrition*. 2012 Apr;107(8):1176-83



## Review Article

# Phytochemicals And Nutraceuticals as A Promising Drug Candidate in Autism Spectrum Disorder

Maria Aslam<sup>1\*</sup> and Muhammad Barkaat Azam<sup>1</sup>

<sup>1</sup>University Institute of Diet and Nutritional Sciences, The University of Lahore, Lahore, Pakistan.

## ARTICLE INFO

### Key Words:

Autism, neurological disorders, children, stress, neurodevelopmental disorders

### How to Cite:

Aslam, M., & Barkaat Azam, M. . (2022). Phytochemicals And Nutraceuticals as A Promising Drug Candidate in Autism Spectrum Disorder: Phytochemicals and Nutraceuticals. *DIET FACTOR (Journal of Nutritional & Food Sciences)*, 3(1), 05-09.

<https://doi.org/10.54393/df.v3i1.12>

### \*Corresponding Author:

Maria Aslam

University Institute of Diet and Nutritional Sciences, The University of Lahore, Lahore, Pakistan

[maria.aslam@ahs.uol.edu.pk](mailto:maria.aslam@ahs.uol.edu.pk)

Received Date: 25<sup>th</sup> March, 2022

Acceptance Date: 19<sup>th</sup> May, 2022

Published Date: 30<sup>th</sup> June, 2022

## ABSTRACT

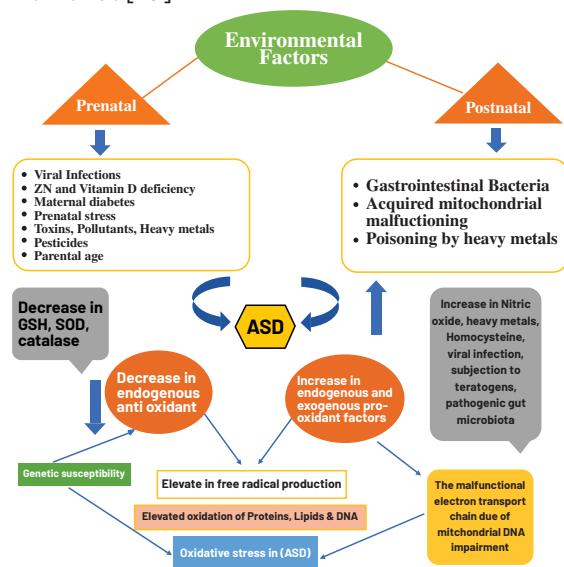
Autism is a diversified group of neurological disorders having unknown cause which are interpreted entirely based on behavioral examination. During the last two decades, the frequency and prevalence rate of autism spectrum disorder (ASD) have risen. The elevated level of oxidative stress and reduced antioxidant potential has been associated with this disorder. Further in autism, the genetic as well as environmental determinants may escalate susceptibility to oxidative stress. Elevated oxidative stress in ASD give rise to the development of this disorder regarding both clinical manifestations and pathological process. Autism manifests the characteristics like changes in complicated human behaviors which includes social interaction, communication and stereotypes. In addition, children suffering from autism may not be able to cope anxiety and behave unreasonably even to otherwise benign stimulators. It is proposed by growing evidence that epigenetic mechanisms play a role in the etiology of autism. To detect epigenetic biomarkers for ASD, numerous studies have endeavored until now. Children having autism spectrum disorder (ASD) usually show remarkable behavioral difficulties in combination with dysfunction in social relationship.

## INTRODUCTION

Autism paves a spectrum of neurodevelopmental diseases which start in the initial childhood and have potential to remain till adolescence and adulthood. According to Diagnostic and Statistical Manual of Mental Disorders (DSM-5), people suffering from Autism spectrum disorder (ASD) have compromised social skills, impediments in speech and communication and repetitive behaviors at some level [1]. ASD is a framework applied to demonstrate individuals having particular integration of deterioration in social interaction, speech and obsessive behaviors, immensely confined concerns and/or neurological behaviors occurring at initial stages of life [2]. The loss in two major domains, first, constraints in social relationships, communication and stereotyped, constant

patterns of behaviors are the characteristics of autism which is a common neuropsychiatric problem [3]. Autism is a highly inherited and diversified group of neurological development phenotype identified in greater than 1% of children [4]. The prevalence of autism is fairly less than 1% globally but in high-earning countries, estimates are greater [2]. 1 in 59 children (almost 1.7%) has been reported its prevalence in United States of America (USA) [5]. It is a growth phase classified by compromised social interaction, speech and repetitive behavior affecting 1 in 59 children. By 2020, ASD is predicted to affect 1 in almost forty (40) children [6]. Autism is complex neurological development impairment and the symptoms vary from absence of social relations and loss of communication to

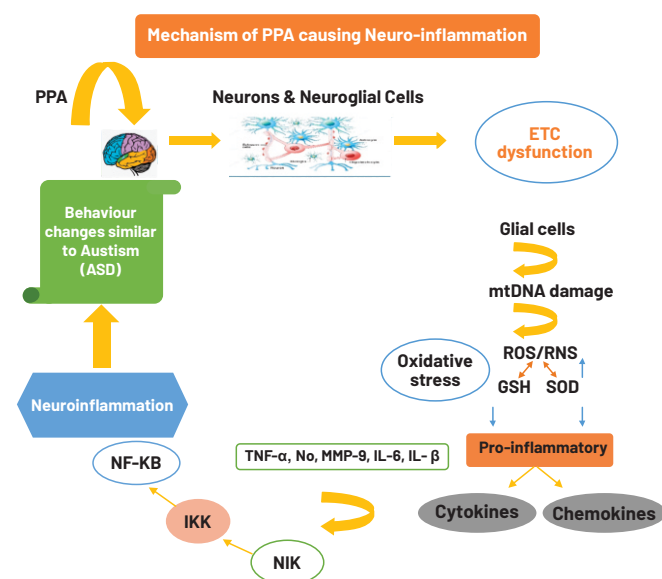
inflexible, stereotypic and repetitive behaviors. This disorder has also been linked with comorbidities like, epilepsy, aggression, loss in sensory processing, anxiety and also with Attention-deficit/hyperactivity disorder (ADHD) [7]. Pre-natal stress has also been related with greater risk to develop autism in the child. Elevated levels of oxidative stress and reduced levels of antioxidant like glutathione peroxidase, catalase and superoxide dismutase thereby increasing inflammation, malfunctioning of immune system and mitochondria leading cause of ASD [8]. Adults suffering from post-traumatic stress disorder (PTSD) face complicated retarding impulses and has been linked to Autism in children [9]. Autism can be diagnosed at the juvenile age of eighteen (18) months, so it is recommended that typical inspection of ASD at the age of 18-24 months with proceeding developmental surveillance in the primary care to be intervened [10].



**Figure 1:** Different environmental predisposing factors which could be important for development of ASD by influencing genetic marks

**Pathophysiology:** In autism spectrum disorder (ASD), imbalance in the pathway of PI3K/Akt/mTOR has become the center of attention identify a curative role for tau depletion in down regulating this pathway and ameliorating the symptoms related with autism [10]. The distinct immune cells, mast cells, are provoked by stress and environmental stimuli that might then provoke microglia resulting in aberrant synaptic pruning as well as malfunctioning of neural connection. The “fear threshold” in the amygdala might be changed by this process and prompt a heightened “fight or flight” response. The integration of environmental stimuli together with corticotropin releasing hormone (CRH) which is secreted under the condition of stress, might be the main

contributors to the pathological process of autism [7]. Alterations in the sequence of DNA is DNA methylation which is linked to autism causation [11]. In ASD, the prevalence range of gastrointestinal complications is nine percent (9%) to seventy percent (70%) and it correlates with attitudes and behaviors compatible with the autistic endophenotype suggesting that these might be considered the main complications related with autism. A robust link of gut to brain cross-communication takes place due to gut dysbiosis which is responsible for abundant amount of propanoic acid (PPA) production, a short-chain fatty acid (SCFA), by impaired intestinal microflora in patients with autism. This aggravates impairment in neurochemical, mitochondrial as well as behavioral function taking place in autism [7].



**Figure 1:** In Autism, the mechanism of oxidative stress

It is considered that autism appear during the course of initial cortical development. But, the definite stages of development and related molecular system which prime disease tendency are evasive. Schafer *et al.*, studied subject-acquired induced pluripotent stem cells (iPSCs) during the recapitulation of cortical development in order to figure out initial neurodevelopmental modifications in ASD with macrocephaly. ASD-related alterations in the growth pattern of initial development of neuron, which involved temporal downregulation of certain gene systems and structural growth escalation were revealed by our study. It is indicated by changed chromatin accessibility that observed alterations return back to a pathologically central phase in (NSC's). Concerted disproportionately represented network components in neural stem cells of control group was adequate to provoke autism-like properties, and bypassing the neural stem cells (NSC's) stage through direct conversion of autism induced

pluripotent stem cells (iPSCs) into induced neurons terminated autism-related phenotypes. It is recognized by our findings that heterochronic fluctuations of a gene network which organized initially in development, cause subsequent neurodevelopmental aberrations in autism [12]. Autism is a complex, diversified group of neurodevelopmental disorders occurring due to interaction between genes of environmental factors. ASD is closely linked with behavior alterations and loss of social interaction and communication. It has been suggested by existing research on pathophysiology that there is an association between severity of ASD symptoms and gastrointestinal problems. The intestinal permeability, mucosal immune function might be affected by downregulation of gut micro flora and intestinal inflammation. It has also been suggested by several studies that dietary components (food allergens/toxins) and metabolic activity of the gut microflora role might be related with behavioural modifications in neurodevelopmental disorders including ASD [13]. Sleep related problems are very common in young children suffering from autism (ASD) and are related with evidence of aggressiveness, anxiety or depression and attention problems [14]. The brain bases of autism (ASD) remain unknown despite its growing prevalence. It is indicated by aberrant levels of *N*-acetyl compounds, creatine + phosphocreatine, glutamate+glutamine or choline compounds computed by proton magnetic resonance spectroscopy which energetic metabolism of mitochondria, glial or neuron density and/or inflammation may add up to neuropathogenesis of ASD. The neuroanatomic distribution of these metabolites might assist analyze key theories of autism [14]. The gut microflora varies among typically developing (TD) and individuals with autism, although leaving it uncertain either the microflora contributes to symptoms besides from genetic risks. We transplanted gut microflora into disease free mice, taken from patients having autism or typically developing control group which showed that colonization of ASD gut flora is adequate for the induction of distinctive autism related behaviors. The mice brains having colonization of autism gut flora exhibit substitute grafting of autism-related genes. The particular species of bacteria as well as their metabolites take part in regulation of behaviors related to autism. It is anticipated by microbiome and metabolome profiles of mice fostering the gut flora of human. In fact, the treatment with metabolite of candidate microbe of an autism mouse model improved and regulated respectively behavioral abnormalities and excitability of neurons in the brain. We suggest that gut microflora, through formation of neuroactive metabolites, modulate the mice behaviors. This indicate that gut and brain

relations add up the pathophysiology of autism spectrum disorder [15].

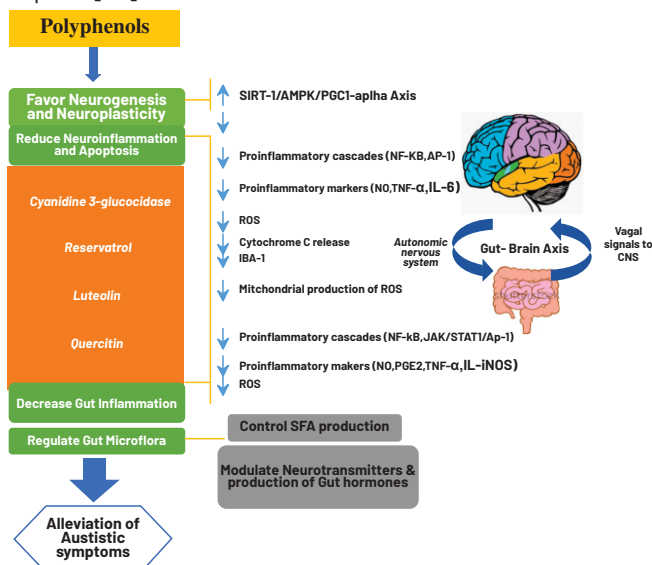
#### **Natural Products to Combat Autism Spectrum Disorder –**

**A Mechanistic Approach:** Dietary phytochemicals, as a substitute neurotherapeutic moiety, are considered to be secure and beneficial. By regulating signaling pathways like NF- $\kappa$ B, Nrf2, MAPK cascade or Sirtuin-FoxO cascade, these compounds give neuroprotection. In scientific literature, there has been current evidence that dietary phytochemicals like curcumin, sulforaphane, naringenin and resveratrol regulate gut-brain debate responsible for behavioral, mitochondrial and biochemical malfunctioning and also cellular and behavioral sensory modifications. These dietary phytochemicals may be composed of novel brain-centered supply systems that control their constraints of reduced oral bioavailability and short half-life resulting in elongated action. The work on the formation of brain-centered potential therapeutic agents for neurological disorders like autism is still insufficient. In this chapter, we explore credible mechanisms and proof from scientific research studies as well as from our personal research for the usage of sulforaphane, resveratrol, naringenin and curcumin as neurotherapeutic agents for ASD [6].

**Polyphenols:** To fight against neurological (brain) disorders, dietary polyphenols are identified as auspicious nutraceuticals. These are the distinctive compounds which have indicated to be very beneficial to neutralize the neurodegeneration among other morbid conditions, oxidative stress, reduce inflammation, helpful in the prevention as well as treatment of numerous chronic diseases. In order to prevent and treatment of neurological disorders, the ability of these dietary polyphenols has not only been linked with their potential to arrive up the brain which rely upon their chemical composition and interaction promptly with cells in brain, but also on their capacity to regulate the cross-talk among gut and brain, interfering with various branches of this axis [16]. In order to prevent from or treat psychological or neurological disorders, one or more cannabinoids and/or terpenes together with psilocybin and/or psilocin can be used [17]. The compositions cannabinoid is depicted including minimum one (1) particular quantity of cannabinoid, particular quantity of a primary terpene, non-cannabinoid minimum 5% in terms of weight, carrier, non-terpene, optionally minimum three (3) secondary terpenes, glycol <5% in terms of weight and water <20% in terms of weight, where said non-terpene, non-cannabinoid carrier contains cellulose and terpenes to cannabinoids is about 0.1 to almost 1.0. In terms of weight-to-weight ratio in said composition. Also depicted are the above compositions where said non-cannabinoid, non-terpene carrier contains



<5% by weight cellulose and almost 0.05-1.0 is the terpenes to cannabinoids weight-to-weight ratio in said compositions, making terpene-enriched cannabinoid compositions with improved therapeutic effect compared with that of a composition consisting the similar quantities of cannabinoids and one half the amount of said primary terpene [18].



**Figure 3 :** Flow chart representing the major targets of polyphenols in ASD

**Alkaloids:** The aromatic oils, terpenoids, naturally occurring in numerous plants and greater than 200 have been described. Phytol, pinene, linalool, limonene, myrcene, caryophyllene oxide, nerolidol and  $\beta$ -caryophyllene all are the examples of terpenoids. The regulatory bodies such as the Food and Extract Manufacturers Association and the United States Food and Drug Administration (FDA) recommend that these terpenoids are generally Recognized as Safe as food additives [19].

**Flavonoids:** here has been a revival of attraction in pseudo and plant-based flavonoids as regulator of ( $GABA_A$ ) receptor activity which affect restriction controlled by the main repressive neurotransmitter gamma-amino butyric acid-A ( $GABA_A$ ) in the brain. The captivating domain comprise (i) flavonoids which *in vitro* studies exhibit subtype selectivity in recombinant receptor persistent with their behavior related impacts *in vivo*, (ii) by flavonoids, flumazenil-insensitive regulation of  $GABA_A$  receptor action, (iii) by benzodiazepines the capacity of a few flavonoids to function as second-order regulators of first-order regulation and (iv) on  $GABA_A$  receptor complexes, the recognition of the various active sites of flavonoids. In the unavailability of  $GABA_A$ , a growing and captivating domain is the triggering of  $GABA_A$  receptors through flavonoids. For the formation of latest therapeutic agents, the flavonoids

are beneficial scaffolds which is implied by comparatively their hard configuration. Flavonoids have broad spectrum influences on several biological marks as similar to steroids. The confront is to perceive the structural components of flavonoid influences on certain marks and formulation of agents which are particular for these marks [20]. Natural flavonoids such as quercetin and luteolin display strong anti-inflammatory as well as anti-oxidant functions and restrict the secretion of inflammatory mediators from human Mast Cells (MCs). Luteolin and its structurally related quercetin inhibit allergic inflammation as well as the release of interleukin-6 and interleukin-8 (IL-6), (IL-8), histamine, leukotrienes and TNF-alpha from cultured mast cells of humans. It is indicated by brain expression, microglia activation and also by elevated levels of IL-6 and TNF-alpha in plasma that there is a close link between autism spectrum disorders (ASDs) brain inflammation [21].

**Naphthoquinones:** To aggregate neuroactive compounds, fermentation is considered as a beneficial procedure. The alterations in the quantities of neuroactive substances which are present in food are permitted by food processing. Food components may influence the production of neuroactive compounds by gut microflora. There is an association between probiotics, prebiotics and psychological health of humans. Specific plants and microbes manufacture the neuroactive compounds through playing various roles, particularly as a stress response. In foods, the well-known neuroactive compounds are dopamine, serotonin, melatonin, norepinephrine, tyramine, histamine, tryptamine, kynurenic acid, kynurenine, gamma-aminobutyric acid (GABA) and  $\beta$ -phenylethylamine. A few of these compounds are present in fermented foods that may affect mood or behavior as well as on overall human health [22].

## CONCLUSIONS

Autism is broad spectrum disorder associated with behavioral abnormalities and elevated stress and anxiety levels. Environmental pollutants, poor maternal diet, gut microbiome anomalies are major etiological factors of ASD. Diet comprising of bioactive components plays a pivotal role in combating neurological disorders as Autism and Alzheimer. Gut microflora is associated with good brain health so, neuroactive substances in foods possesses health benefits; these substances can also be manufactured by gut flora that is very appealing subject to evaluate the relationship of gut microflora with brain health.

## REFERENCES

- [1] Strunecká A, Strunecký O, Guan Z. The resemblance of fluorosis pathology to that of autism spectrum

- disorder: A mini-review. *Fluoride*. 2019 Apr; 52(2):105-15.
- [2] Lord C, Brugha TS, Charman T, Cusack J, Dumas G, Frazier T, et al. Autism spectrum disorder. *Nature Reviews Disease Primers*. 2020; 6(1):5. doi: 10.1038/s41572-019-0138-4.
- [3] Jussila K, Junttila M, Kielinen M, Ebeling H, Joskitt L, Moilanen I, et al. Sensory abnormality and quantitative autism traits in children with and without autism spectrum disorder in an epidemiological population. *Journal of autism and developmental disorders*. 2020 Jan; 50(1):180-188. doi: 10.1007/s10803-019-04237-0.
- [4] Grove J, Ripke S, Als TD, Mattheisen M, Walters RK, Won H, et al. Identification of common genetic risk variants for autism spectrum disorder. *Nature genetics*. 2019 Mar; 51(3):431-444. doi: 10.1038/s41588-019-0344-8.
- [5] Hyman SL, Levy SE, Myers SM. Identification, evaluation, and management of children with autism spectrum disorder. *Pediatrics*. 2020 Jan; 145(1):e20193447. doi: 10.1542/peds.2019-3447.
- [6] Theoharides TC, Kavalioti M, Tsilioni I. Mast cells, stress, fear and autism spectrum disorder. *International journal of molecular sciences*. 2019 Jul; 20(15):3611. doi: 10.3390/ijms20153611.
- [7] Bhandari R, Paliwal JK, Kuhad A. Neuropsychopathology of Autism Spectrum Disorder: Complex Interplay of Genetic, Epigenetic, and Environmental Factors. *Advances in Neurobiology* 2020; 24:97-141. doi: 10.1007/978-3-030-30402-7\_4.
- [8] Manivasagam T, Arunadevi S, Essa MM, Saravana Babu C, Borah A, Thenmozhi AJ, et al. Role of Oxidative Stress and Antioxidants in Autism. *Advances in Neurobiology*. 2020; 24:193-206. doi: 10.1007/978-3-030-30402-7\_7.
- [9] Dickinson S, Agazzi H. A Father with Posttraumatic Stress Disorder and a Son with Autism Spectrum Disorder: A Parent-Child Interaction Therapy Case Study. *Military Behavioral Health*. 2019 Jul; 7(3):345-53.
- [10] Modi ME, Sahin M. Tau: A Novel Entry Point for mTOR-Based Treatments in Autism Spectrum Disorder? *Neuron*. 2020 May; 106(3):359-361. doi: 10.1016/j.neuron.2020.04.019.
- [11] Kimura R, Nakata M, Funabiki Y, Suzuki S, Awaya T, Murai T, et al. An epigenetic biomarker for adult high-functioning autism spectrum disorder. *Scientific reports*. 2019 Sep; 9(1):13662. doi: 10.1038/s41598-019-50250-9.
- [12] Schafer ST, Paquola AC, Stern S, Gosselin D, Ku M, Pena M, et al. Pathological priming causes developmental gene network heterochronicity in autistic subject-derived neurons. *Nature neuroscience*. 2019 Feb; 22(2):243-255. doi: 10.1038/s41593-018-0295-x.
- [13] Mahajan PV, Salvi PS, Mahajan S, Subramanian S. A Mini Review of Gastrointestinal Pathology and Nutrition in Autism Spectrum Disorder. *Journal of Advances in Medicine and Medical Research*. 2019 Jun; 1-8. doi.org/10.9734/jammr/2019/v29i1130144
- [14] Zaidman-Zait A, Zwaigenbaum L, Duku E, Bennett T, Szatmari P, Mirenda P, et al. Factor analysis of the children's sleep habits questionnaire among preschool children with autism spectrum disorder. *Research in developmental disabilities*. 2020 Feb; 97:103548. doi: 10.1016/j.ridd.2019.103548.
- [15] Sharon G, Cruz NJ, Kang DW, Gandal MJ, Wang B, Kim YM, et al. Human gut microbiota from autism spectrum disorder promote behavioral symptoms in mice. *Cell*. 2019 May; 177(6):1600-1618.e17. doi: 10.1016/j.cell.2019.05.004.
- [16] Serra D, Almeida LM, Dinis TC. Polyphenols in the management of brain disorders: Modulation of the microbiota-gut-brain axis. In *Advances in food and nutrition research* 2020; 91:1-27. doi: 10.1016/bs.afnr.2019.08.001.
- [17] Küçüksen M, Küçüksen AN, inventors; Procure Beheer BV, assignee. Psilocybin and/or psilocin in combination with cannabinoids and/or terpenes. United States patent US 2020 Aug;(10):706-729.
- [18] Eyal AM, inventor; Buzzelet Development, Technologies Ltd, assignee. Terpene-enriched cannabinoid composition. United States patent application US 15/578,882. 2018 Jun.
- [19] Poleg S, Golubchik P, Offen D, Weizman A. Cannabidiol as a suggested candidate for treatment of autism spectrum disorder. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*. 2019 Mar; 89:90-96. doi: 10.1016/j.pnpbp.2018.08.030
- [20] Hanrahan JR, Chebib M, Johnston GA. Flavonoid modulation of GABAA receptors. *British journal of pharmacology*. 2011 May; 163(2):234-45. doi: 10.1111/j.1476-5381.2011.01228.x.
- [21] Tsilioni I, Taliou A, Francis K, Theoharides TC. Children with autism spectrum disorders, who improved with a luteolin-containing dietary formulation, show reduced serum levels of TNF and IL-6. *Translational psychiatry*. 2015 Sep; 5(9):e647. doi: 10.1038/tp.2015.142.
- [22] Yılmaz C, Gökmen V. Neuroactive compounds in foods: Occurrence, mechanism and potential health effects. *Food Research International*. 2020 Feb; 128:108744. doi: 10.1016/j.foodres.2019.108744



## Original Article

# Evaluation of Pregnancies with Pre-existing Hypertension and Diabetes

Hateem Qaiser<sup>1</sup>, Akash John<sup>1</sup>, AbidAli<sup>1</sup>, Shehr Bano<sup>1</sup> and Nayyar Ashfaq<sup>1</sup>

<sup>1</sup>Department of Allied Health Sciences, University Institute of Radiological Sciences and Medical Imaging, The University of Chenab, Gujrat, Pakistan

## ARTICLE INFO

### Key Words:

Diabetes mellitus, hypertension, pregnancy, polyhydramnios, oligohydramnios

### How to Cite:

Qaiser, H., John, A., Ali, A., Bano, S., & Ashfaq, N. (2022). Evaluation of Pregnancies with Pre-existing Hypertension and Diabetes: Pregnancies with Pre-existing Hypertension and Diabetes. *DIET FACTOR (Journal of Nutritional & Food Sciences)*, 3(1).

<https://doi.org/10.54393/df.v3i1.44>

### \*Corresponding Author:

Hateem Qaiser  
Department of Allied Health Sciences, University Institute of Radiological Sciences and Medical Imaging, The University of Chenab, Gujrat, Pakistan

Received Date: 2<sup>nd</sup> April, 2022

Acceptance Date: 3<sup>rd</sup> May, 2022

Published Date: 30<sup>th</sup> June, 2022

## ABSTRACT

The complications in pregnancy can happen due to diabetes and hypertension which may affect the mother or the fetus. **Objective:** To evaluate pregnancy in hypertensive and diabetic pregnant women to detect associated risk factors and complications. **Methods:** The research was a cross-sectional method of study, conducted over 4 months from December 2021 to March 2022 in a private hospital in Gujranwala, Pakistan. A sample size of 50 was considered as per convenience. The data was analyzed using SPSS V20 software. The age of patients considered was minimum 18 years to maximum 50 years. The scan was done using greyscale type 2D Mindary ultrasound equipment. A written consent form was also taken from patients. **Results:** The results showed that 15(30%) patients were presented with diabetes mellitus, 32(64%) has hypertension and 3(6%) has both hypertension and diabetes mellitus. The complications included low lying placenta and placental abruption in 1(2%), polyhydramnios in 3(6%) and oligohydramnios in 1(2%). Microcephaly was found in 1(2%) and hydrocephalus was seen in 2(4%). Fetal abortion was found in 7(14%) and only 3(6%) have chance of having a fetus with abnormalities due to hypertension and diabetes whereas most of them have normal birth 43(86%) with no complications. **Conclusion:** The majority of women with diabetes mellitus and hypertension can have a normal pregnancy and birth, but some may face difficulties such as intrauterine fetal mortality, fetal congenital abnormalities and defects and still birth.

## INTRODUCTION

The duration of pregnancy is 280 days, 40 weeks, or 9 months. It is divided into three periods. The 1st period is the 1st trimester which begins from the 1st week to 12 weeks in which the oogenesis is going on [1]. The 2nd period is the 2nd trimester which begins from 13 to 26 weeks, and the last period is the 3rd trimester which begins from 27 till delivery [2]. Pregnancy is a critical duration for both mother and fetus due to several problems and complications that may occur during this period [3]. These problems include diabetes mellitus, gestational diabetes, hypertension, and induced hypertension [4]. Hypertension is thought to complicate nearly 10% of all pregnancies around the world [5]. These problems lead to reverse outcomes even for mother and fetus such as abortions, malformations, preeclampsia, stillbirth and intrauterine

fetal restrictions [6]. One of the most common central nervous system congenital malformations owing to hypertension and diabetes in pregnancy is congenital hydrocephalus [7,8]. Hypertension in pregnancy is defined as having a systolic blood pressure (BP) of 140 mmHg or higher and a diastolic blood pressure (BP) of 90 mmHg or higher on at least two occasions more than four hours apart when resting [9]. A systolic blood pressure of 160 mmHg or higher and diastolic blood pressure of 110 mmHg or higher reported on two separate occasions is considered severe hypertension [10]. Pregnancy induced hypertension are classified into 4 categories: gestational hypertension, preeclampsia/eclampsia, chronic hypertension and preeclampsia superimposed on chronic hypertension [11]. In the United States, hypertension is the most prevalent

pregnancy problem, affecting 8-10% of pregnancies [12]. The hypertensive disorders of pregnancy continue to be one of the leading causes of pregnancy-related maternal mortality, accounting for 7-12% of all pregnancy-related maternal fatalities each year in United States [13,14]. Diabetes is linked to an increased probability of maternal and newborn morbidity in pregnant women, [15] and it remains a substantial medical problem [16]. It raises the risk of delivery trauma, and cesarean section by increasing the prevalence of macrosomia [17]. Obesity, family history of diabetes, impulsive abortions, and previous pregnancies with gestational diabetes had a increased rate of gestational diabetes mellitus in current pregnancy [18]. In addition, gestational diabetic patients have increased risk of perinatal death, neonatal hypoglycemia, hyperbilirubinemia, gestational hypertension and pre-eclampsia [19]. Perinatal outcomes, linked to inadequate glycemic management in mothers, have a 42.9 percent motility rate [20]. When it comes to assessing the fetus during pregnancy, ultrasound has become a necessary component [21]. It is a simple, non-invasive process that can be used to determine whether or not a woman is pregnant [22,23]. It was previously used to confirm pregnancy in the first trimester, whether positive or negative, gestational age, and the number of children [24]. Ultrasound evaluates gender, number of gestational sacs, anticipated delivery date, amniotic fluid volume, placenta site and size and fetal anomalies [25]. This study was used to assess pregnancy in hypertensive and diabetic pregnant women, as well as the detection of hypertension and diabetes-related complications like abortion, polyhydramnios, oligohydramnios, placental site abnormalities and fetal malformations. The importance of ultrasound as an early diagnostic tool and prediction of hypertension and diabetes related problems in pregnancy will be highlighted in this study.

## METHODS

The research was a cross-sectional method of study, conducted over 4 months from December 2021 to March 2022. A sample size of 50 was considered as per convenience. The age of patients for this study was minimum 18 years to maximum 50 years who had undergone ultrasonography. This study was conducted in the department of radiology in a private hospital in Gujranwala, Pakistan. The scan was done using greyscale type 2D Mindary ultrasound equipment. A written consent form was also taken from patients. The data were analyzed using SPSS version 20.0.

## RESULTS

This study was conducted by dividing patients into three age groups, ranging from under 20 to above 43 years old.

Age Groups	Frequency (%)
<25	8(16%)
25-40	39(78%)
>40	3(6%)
Total	50(100%)

**Table 1:** Frequency distribution of age group

Table 1 shows that the second group (25-40 years) with maximum frequency 39(78%) of the sample as compared to the first group (under 25 years) with 8 (16%) of the sample and the third group (40 years and more) with minimum frequency 3(6%) of the sample.

Incidence of diabetes mellitus and hypertension	Frequency (%)
Hypertension	32 (64%)
Diabetes Mellitus	15 (30%)
Diabetes And Hypertension	3 (6%)
Total	50 (100.0%)

**Table 2:** Frequency distribution of incidence of diabetes mellitus and hypertension

Table 2 shows that there is a higher incidence of hypertension 32 (64%), followed by 15 (30%) of diabetes mellitus and the least incidence of having both hypertension and diabetes mellitus that is only 3(6%).

Placental Site	Frequency (%)
Normal	48 (96%)
Low Lying	1(2%)
Abruption	1(2%)
Total	50 (100%)

**Table 3:** Frequency distribution of placental sites

Table 3 shows that there is a higher incidence of having normal placental site 48(96%), but only 1(2%) are presented with the low lying placenta and 1 (2%) with placental abruption.

The Volume of Amniotic Fluid	Frequency (%)
Normal	46 (92.0%)
Polyhydramnios	3 (6.0%)
Oligohydramnios	1 (2.0%)
Total	50 (100.0%)

**Table 4:** Frequency distribution of volume of amniotic fluid

Table 4 shows that normal amniotic fluid volume was found in 46(92%), with polyhydramnios present in 3(6%) and least were presented with oligohydramnios in 1(2%).

Incidence of Abortion	Frequency (%)
Yes	7 (14%)
No	43 (86.0%)
Total	50 (100.0%)

**Table 5:** Frequency distribution of incidence of abortion

Table 5 shows that there is less chance of fetal abortion 7 (14%) due to hypertension and diabetes whereas most have normal birth 43(86%).

Incidence of Fetal Anomaly	Frequency (%)
Normal	47 (94%)
Hydrocephaly	2 (4%)
Microcephaly	1 (2%)
Total	50 (100%)

**Table 6:** Frequency distribution of incidence of fetal anomalies

Table 6 shows that patients with diabetes and hypertension had an 3 (6%) chance of having a fetus with abnormalities: Microcephaly was found in 1 (2%) and hydrocephalus was seen in 2 (4%).

## DISCUSSION

This study was conducted using ultrasonography to analyze pregnancy in diabetic and hypertensive women in Gujranwala, Pakistan, by analyzing amniotic fluid volume, placenta site, abortions, and fetal malformations. A total of 50 pregnant diabetic and hypertensive women were scanned to determine their pregnancy status from the perspective of the prior issues. The current study showed that 39 (78%) of the pregnant women affected by hypertension and diabetes mellitus are from 25-40 years of age while only 8 (16%) of female below 25 years of age and 3 (6%) of female above 40 years were affected with diabetes and hypertension in the current study, it was proved that pregnant women in the adult age group most commonly affected with complications due to hypertension and diabetes. A previous study was done by Bener et al 2011 also mentioned that adult age pregnancy also affected by complications due to gestational diabetes [15]. Among these most of the women were affected by hypertension i.e., 32 (64%), 15 (30%) had diabetes mellitus and only 3 (6%) of women are affected by both diabetes and hypertension. A previous study done by Mahmoud 2019 also found that most of the pregnant women were affected by hypertension. It is also shown in this study that 48 (96%) of women with diabetes and hypertension have a normal placental site and only 1 (2%) are presented with the low-lying placenta and 1 (2%) placental abruption [2]. The volume of amniotic fluid was normal in 46 (92%) of women with 3 (6%) having polyhydramnios and 1 (2%) having oligohydramnios. Mahmoud 2019 also proved that there were more normal placental sites but can cause low lying and placental abruption in very less cases [2]. He also mentioned that there are more normal amniotic fluid volume due to hypertension and diabetes and has very less polyhydramnios and oligohydramnios in a few cases. There are only 7 (14%) abortions due to diabetes and hypertension in pregnancy whereas in 43 (86%) there is normal birth. 47 (94%) of pregnant women with hypertension and diabetes had no incidence of any fetal anomaly while 2 (4%) of a fetus is presented with hydrocephaly and 1 (2%) of the fetus is presented with microcephaly. Mahmoud 2019 also proved that there are

fewer abortions due to hypertension and diabetes and had lesser incidence of fetal anomalies [2].

## CONCLUSIONS

This study concluded that the majority of women with diabetes mellitus/ hypertension can have a normal pregnancy and birth, but some may have difficulties such as fetal congenital abnormalities and defects, and stillbirth. Age is a continuous risk factor for diabetes/ hypertension during pregnancy. The diabetes and hypertension-related problems include abortions, placenta site abnormalities, polyhydramnios, oligohydramnios, and fetal malformations. The Complications in the mother can lead to later diabetes and hypertension, as well as an increased risk of death and morbidity, whereas fetal complications include abnormalities and congenital deformities.

## REFERENCES

- [1] Naeye RL. Maternal body weight and pregnancy outcome. *The American journal of clinical nutrition*. 1990 Aug; 52(2):273-9. doi: 10.1093/ajcn/52.2.273.
- [2] Mahmoud SH. Evaluation of Pregnancy in Patients with Hypertension and Diabetes Using Ultrasonography: Sudan University of Science and Technology; 2019.
- [3] Pacini L, Digne F, Boumendil A, Muti C, Detaint D, Boileau C, et al. Maternal complication of pregnancy in Marfan syndrome. *International journal of cardiology*. 2009 Aug; 136(2):156-61. doi: 10.1016/j.ijcard.2008.04.035.
- [4] Ali S, Dornhorst A. Diabetes in pregnancy: health risks and management. *Postgraduate medical journal*. 2011 Jun; 87(1028):417-27. doi: 10.1136/pgmj.2010.109157.
- [5] Dhinwa M, Gawande K, Jha N, Anjali M, Bhadoria AS, Sinha S. Prevalence of hypertensive disorders of pregnancy in India: A systematic review and meta-analysis. *Journal of Medical Evidence*. 2021; 2(2):105. doi.org/10.4103/JME.JME\_168\_20
- [6] Ogawa K, Morisaki N, Piedvache A, Nagata C, Sago H, Urayama KY, et al. Association between birth weight and risk of pregnancy-induced hypertension and gestational diabetes in Japanese women: JPHC-NEXT study. *Journal of epidemiology*. 2022 Apr; 32(4):168-73.
- [7] Kalyvas AV, Kalamatianos T, Pantazi M, Lianos GD, Stranjalis G, Alexiou GA. Maternal environmental risk factors for congenital hydrocephalus: a systematic review. *Neurosurgical focus*. 2016 Nov; 41(5):E3. doi: 10.3171/2016.8.FOCUS16280.
- [8] Hasan SA, Abbasi SUH, Baig SA, Mansur-Ul-Haq S,

- Jabbar S. Unusual Risk Factors Associated With Congenital Hydrocephalus: Case Series Of 3 Patients. *Medical Channel*. 2012 Jul; 18(3):38.
- [9] Everitt IK, Freaney PM, Wang MC, Grobman WA, O'Brien MJ, Pool LR, et al. Association of state medicaid expansion status with hypertensive disorders of pregnancy in a singleton first live birth. *Circulation: Cardiovascular Quality and Outcomes*. 2022 Jan; 15(1):e008249. doi: 10.1161/CIRC-OUTCOMES.121.008249.
- [10] Vest AR, Cho LS. Hypertension in pregnancy. *Current atherosclerosis reports*. 2014 Mar; 16(3):395. doi: 10.1007/s11883-013-0395-8.
- [11] Folk DM. Hypertensive disorders of pregnancy: overview and current recommendations. *Journal of midwifery & women's health*. 2018 May; 63(3):289-300. doi: 10.1111/jmwh.12725.
- [12] Kloppenburg JE, Nunes AP, Jesdale WM, Leftwich HK. Prevalence and outcomes of hypertension in pregnancy in non-metropolitan and metropolitan communities. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2022 Feb; 28:1-7. doi: 10.1080/14767058.2022.2044773.
- [13] Varagic J, Desvigne-Nickens P, Gamble-George J, Hollier L, Maric-Bilkan C, Mitchell M, et al., Maternal morbidity and mortality: Are we getting to the "heart" of the matter? *Journal of Women's Health*. (Larchmt). 2021 Feb; 30(2):178-186. doi: 10.1089/jwh.2020.8852.
- [14] Heck JL, Jones EJ, Bohn D, mccage S, Parker JG, Parker M, et al. Maternal mortality among American Indian/Alaska Native women: A scoping review. *Journal of Women's Health*. 2021 Feb; 30(2):220-229. doi: 10.1089/jwh.2020.8890.
- [15] Bener A, Saleh NM, Al-Hamaq A. Prevalence of gestational diabetes and associated maternal and neonatal complications in a fast-developing community: global comparisons. *International journal of women's health*. 2011; 3:367-73. doi: 10.2147/IJWH.S26094.
- [16] Vambergue A, Fajardy I. Consequences of gestational and pregestational diabetes on placental function and birth weight. *World journal of diabetes*. 2011 Nov; 2(11):196-203. doi: 10.4239/wjd.v2.i11.196.
- [17] Sesmilo G, Prats P, Álvarez M, Romero I, Guerrero M, Rodríguez I, et al. Gestational diabetes prevalence and outcomes in women undergoing assisted reproductive techniques (ART). *Endocrinología, Diabetes y Nutrición*. 2022 Feb.
- [18] Saxena P, Tyagi S, Prakash A, Nigam A, Trivedi SS. Pregnancy outcome of women with gestational diabetes in a tertiary level hospital of north India. *Indian Journal of Community Medicine: Official Publication of Indian Association of Preventive & Social Medicine*. 2011 Apr; 36(2):120-3. doi: 10.4103/0970-0218.84130.
- [19] Poolsup N, Suksomboon N, Amin M. Effect of treatment of gestational diabetes mellitus: a systematic review and meta-analysis. *Plos one*. 2014 Mar; 9(3):e92485. doi: 10.1371/journal.pone.0092485.
- [20] Kalra P, Kachhwaha CP, Singh HV. Prevalence of gestational diabetes mellitus and its outcome in western Rajasthan. *Indian journal of endocrinology and metabolism*. 2013 Jul; 17(4):677-80. doi: 10.4103/2230-8210.113760.
- [21] Westerneng M, de Jonge A, van Baar AL, Witteveen AB, Jellema P, Paarlberg KM, et al. The effect of offering a third-trimester routine ultrasound on pregnancy-specific anxiety and mother-to-infant bonding in low-risk women: A pragmatic cluster-randomized controlled trial. *Birth*. 2022 Mar; 49(1):61-70. doi: 10.1111/birt.12573.
- [22] Lewis C, Hill M, Chitty L. Non-invasive prenatal diagnosis for single gene disorders: experience of patients. *Clinical genetics*. 2014 Apr; 85(4):336-42. doi: 10.1111/cge.12179.
- [23] Lindberger E, Wikström A-K, Sundström Poromaa I, Ahlsson F. Maternal Blood-Based Protein Biomarkers in Relation to Abdominal Fat Distribution Measured by Ultrasound in Early Mid-Pregnancy. *Reproductive Sciences*. 2022 Feb. doi: 10.1007/s43032-022-00876-4.
- [24] Hsu S, Euerle BD. Ultrasound in pregnancy. *Emergency Medicine Clinics North America*. 2012 Nov; 30(4):849-67. doi: 10.1016/j.emc.2012.08.001.
- [25] Simpson LL, editor *Ultrasound in twins: dichorionic and monochorionic*. *Seminars in perinatology*; 2013 Oct; 37(5):348-58. doi: 10.1053/j.semperi.2013.06.013



## Original Article

# Evaluation of Liver Changes in Type-2 Diabetes Mellitus Patients using Computed Tomography

Nayyar Ashfaq<sup>1</sup>, Akash John<sup>1</sup>, Abid Ali<sup>1</sup>, Amina Sharif Bhatti<sup>1</sup> and Hateem Qaiser<sup>1</sup>

<sup>1</sup>Department of Allied Health Sciences, University Institute of Radiological and Medical Imaging Sciences, The University of Chenab, Gujrat, Pakistan

## ARTICLE INFO

### Key Words:

Fatty liver disease, Diabetes mellitus, Hypertension, Computed tomography

### How to Cite:

Ashfaq, N. ., John, A. ., Ali, A. ., Sharif Bhatti, A. ., & Qaiser, H. . (2022). Evaluation of Liver Changes in Type-2 Diabetes Mellitus Patients using Computed Tomography: Liver Changes in Type-2 Diabetes Mellitus Patients using Computed Tomography. DIET FACTOR (Journal of Nutritional & Food Sciences), 3(1). <https://doi.org/10.54393/df.v3i1.45>

### \*Corresponding Author:

Nayyar Ashfaq  
Department of Allied Health Sciences,  
University Institute of Radiological and Medical  
Imaging Sciences, The University of Chenab,  
Gujrat, Pakistan

Received Date: 10<sup>th</sup> April, 2022

Acceptance Date: 16<sup>th</sup> May, 2022

Published Date: 30<sup>th</sup> June, 2022

## ABSTRACT

There is an association between hypertension, non-alcoholic fatty liver, and diabetes mellitus. Diabetic patients commonly have fatty liver and heart problems. **Objectives:** To evaluate the adverse effects of diabetes on the liver, and to determine the association between diabetes and metabolic associated fatty liver disease using Computed Tomography. **Methods:** It was a cross-sectional study conducted on 50 diabetic patients using convenient sampling method. The research was carried out in CT Department of Radiology of Tertiary care hospital in Gujranwala, Pakistan. Males and females between the ages of 30-80 who had undergone abdominal CT scans were included in this study. A written consent form was also signed by patients. This study was conducted over 4 months from December 2021 to March 2022. Data were entered and analyzed using SPSS version 20.0. **Results:** The current study revealed that male diabetic patients have more chances to have non-alcoholic fatty liver disease 33 (66%) than females 17 (34%). The diabetic patients of in senior age group (50-60) years were most commonly affected by 27 (54%) with metabolic-associated fatty liver disease. According to findings diabetic patients frequently had fatty liver disease 22 (44%) and fatty liver disease along with cardiovascular disease was 11 (22%). Some other findings with less occurrence of non-alcoholic fatty liver disease were hypertension and hyperlipidemia 7(14%). **Conclusions:** Diabetic patients are more common to be related with fatty liver disease. There was strong connection between diabetes mellitus and fatty liver disease. Elderly patients are more commonly affected.

## INTRODUCTION

Diabetes mellitus is defined as disturbances in carbohydrates, lipids, and protein metabolism because of abnormalities in production of insulin or action of insulin in addition to chronic hyperglycemia. Almost 90% to 95% are affected by Type-2 diabetes mellitus [1]. Previous research has linked diabetes to an increased threat of chronic liver disease and metabolic associated liver disease [2]. In 2015, there were an estimated 400 million confirmed cases of diabetes worldwide. The number of confirmed Type-2 diabetes mellitus cases is hope for to reach 640 million by 2040 [3]. In individuals with metabolic associated fatty liver disease, diabetes mellitus type-2 raises the danger of

liver-related mortality rate by 22 times. On the other hand, fatty liver disease can increase the chances of death in diabetes patients. A community-based study of Type-2 diabetic patients found that those with metabolic associated liver disease had higher risk of mortality than those without any metabolic diseases [4]. However, 30%-60% of Type-2 diabetes patients have metabolic liver disease [5]. Endangerment for liver diseases in patients of diabetes are age, gender, dyslipidemia, metabolic disorders and increased weight [6]. A strong correlation between diabetes and non-alcoholic metabolic liver disease indicates that 80 to 90% of diabetes patients will

acquire metabolic fatty liver disease [7]. Diabetes is a persistent metabolic disease distinguished by high sugar in blood, insulin resistance and insufficiency [5]. Main symptoms include excessive thirst, excessive urination, and loss of weight. Further indicators to look out for are unbalanced diet, fatigue, and unhealed sores [8]. Now a days, the risk of diabetes mellitus has increased 30–40% due to sedentary lifestyle [9]. Diabetes appears to be associated with liver damage. Homeostasis of carbohydrates relies heavily on the liver [10]. Hepatocellular glycogen accumulation causes hepatomegaly and abnormal liver enzymes in patients with poorly managed diabetes [11]. High cholesterol, seizures, nephrotic syndrome, and insufficient blood flow in the limbs, which can lead to amputations, are all deep rooted effects of impaired glucose tolerance [12]. Type-2 hypoglycemia can be avoided by feeding well, staying active, and sustaining healthy weight [13]. When blood glucose levels aren't under control, metformin is frequently prescribed. Insulin shots may be required for a large number of patients [14]. Men are more probably to develop nonalcoholic fatty liver disease among diabetes patients [15]. Imaging tests have been used to help in diagnosis, risk stratification, disease progression, and therapy response [16]. Although the US is arguably the most extensively used as an imaging tool for diagnosing hepatic changes, it has a poor sensitivity for diagnosing severe hepatic encephalopathy and does not offer accurate quantitative data as well as technician dependence [17]. US may not be an acceptable method for detecting the pathology in patients with metabolic liver disease [18]. There may also be computed tomography which provides more accurate examination along with Hounsfield unit measurements of liver [19]. For detecting steatosis, non-contrast CT scanning appears more successful than contrast enhanced computed tomography [20]. Evaluation of hepatic attenuation independently, normalization of liver attenuation by splenic attenuation, expressing discrepancy in spleen and liver attenuation, and giving proportion of findings are only a few of the methods for determining the correct CT readings [21]. The spleen attenuates roughly 8–10 HUs in normal persons, which is less than the [22]. A liver attenuation of < 40 HUS on CT. Hepatosteatosis is found to be significantly predicted by CT [23]. Spleen attenuation ratios in CT are beneficial for identifying >30 percent steatosis. This approach has a sensitivity of 73%–100% and a specificity of 100% [24]. As a result, assessment of liver fat on CT is a relevant modality for individuals suffering from metabolic syndrome, such as those with diabetes mellitus [25]. This study showed that diabetes mellitus is strongly linked to metabolic associated liver diseases. This study will evaluate the impact of

diabetes on liver on computed tomography. Obesity and a sedentary lifestyle are two variables that extend the chance of diabetes. To avoid diabetes-related disorders such as non-alcoholic hepatic disease maintain a healthy lifestyle consisting of nutritious food, activity, and body weight.

## METHODS

It was a cross-sectional study conducted on 50 diabetic patients using convenient sampling method. The research was carried out in CT department of radiology of tertiary care hospital in Gujranwala, Pakistan. Males and females between the ages of 30–80 who had undergone abdominal CT scans were included in this study. A written consent form was also signed by patients. This study was conducted over 4 months from December 2021 to March 2022. Data were entered and analyzed using SPSS version 20.0. Abdominal CT scan were performed using TOSHIBA CT scan Machine.

## RESULTS

Table 1 is showing 50 diabetic patients that includes 33 (66%) males and female 7 (34%). Males are more prone to develop liver diseases.

Gender	Frequency (%)
Female	7 (34%)
Male	33 (66%)
Total	50 (100%)

**Table 1:** Frequency distribution of gender of diabetic patients

Table 2 shows that diabetic patients of senior age group (50–60) years are most commonly affected 27 (54%) with non-alcoholic fatty liver. Minimum frequency of patients is 7 (14%) in the age group of (70–80).

Age Groups	Frequency (%)
30–40 years	16 (32%)
50–60 years	27 (54%)
70–80 years	7 (14%)
Total	50 (100%)

**Table 2:** Frequency distribution of age group in diabetic patients

Table 3 shows the findings that the diabetic patients frequently had fatty liver 22 (44%), fatty liver disease along with cardiovascular disease was 11 (22%). Some other findings with low occurrence of metabolic fatty liver disease were hypertension and hyperlipidemia 7 (14%). Only 2 (2%) of patients are affected with renal failure, fatty liver, stroke, only 2 (2%) affected with malignant abdominal mass. The patients affected with malignant liver disease, cirrhosis are 2 (2%), 2 (2%) affected with hypertension and dyslipidemia and only 2 (2%) affected with obesity, hypertension and fatty liver. Diabetic patients most commonly have fatty liver disease and hypertension as compared to non-diabetic patients.



Clinical findings of diabetic patients	Frequency (%)
Only fatty liver disease	22 (44%)
Heart disease, Fatty liver disease	11 (22%)
Hypertension, Fatty liver, Hyperlipidemia	7 (14%)
Renal failure, Fatty liver, Stroke	2 (4%)
Malignant abdominal mass	2 (4%)
Malignant liver disease, Cirrhosis	2 (4%)
Hypertension, Dyslipidemia	2 (4%)
Obesity, Hypertension, Fatty liver.	2 (4%)
Total	50 (100%)

**Table 3:** Frequency distribution of clinical findings in diabetic patients

## DISCUSSION

Total 50 patients were included in this investigation. Effects of diabetes mellitus type-2 on the liver using a CT scan. The participants in the study ranged in age from 30 to 80 years old. The patient's age and gender have an impact on diabetes. Diabetes increases the risk of long-term problems, which usually manifest themselves after a few years. Blood vessel damage is the most serious long-term impact. This study reveals that male diabetic patients are more commonly to have non-alcoholic fatty liver disease 33 (66%) than females 17 (34%). Elderly diabetic patients of age group of 50-60 years are most commonly affected by 27 (54%). The current study found that diabetic patients most commonly have fatty liver disease and hypertension than non-diabetic patients. Osama et al, published 2020 was also mentioned that elderly people with type -2 diabetes mostly affected by fatty liver and hypertension than non-diabetic. Hyperglycemia levels damage major body organs over time. They was also mentioned that male diabetic patients more commonly affected with metabolic liver disease [26]. In current research 22 (44%) diabetic patients were affected with only fatty liver disease and 11 (22%) patients affected with heart disease and fatty liver and 7 (14%) affected with hypertension, fatty liver, and hyperlipidemia. This study proved that diabetic patients are more commonly to have metabolic hepatic disease. There was a strong correlation between diabetes mellitus type-2 and metabolic fatty liver disease. A previous study was done by Hegazy et al., 2019 also prove that there was a strong relationship between diabetes and fatty liver disease by comparing Hounsfield units of the liver in non-diabetes mellitus patients and diabetic patients [27]. Abayazed, 2019 also concluded no association between substantial Hyperlipidemia and enlargement of liver in diabetes patients [28]. In current study also said that Hyperlipidemia was 7 (14%) linked with diabetes mellitus and fatty liver. In the current study, it was proved that diabetic patients were mostly affected with only fatty liver 22 (44%) and heart disease, fatty liver. 11 (22%) Prevalence of these disorders increases in diabetic patients more than

in other diseases. Osama et al., 2020 also mentioned that there is a strong association between type-2 diabetes and metabolic fatty liver disease and heart disease [26].

## CONCLUSIONS

In conclusion, diabetic people in their later years, particularly those between the ages of 50 and 60, are more probably than non-diabetic patients to have metabolic associated fatty liver disease and hypertension. In this study, men more likely to have fatty liver diabetes mellitus Type-2 than women. Metabolic fatty liver disease is commonly found in people with diabetes mellitus, and it's linked to a major organ damage and metabolic disorders. Fatty liver largely influences diabetes co-morbidities and outcomes when type 2 diabetes is present (hepatic and cardiovascular). This study proved that there is ethentic correlation in between the fatty liver disorders and heart disorders in a sample of type-2 diabetic individuals in our investigation.

## REFERENCES

- [1] Haligur M, Topsakal S, Ozmen O. Early degenerative effects of diabetes mellitus on pancreas, liver, and kidney in rats: an immunohistochemical study. *Experimental diabetes research*. 2012; 120645. doi: 10.1155/2012/120645.
- [2] Lai R-M, Chen T-B, Hu Y-H, Wu G, Zheng Q. Effect of type 2 diabetic Mellitus in the prognosis of acute-on-chronic liver failure patients in China. *World Journal of Gastroenterology*. 2021 Jun; 27(23):3372-3385. doi: 10.3748/wjg.v27.i23.3372.
- [3] Song T, Jia Y, Li Z, Wang F, Ren L, Chen S. Effects of liraglutide on nonalcoholic fatty liver disease in patients with type 2 diabetes mellitus: a systematic review and meta-analysis. *Diabetes Therapy*. 2021 Jun; 12(6):1735-1749. doi: 10.1007/s13300-021-01072-4.
- [4] Besutti G, Bonilauri L, Manicardi E, Venturelli F, Bonelli E, Monelli F, et al. Feasibility and efficiency of European guidelines for NAFLD assessment in patients with type 2 diabetes: A prospective study. *Diabetes Research and Clinical Practice*. 2021 Jul; 177:108882. doi: 10.1016/j.diabres.2021.108882.
- [5] Unsal İO, Calapkulu M, Sencar ME, Cakal B, Ozbek M. Evaluation of NAFLD fibrosis, FIB-4 and APRI score in diabetic patients receiving exenatide treatment for non-alcoholic fatty liver disease. *Scientific Reports*. 2022 Jan; 12(1):283. doi: 10.1038/s41598-021-04361-x.
- [6] Tariq R, Axley P, Singal AK. Extra-hepatic manifestations of nonalcoholic fatty liver disease: a review. *Journal of clinical and experimental hepatology*. 2020 Feb; 10(1):81-87. doi:

- 10.1016/j.jceh.2019.07.008.
- [7] Silaghi CA, Silaghi H, Craciun AE, Farcas A, Colosi HA, Cosma DT, *et al.* Age, abdominal obesity, and glycated hemoglobin are associated with carotid atherosclerosis in type 2 diabetes patients with nonalcoholic fatty liver disease. *Medical ultrasonography*. 2015 Sep; 17(3):300-7. doi: 10.11152/mu.2013.2066.173.cas.
- [8] Tan L, Chen L, Jia Y, Li L, Wang J, Huang X, *et al.* Impact of diabetes mellitus on short-term prognosis, length of stay, and costs in patients with acute kidney injury: A nationwide survey in China. *Plos one*. 2021 May; 16(5):e0250934. doi: 10.1371/journal.pone.0250934.
- [9] Sakharkar P, Deb S. Examining Liver Function in Adults with Diabetes in the United States. *Journal of Pharmacy & Pharmaceutical Sciences*. 2021; 24:317-328. doi: 10.18433/jpps31851.
- [10] Fortes PC, de Moraes TP, Mendes JG, Stinghen AE, Ribeiro SC, Pecoits-Filho R. Insulin resistance and glucose homeostasis in peritoneal dialysis. *Peritoneal Dialysis International*. 2009 Feb; 29 Suppl 2:S145-8. doi.org/10.1177/089686080902902S28
- [11] Koutnikova H, Genser B, Monteiro-Sepulveda M, Faurie J-M, Rizkalla S, Schrezenmeir J, *et al.* Impact of bacterial probiotics on obesity, diabetes and non-alcoholic fatty liver disease-related variables: a systematic review and meta-analysis of randomized controlled trials. *British Medical Journal Open*. 2019 Mar; 9(3):e017995. doi: 10.1136/bmjopen-2017-017995.
- [12] Singh SP, Singh A, Pati GK, Misra B, Misra D, Kar SK, *et al.* A study of the prevalence of diabetes and prediabetes in patients of non-alcoholic fatty liver disease and the impact of diabetes on liver histology in coastal Eastern India. *Journal of diabetes mellitus*. 2014; 4(04):290. doi.org/10.4236/jdm.2014.44040
- [13] Khodami B, Hatami B, Yari Z, Alavian SM, Sadeghi A, Varkaneh HK, *et al.* Effects of a low free sugar diet on the management of nonalcoholic fatty liver disease: a randomized clinical trial. *European Journal of Clinical Nutrition*. 2022 Jul; 76(7):987-994. doi: 10.1038/s41430-022-01081-x.
- [14] Brill F, Cusi K. Management of nonalcoholic fatty liver disease in patients with type 2 diabetes: a call to action. *Diabetes Care*. 2017 Mar; 40(3):419-430. doi: 10.2337/dc16-1787.
- [15] Masuoka HC, Chalasani N. Nonalcoholic fatty liver disease: an emerging threat to obese and diabetic individuals. *Annals of the New York Academy of Sciences*. 2013 Apr; 1281(1):106-22. doi: 10.1111/nyas.12016.
- [16] Lee DH. Noninvasive evaluation of nonalcoholic fatty liver disease. *Endocrinology and Metabolism*. 2020 Jun; 35(2):243-259. doi: 10.3803/EnM.2020.35.2.243.
- [17] Mohammed Z. Characterization of Non-alcoholic Fatty Liver Diseases using computed Tomography: Sudan University of Science and Technology; 2020.
- [18] Tamaki N, Ajmera V, Loomba R. Non-invasive methods for imaging hepatic steatosis and their clinical importance in NAFLD. *Nature Reviews Endocrinology*. 2022 Jan; 18(1):55-66. doi: 10.1038/s41574-021-00584-0.
- [19] Lamos EM, Kristan M, Siamashvili M, Davis SN. Effects of anti-diabetic treatments in type 2 diabetes and fatty liver disease. *Expert review of clinical pharmacology*. 2021 Jul; 14(7):837-52. doi: 10.1080/17512433.2021.1917374.
- [20] Heo S, Kim DW, Choi SH, Kim SW, Jang JK. Diagnostic performance of liver fibrosis assessment by quantification of liver surface nodularity on computed tomography and magnetic resonance imaging: systematic review and meta-analysis. *European radiology*. 2022 May; 32(5):3377-87. doi: 10.1007/s00330-021-08436-1.
- [21] Chandan S, Mohan BP, Khan SR, Facciorusso A, Ramai D, Kassab LL, *et al.* Efficacy and safety of intragastric balloon (IGB) in non-alcoholic fatty liver disease (NAFLD): a comprehensive review and meta-analysis. *Obesity Surgery*. 2021 Mar; 31(3):1271-9. doi: 10.1007/s11695-020-05084-0.
- [22] Pastori D, Pani A, Di Rocco A, Menichelli D, Gazzaniga G, Farcomeni A, *et al.* Statin liver safety in non-alcoholic fatty liver disease: A systematic review and metanalysis. *British Journal of Clinical Pharmacology*. 2022 Feb; 88(2):441-51. doi: 10.1111/bcp.14943.
- [23] Cao Q, Yan C, Han X, Wang Y, Zhao L. Quantitative Evaluation of Nonalcoholic Fatty Liver in Rat by Material Decomposition Techniques using Rapid-switching Dual Energy CT. *Academic Radiology*. 2022 Jun; 29(6):e91-e97. doi: 10.1016/j.acra.2021.07.027.
- [24] Tatikonda VK, Gorrela VP, Racherla A. Role of Triple Phase Computed Tomography in the Evaluation of Liver Lesions. 2021. doi.org/10.7860/IJARS/2021/48188.2644
- [25] Abd El-Kader SM, El-Den Ashmawy EMS. Non-alcoholic fatty liver disease: The diagnosis and management. *World journal of hepatology*. 2015 Apr; 7(6):846-58. doi:10.4254/wjh.v7.i6.846.
- [26] Osama H, Siddig A, Gareeballah A, Gameraddin M,

- Osman HE. Evaluation of Liver in Type 2 Diabetes Mellitus Using Unenhanced Computed Tomography. *International Journal of Biomedicine*. 2020;10(4): 402-6. DOI: 10.21103/Article10(4)\_OA14
- [27] Hegazy M, Elsayed NM, Ali HM, Hassan HG, Rashed L. Diabetes mellitus, nonalcoholic fatty liver disease, and conjugated linoleic acid (omega 6): what is the link?. *Journal of Diabetes Research*. 2019 Apr; 2019. doi.org/10.1155/2019/5267025
- [28] Bayazed AR. Study of Liver Changes in Diabetic Patients using Computed Tomography (Doctoral dissertation, Sudan University of Science and Technology). 2019.

**Original Article****Physical and Sensory Evaluation of Peanut Yogurt**

Misbah Arshad<sup>1</sup>, Zainab Sharmeen<sup>1</sup>, Asad Nawaz<sup>2</sup> and Amir Iqbal<sup>3</sup>

<sup>1</sup>University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan

<sup>2</sup>University of Agriculture, Faisalabad, Pakistan

<sup>3</sup>University of Management and Technology, Lahore, Pakistan

**ARTICLE INFO****Key Words:**

Yogurt, jaukurt, skimmed milk, peanut milk, skimmed milk powder

**How to Cite:**

Arshad, M. ., Sharmeen, Z. ., Nawaz, A. ., & Iqbal, A. . (2022). Physical And Sensory Evaluation of Peanut Yogurt: Physical and Sensory Evaluation of Peanut Yogurt. *DIET FACTOR (Journal of Nutritional & Food Sciences)*, 3(1). <https://doi.org/10.54393/df.v3i1.48>

**\*Corresponding Author:**

Misbah Arshad  
University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan  
[fatimamisbah10@gmail.com](mailto:fatimamisbah10@gmail.com)

Received Date: 2<sup>nd</sup> June, 2022

Acceptance Date: 14<sup>th</sup> June, 2022

published Date: 30<sup>th</sup> June, 2022

**ABSTRACT**

The word "yogurt" is related to the Turkish word "jaukurt" which means thick milk. Yogurt refers to a fermented milk product made by using selected microorganisms to develop not only the characteristic flavor but also body and texture. Peanut is one of the important nutrients which has significant amount of all essential nutrients. **Objective:** In this study physical and sensory properties of peanut yogurt are evaluated by using different scientifically proved sensory evaluation methods. **Methods:** The whole process of manufacturing and evaluating peanut milk yogurt was conducted in National Institute of Food Science and Technology, University of Agriculture Faisalabad. After washing and soaking peanuts in water for seven straight hours at room temperature, the peanuts were subjected to be used to prepare peanut milk. This process was followed up by grounding the peanuts in water. The resultant slurry thus produced was centrifuged with cheese cloth. After heating the product at 90°C for 15 minutes, physical and sensory properties were assessed. Modified centrifugation process was used for the determination of syneresis. **Results:** By concluding the organoleptic analysis, the yogurt demonstrated impact of storage and treatments on different sensory metrics with advancing degradation in flavor, body, texture, and appearance of yogurt. During the study, complete parameters/metrics and minimal alterations were all noticed in the yogurt throughout the study. While conducting treatments, maximum percentages were given to different treatments including 1% sugar, 9% skimmed milk powder, 80% skimmed milk liquid, and 10% peanut milk. With various recent examinations and studies, it has been reported that the treatment T<sub>1</sub> with 10% peanut milk is better for production of peanut milk yogurt as compared to other treatments. T<sub>2</sub> with 1% sugar, 9% skimmed milk powder, 20% peanut milk, and 70% skimmed milk liquid and peanut milk yogurt with 1% sugar, 9% skimmed milk powder, 30% peanut milk, and 60% skimmed milk liquid showcased deteriorated firmness and organoleptic acceptance. **Conclusion:** Upon completion of the study, it was determined that the presence of fat, total solids, and protein content in the milk produced by peanuts impact the magnitude of serum separation and pH of yogurt, affecting texture and entire yogurt acceptability.

**INTRODUCTION**

In most countries yogurt is popular cultured dairy product all the time. On the subject of possible health benefits of yogurt, this is to some extent due to a better responsiveness of customers. Yogurt is enriched with protein, fat, phosphorus, calcium etc. which has a high nutritional value, easily digestible, and its role in total phosphorus intake has been reported as 33-44 %. During fermentation, yogurt is milk based product which can digest quickly due to presence of milk protein, lactose and fat components undertake fractional hydrolysis [1].

Between various milk products manufactured through fermentation, that may include butter milk, acidophilus milk, sour cream, ropy milk, and cheese owing, yogurt is possibly the most popular one because of its refreshing aroma, flavor, and creamy consistency [2]. Fermented foods offer a wide range of texture, flavor and aroma to improve the value of human diet. More than 3500 fermented foods are distributed all over the world [3]. For production of peanut milk yogurt mostly research has been done on utilization of fermentation techniques for

extraction of peanut milk in the presence of lactic acid bacteria. Moreover, the presence of extensive nutty and whey flavor may turn the whole thing into an unsuitable product for yogurt substitution [4]. Peanut has an important role in fighting against malnutrition due to its phytochemical and nutrient content [5]. A yogurt-like product (Dahi) was profitably produced using lactic cultures with miltone (derived by supplementing spray-dried peanut protein isolates with animal milk). Although, the fermentation in the involvement of *L. acidophilus* NRRL B-1910 and *L. bulgaricus* NRRL B-1909 develops a custard like texture in peanut milk but extreme amount of whey can make the product unpleasant. The ever-changing norms of consumers for natural products owes to the developing comprehension on human health ailment because of synthetic additives. In food systems different types of additives are in use i.e. coloring agents, flavoring agents and variety of preservatives. Antioxidants play a major role in scavenging free radicals for the mitigation of oxidation processes, marking them as important additives as compared to others [6]. Despite of the inferior quality of peanut milk yogurt as compare to that of yogurt from cow milk it is consumable and had good textural properties and its overall acceptability scores were also satisfactory. In yogurt production, *S. thermophilus* and *L. bulgaricus* starter cultures are required for fermentation. Due to this reason, for development of proper color and flavor, interaction between starter cultures and their individual characteristics are of much importance [7]. According to the main characters i.e. texture is the only one which defines the yogurt quality [8]. Examined the effects of several attributes and ingredients on the preference and sensory perception of the yogurt. It was noted that acidity played an important role in aroma and flavor of the yogurt as compared to acetals like 2,3-pentanedione and diacetyl [9]. Observed the physical characteristics and shelf-life of yogurt made of corn milk. They compared physico-chemical, microbiological characteristics and shelf-life of corn milk and cow milk yogurt (CMY). Results of this study recommend that corn milk is a prospective raw material for making an innovative yogurt. The corn milk yogurt had low fat contents [10], protein with harder and higher consistency than CMY. The physical appearance, color and flavor of corn milk yogurt and commercial yogurt were not much different. The main flavor compounds of CMY were tridecane, tetradecane, dodecane and heptyl methyl ketone whereas those of corn milk yogurt were tridecane, ethyl oleate, tetradecane, ethyl linoleate [11]. Viscosity or firmness plays an important role in determining the quality and acceptability of the yogurt without syneresis. The firmness of the yogurt is affected by the source of milk and the yogurt with higher total solids

and protein content has higher firmness or viscosity. Viscosity also affects the mouth feel and texture of fluid [12]. The sensory properties can be adversely affected by various possibilities, among them is an increased number of stabilizers which can change flavor and make the overall texture over-stabilized, giving a gel-like mouthfeel. While comparing peanut yogurt, it can be produced without the need of added solids or stabilizers having solids content of 16-18 % in the milk [13]. The consistency and brittleness level of yogurt could be achieved by changing fat and protein levels. Protein component was used most effectively to enhance consistency. The yogurt having large protein components (7.39 %) created less number of pores and have lower syneresis as compared to lower protein yogurts [14]. The fortification of the peanut milk for manufacturing of yogurt milk was done by 4g/100g skimmed milk powder and 12g/100g total solids. These were later subjected for physicochemical assessment by leveraging CMY as control for the study. When compared to CMY peanut milk yogurt has higher content of protein, water holding capacity [15], fats and unsaturated fatty acids also higher than saturated ones [16].

## METHODS

Procurement of raw materials: Peanuts, raw milk, skimmed milk, sugar and chemicals (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*) are the materials that were used for this study. All these materials were purchased from the local market with a care that all the materials should be of good quality. Peanut milk yogurt was manufactured and analyzed in the Laboratory of National Institute of Food Science & Technology, University of Agriculture, Faisalabad. Preparation of peanut milk: Firstly, peanuts were washed and soaked in water for seven hours at room temperature. Then peanuts were grounded followed by water which was twice of peanut weight. Peanut milk was obtained by filtering the resultant slurry through centrifugal separator with a double layered cheese cloth. It was heated for 15 min at 90 °C. Physical and sensory properties were determined by following methods. Yogurt syneresis was evaluated from the centrifugation process, conducted with a couple of alterations. The liberation of watery-whey like liquid on the surface of the gel is termed as syneresis. 200g of yogurt sample (Y) was taken and prepared inside a centrifuge cup which was then subjected to centrifugation for 10 minutes at 2500 RMP with an average 640xg at 4°C. The weight of the expelled whey content (W) was analyzed and then eliminated while the syneresis was examined by the following formula [17].

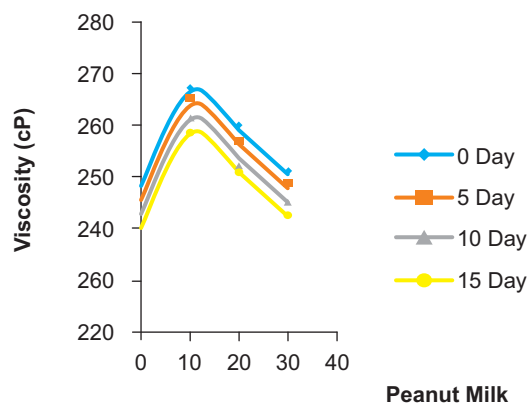
$$\text{Syneresis(\%)} = \frac{W}{Y} \times 100\%$$

Apparent viscosity of yogurt was determined at 10 to 15°C and the obtained yogurt was then agitated for more than 40

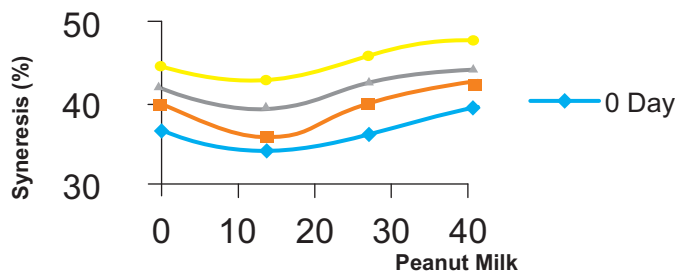
seconds prior to measuring the overall viscosity. With a rotation of around 10 RPM, spindle 4 was utilized for the previously described measurement. Two units of reading were used, a) percent torque and b) centipoises (cP) for taking the Viscometer reading. Yogurt samples were evaluated for color, flavor, body/texture and overall acceptability using 9-point hedonic scale by the panel of researchers from the faculty members at the National Institute of Food Science and Technology, University of Agriculture, Faisalabad [18]. The data obtained for each parameter was subjected to statistical analysis under factorial design using completely randomized design (CRD). Interaction was carried out up-to two ways. Statistix 8.1 software was used to analyze data statistically according to the method described by [19].

## RESULTS

With a rotation of around 10 RPM, spindle 4 was utilized for the previously described measurement. Two units of reading were used, a) percent torque and b) centipoises (cP) for taking the Viscometer reading. Yogurt samples were evaluated for color, flavor, body/texture and overall acceptability using 9-point hedonic scale by the panel of researchers from the faculty members at the National Institute of Food Science and Technology, University of Agriculture, Faisalabad [18]. The data obtained for each parameter was subjected to statistical analysis under factorial design using completely randomized design (CRD). Interaction was carried out up-to two ways. Statistics 8.1 software was used to analyze data statistically according to the method described by [19].



**Figure 1:** Effect of different treatments of PM and storage days on viscosity of PMY



**Figure 2:** Effect of different treatments of PM and storage days on syneresis

Treatments	Storage (Days)				Mean±SD
	0	5	10	15	
T <sub>0</sub>	8.37±0.41	7.92±0.39	7.65±0.38	6.75±0.33	7.67±0.37a
T <sub>1</sub>	7.92±0.39	7.47±0.37	7.2±0.36	6.93±0.34	7.38±0.36b
T <sub>2</sub>	6.84±0.34	6.48±0.32	6.57±0.32	5.76±0.28	6.41±0.31c
T <sub>3</sub>	6.39±0.31	6.03±0.30	6.3±0.31	5.31±0.26	6.00±0.29d
Means	7.38±0.36a	6.97±0.34b	6.93±0.34b	6.18±0.30c	

**Table 1:** Mean value of color and appearance during storage  
ABC, similar alphabets on means in column do not vary in a great deal at P≤0.01  
ABCD, similar alphabets on means in row do not differ significantly at P≤0.01

Treatments	Storage (Days)				Mean±SD
	0	5	10	15	
T <sub>0</sub>	8.57±0.42a	8.13±0.40ab	7.92±0.39abc	7.12±0.35de	7.93±0.39a
T <sub>1</sub>	8.13±0.40ab	7.48±0.37bcd	7.2±0.36de	6.33±0.31fg	7.28±0.36b
T <sub>2</sub>	7.2±0.36de	7.06±0.35cde	6.69±0.33ef	5.97±0.29g	6.73±0.33c
T <sub>3</sub>	6.98±0.34def	6.33±0.316fg	5.90±0.29g	5.68±0.28g	6.22±0.30d
Means	7.72±0.38a	7.25±0.35b	6.92±0.34c	6.27±0.30d	

**Table 2:** Mean value of flavor during storage  
a-g, similar alphabets on means do not differ significantly at P≤0.05  
ABCD, similar alphabets on means in column do not differ significantly at P≤0.01  
ABCD, similar alphabets on means in row do not differ significantly at P≤0.01

Treatments	Storage (Days)				Mean±SD
	0	5	10	15	
T <sub>0</sub>	7.99±0.39	7.56±0.37	6.98±0.34	6.04±0.30	7.14±0.35a
T <sub>1</sub>	7.48±0.37	7.41±0.37	6.55±0.32	5.68±0.28	6.78±0.33b
T <sub>2</sub>	6.91±0.34	6.37±0.31	6.26±0.31	5.18±0.25	6.18±0.31c
T <sub>3</sub>	6.19±0.30	5.83±0.29	5.26±0.26	4.96±0.24	5.56±0.27d
Means	7.14±0.35a	6.79±0.33a	6.26±0.30b	5.46±0.26c	

**Table 3:** Mean value of body and texture during storage  
ABC, similar alphabets on means in column do not differ significantly at P≤0.01  
ABCD, similar alphabets on means in row do not differ significantly at P≤0.01

## DISCUSSION

The results regarding the viscosity of peanut milk yogurt under various treatments during storage exposed that viscosity decreased in peanut milk yogurt through entire period of storage due to increase of shear rate. The peptide

chains of peanut milk proteins are unfolded with high temperatures, which may cause the change in the nature of the protein and viscosity altered [20]. The apparent viscosity of yogurt was extremely affected by the content of total solids of yogurt, it was observed that with an increase in the total solids there was a change in apparent viscosity [2]. The viscosity or firmness of peanut milk yogurt samples under various treatments decreased during storage. At zero day the highest firmness/viscosity values were observed (267.33 cP) in yogurt sample T1 of 10% peanut milk and minimum value (251.33 cP) was observed in yogurt sample T3 of 30% peanut milk. After 15 days of storage minimum decrease in viscosity value (8.66) was observed in peanut milk yogurt sample T2 of 20% peanut milk. Changes in viscosity were graphically showed in figure 1. The statistical analysis showed that the change in viscosity was highly significant for treatments as well as storage and their interaction was non-significant. The main defect of yogurt which should be overcome during storage is the whey separation. The syneresis of yogurt under various treatments increased due to increase in acidity during storage. The increase in syneresis might be due to rearrangement of protein network resulting from changes in pH, acidity and temperature during storage of yogurt. The results regarding the syneresis of yogurt under various treatments during storage are shown in figure 2, which showed that syneresis increased in yogurt through storage period. The increase in syneresis values after 15 days of storage were from 40.54 to 45.87, 38.93 to 44.75, 40.33 to 46.93 and 42.47 to 47.99 for 0% peanut milk to 30% peanut milk respectively. The statistical analysis demonstrated that the results were highly significant for treatments, storage days and their interaction during storage. All samples of prepared peanut milk yogurt were organoleptically evaluated at 0, 5, 10 and 15 days intervals using 9-point hedonic scale. Five judges were provided with printed Performa. The data collected on organoleptic evaluation i.e. flavor, body, texture and appearance was associated with quality and the acceptability of cultured dairy products as affected by storage are discussed below. Color and Appearance: The data on the appearance of peanut milk yogurt under various treatments during storage is given in Table 1. The mean score for appearance decreased like other characteristics during storage. The mean score for appearance after 15 days' storage decreased from 8.37 to 6.75 for T0, 7.92 to 6.93 for T1, 6.84 to 5.76 for T2 and 6.39 to 5.31 for T3 respectively. The data in Table 4.19 showed that there was maximum decrease in the scores for appearance T1 while T2 got maximum score. The appearance of yogurt is also affected due to increase in yeast and mold counts in yogurt during storage, which ultimately deteriorates the quality of yogurt. Flavor is a

combined perception of taste, smell and mouth feel [21]. When it is requested to give comments on the flavor of the two yogurts, some judges cherished the PMY flavor upon that of CMY but the most judges favored the CMY flavor. These indications recommend that if we improve the flavor of PMY, then PMY turn out to be more satisfactory and appealing to prospective customers. The data on flavor scores of yogurts under various treatments as affected by storage is shown in Table 1.2. The mean flavor scores of yogurts decreased during storage [22]. It is evident from the results of Table 1.3 that T1 containing 10% peanut milk got the maximum scores for flavor during storage period of 15 days. The overall texture refers to being bite resistant and chewy. Texture can be easily simplified by adjusting the mixture proportion, preparation, and freezing. In organoleptic evaluation, the body and texture of the product is the second most important factor. The level of protein present in milk affects the consistency of yogurt; hence the fortification is very important. The data on body and texture scores of peanut milk yogurts under various treatments during storage is shown in Table 1.3. The mean value body and texture scores for yogurt samples were decreased during storage conditions. The mean body and texture scores after 15 days' storage decreased from 7.99 to 6.04 for T0, 7.48 to 5.68 for T1, 6.91 to 5.18 for T2 and 6.19 to 4.96 for T3. T1 got highest points for body and texture while T3 got least points because of its delicate structure and very hard curd. The least decrease in body and texture during storage was also observed in T1.

## CONCLUSIONS

Organoleptic evaluation of yogurt showed that storage as well as treatments administered major impact on all sensory parameters and a progressive deterioration in flavor, body & texture and appearance of yogurt under various preparatory treatments and storage time.

## REFERENCES

- [1] Sanchez-Segarra PJ, García-Martínez M, Gordillo-Otero MJ, Díaz-Valverde A, Amaro-Lopez MA, Moreno-Rojas R. Influence of the addition of fruit on the mineral content of yoghurts: nutritional assessment. *Food Chemistry*. 2000 Oct; 71(1):85-9.
- [2] Huma N, Hafeez K, Ahmad I. Preparation and evaluation of apple stirred yogurt. *Pakistan Journal of Food Science*. 2003; 13:5-9.
- [3] Khurana HK, Kanawjia SK. Recent trends in development of fermented milks. *Current Nutrition & Food Science*. 2007 Feb; 3(1):91-108.
- [4] Granato D, Branco GF, Nazzaro F, Cruz AG, Faria JAF. Functional Foods and Nondairy Probiotic Food Development: Trends, Concepts, and Products. *Comprehensive Reviews in Food Science and Food*

- Safety. 2010 May; 9(3):292-302. doi: 10.1111/j.1541-4337.2010.00110.x.
- [5] Duncan CE, Gorbet DW, Talcott ST. Phytochemical content and antioxidant capacity of water-soluble isolates from peanuts (*Arachis hypogaea* L.). *Food research international*. 2006 Oct; 39(8):898-904.
- [6] Agrawal R. Probiotics: An emerging food supplement with health benefits. *Food Biotechnology*. 2005 Sep; 19(3):227-46.
- [7] Cruz AG, Castro WF, Faria JA, Lollo PC, Amaya-Farfán J, Freitas MQ, et al. Probiotic yogurts manufactured with increased glucose oxidase levels: postacidification, proteolytic patterns, survival of probiotic microorganisms, production of organic acid and aroma compounds. *Journal of Dairy Science*. 2012 May; 95(5):2261-9. doi: 10.3168/jds.2011-4582.
- [8] Gonçalves D, Pérez C, Reolon G, Segura N, Lema P, Gámbaro A, Ares G, et al. Effect of thickeners on the texture of stirred yogurt. *Alimentos e Nutrição Araraquara*. 2009 Feb; 16(3):207-11.
- [9] Bouteille R, Cordelle S, Laval C, Tournier C, Lecanu B, This H, Schlich P. Sensory exploration of the freshness sensation in plain yoghurts and yoghurt-like products. *Journal of Food Quality and Preference*. 2013 Dec; 30(2):282-92.
- [10] Le TT, Van Camp J, Pascual PA, Meesen G, Thienpont N, Messens K, et al. Physical properties and microstructure of yoghurt enriched with milk fat globule membrane material. *International Dairy Journal*. 2011 Oct; 21(10):798-805.
- [11] Supavititpatana P, Wirjantoro TI, Apichartsrangkoon A, Raviyan P. Addition of gelatin enhanced gelation of corn-milk yogurt. *Food chemistry*. 2008 Jan; 106(1):211-6.
- [12] Bille PG, Keya EL. A comparison of some properties of Vat-heated and dry skim milk powder fortified set yoghurts. *Journal of Food Technology in Africa*. 2002; 7(1):21-3.
- [13] Marzeih M, Mazaheri MT. Effect of some stabilizers on the physiochemical and sensory properties of soy yoghurt. *Journal of Food Science and Technology*. 2008; 4:140-5.
- [14] Francisco ML, Resurreccion AV. Functional components in peanuts. *Critical Reviews in Food Science and Nutrition* 2008 Sep; 48(8):715-46. doi: 10.1080/10408390701640718.
- [15] Guven M, Yasar K, Karaca OB, Hayaloglu AA. The effect of inulin as a fat replacer on the quality of set-type low-fat yogurt manufacture. *International journal of dairy Technology*. 2005 Aug; 58(3):180-4.
- [16] Yadav DN, Singh KK, Bhowmik SN, Patil RT. Development of peanut milk-based fermented curd. *International journal of food science & technology*. 2010 Dec; 45(12):2650-8.
- [17] Meilgaard MC, Civille GV, Carr BT. *Sensory evaluation techniques 4th ed* CRC Press LLC. New York. 2007.
- [18] L Mason R. *Statistical design and analysis of experiments. With Applications to Engineering and Science*, In; *Statistical Design and Analysis of Experiments*, 2nd Ed. John Wiley and Sons Inc, Hoboken, NJ, USA. 2003; 746.
- [19] Kumar P, Mishra HN. Mango soy fortified set yoghurt: effect of stabilizer addition on physicochemical, sensory and textural properties. *Food chemistry*. 2004 Oct; 87(4):501-7.
- [20] Isanga J, Zhang G. Production and evaluation of some physicochemical parameters of peanut milk yoghurt. *LWT-Food Science and Technology*. 2009 Jul; 42(6):1132-8.
- [21] Hafeez K. Preparation and evaluation of apple based stirred yoghurt. *Food Technology. M.Sc.(Hons) Food Technology*. Faisalabad, Pakistan 2002.
- [22] Jumah RY, Shaker RR, Abu-Jdayil B. Effect of milk source on the rheological properties of yogurt during the gelation process. *International Journal of Dairy Technology*. 2001 Aug; 54(3):89-93.





## Original Article

# Awareness Regarding Colostrum Feeding Among Nursing Females

Zainab Murtaza Malhi<sup>1</sup>, Faiz-ul-Hassan Shah<sup>2</sup>, Noor ul Huda<sup>3</sup>, Maria Aslam<sup>\*</sup> and Misbah Arshad<sup>1</sup>

<sup>1</sup>University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan

<sup>2</sup>The Islamia University, Bahawalpur, Pakistan

<sup>3</sup>University of Agriculture, Toba Tek Singh, Pakistan

## ARTICLE INFO

### Key Words:

Colostrum, Breast feeding, Females, Children

### How to Cite:

Murtaza Malhi, Z. ., Shah, F.- ul-H. ., Huda, N. ul ., Aslam, M. ., & Arshad, M. . (2022). Awareness Regarding Colostrum Feeding Among Nursing Females: Colostrum feeding in Females. DIET FACTOR (Journal of Nutritional & Food Sciences), 3(1). <https://doi.org/10.54393/df.v3i1.52>

### \*Corresponding Author:

Maria Aslam  
University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore  
[mnarz.aslam@gmail.com](mailto:mnarz.aslam@gmail.com)

Received Date: 30<sup>th</sup> May, 2022

Acceptance Date: 19<sup>th</sup> June, 2022

Published Date: 30<sup>th</sup> June, 2022

## ABSTRACT

Colostrum is well known for helping to fight infection and promote the growth and development of the infant. The acceptance of colostrum and the frequency of colostrum feeding vary between cultures in Pakistan. **Objectives:** To determine whether females are aware of the value of breastfeeding and colostrum feeding. **Methods:** Data collection was done through females attending Sheikh Zaid hospital, Rahim Yar Khan. In this cross-sectional study, non-probability convenient sampling was employed with a sample size of 100. **Results:** Among the women, 79 were knowledgeable about breastfeeding, whereas 21 were not. Also, 33 women started nursing right away after delivery compared to 67 who didn't. Lastly, the findings showed that just 10 women thought of colostrum as a complete source of nutrition, whereas 90 women did not have any idea. **Conclusions:** The findings suggests that further efforts are needed to enhance the knowledge, attitude, and practice of colostrum feeding since many mothers were unaware of the significance of colostrum and initiation of breastfeeding soon after delivery.

## INTRODUCTION

The reproductive process includes both pregnancy and breast-feeding in all mammalian species, in the absence of the latter, none of these animals could have survived including man [1]. The value of breast-feeding in low and middle-income countries is well known, but in high-income countries, there is less certainty about its significance. Only 37 percent of children under the age of 6 months are breastfed in low and middle income countries alone. In few exceptions, breast-feeding periods in high-income countries are shorter than in resource-poor ones [2]. For most kids human milk is the perfect diet. Breastfeeding helps both mothers and children. Breast-fed babies get breast milk antibodies that protect against early postpartum infection, and breast-fed is cheaper than baby

formula [3]. Breast-feeding improves all children's freedom, health and development. This saves the lives of women, and adds to human resources [4]. The American Academy of Pediatrics (AAP) underlines the pediatrician's essential role in promoting, securing, and supporting breastfeeding. Breastfeeding is defined as the best way to feed babies, and is the primary means of ensuring optimal health, growth and development of infants and children [5]. The AAP has published a breast-feeding plan with recommended breast-feeding practices and recommendations that pediatricians should adopt. The American Academy of Family Physicians (AAFP) advises that all children be breastfed and/or receive processed human milk solely for the first 6 months of their lives, with

minor exceptions [6]. The first milk generated by a mammal's mammary glands occurs in the latter stages of pregnancy, soon before giving birth, and continues through the first several weeks of nursing [7]. Although colostrum has less lipids and potassium than regular milk, it is much richer in proteins, carbs, vitamin A, and salt chloride. Because of their immature digestive systems, newborns benefit from colostrums' concentrated, low-volume type of nutrition delivery. Meconium, a baby's first faeces, is more likely to pass because to the laxative properties of colostrum. This helps to avoid jaundice by removing extra bilirubin, which is generated in significant amounts during birth. IgA (reactive to *Escherichia coli* virulence related proteins), IgG, and IgM3 are just a few of the immunoglobulins present [8]. Lactoferrin, lysozyme, lactoperoxidase, complement, and proline-rich peptide (PRP) are other immunological components of colostrum [9]. Additionally, it includes a number of cytokines and growth factors. PRP aids in the battle against a variety of bacterial and viral infections that are difficult to treat, as well as numerous cancers, asthma, allergies, and autoimmune illnesses. It aids in lowering one of the major killers in our nation, along with diarrhoea and acute respiratory infections [10]. Despite the fact that breastfeeding is advised by all significant health organisations, rates have remained below average because some women still have difficulty achieving their nursing objectives. The importance of breastfeeding is underestimated. Children are deprived of their fundamental right to breastmilk and colostrum because of uninformed parents and unhealthy nursing practices. In light of this, the purpose of this study was to assess females' knowledge about breastfeeding and colostrum.

## METHODS

To determine the knowledge of breast feeding soon after delivery and the benefits of colostrum among women attending Sheikh Zaid Hospital, Rahim Yar Khan, Pakistan, were enrolled for the study. In this cross sectional study, non-probability convenient sampling was employed with a sample size of 100. Nursing women visiting Sheikh Zaid hospital Rahim Yar Khan were included in the inclusion criteria and women from other hospitals and non-cooperative women were added in the exclusion criteria. The rules and regulations set by the ethical committee of The University of Lahore were followed while conducting the research and the rights of the research participants were respected. After taking informed written consent, data was collected by the researcher with the help of data collection tool (questionnaire/ Performa) and according to the variables of the questionnaire. Data were tabulated and analyzed with the help of SPSS version 21.0 and reported using descriptive and inferential statistics. The

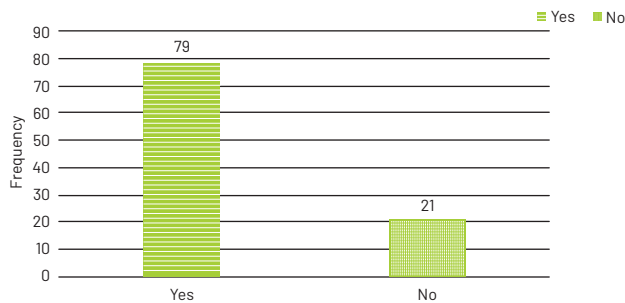
quantitative variables like age, income, etc. were assessed by using mean and standard deviation and were reported using percentages and frequencies. The study duration was 4 months.

## RESULTS

Out of 100 women, 15 were literate and 85 were illiterate, 83 were housewives while 17 were working ladies. 79 of the husbands were educated whereas 21 were not. 36 of them had government jobs, 60 of them had private jobs and 4 were unemployed. The income of 56 patients was 10,000-25,000 and 41 was 26,000-50,000 and 3 of them had above 50,000. 64 were from urban areas and 36 were from rural areas. 42 patients were from lower class and 58 patients were from middle class. 63 patients had their own house whereas 37 lived in rented house as represented in Table 1.

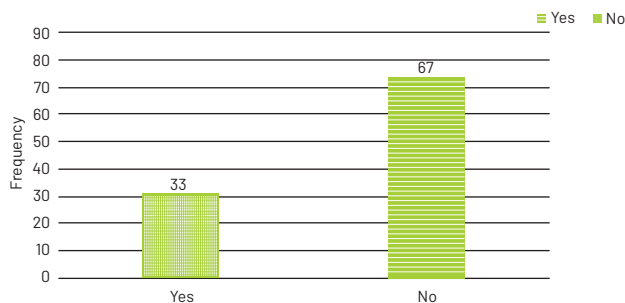
Patient's Education	
Literate	15
Illiterate	85
Total	100
Women's Occupation	
Housewife	83
Working Lady	17
Total	100
Husband's Education	
Educated	79
Uneducated	21
Total	100
Husband's Occupation	
Government Job	36
Private Job	60
Unemployed	4
Total	100
Income	
Below 10,000	0
10,000-25,000	5
26,000-50,000	64
Above 50,000	13
Total	100
Geographical Location	
Urban	64
Rural	36
Total	100
Socioeconomic status	
Lower class	42
Middle class	58
Total	100
Residential status	
Own	63
Rented	37
Total	100

**Table 1:** Socio Demographic characterization  
79 of the women had knowledge about breastfeeding and 21 didn't have any knowledge as shown in the Figure 2.



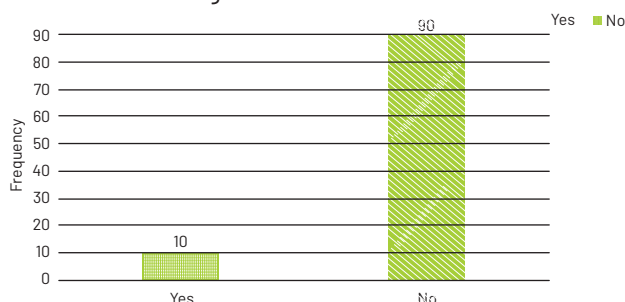
**Figure 2:** Frequency Distribution of Knowledge about breastfeeding

The results in Figure 3 represents that only 33 women initiated breastfeeding immediately after birth whereas 67 women didn't.



**Figure 3:** Frequency Distribution of initiating breastfeeding immediately after birth

The results depicts that only 10 women considered colostrum as a whole nutritious milk whereas 90 women didn't as shown in figure 4.



**Figure 4:** Frequency Distribution considering colostrum as a whole nutritious milk

## DISCUSSION

A study was directed to determine the breast feeding and colostrum among women attending Sheikh Zaid hospital Rahim Yar Khan, Pakistan. The patients were selected through non probability convenient sampling technique. The results of this study showed that 79 women had knowledge about breast feeding. Similar results were shown by Tadele et al., where he showed in his study that 93.6% of participants in the study had knowledge about breast feeding [11]. Similar results were also shown by Daly et al., where they used factor analysis method to examine the awareness and community perceptions of breast feeding in Western Australia. The knowledge of breast

feeding had ORs ranging from 1.22-1.44 [12]. A cross-sectional was conducted by Saied et al., in 2013. The findings revealed that most research participants have a strong understanding of the health benefits of breast feeding for babies and mothers [13]. A similar study was also conducted by Mbada et al., and according to results 71.3% of the respondents had good knowledge while 54.0% had positive attitude [14]. However, in Sialkot settings Chattha et al., aimed to evaluate the knowledge of breast feeding and its practices. It was thus concluded that the knowledge and practice of early breastfeeding has been very poor in areas with limited facilities [15]. There are variations in separate regional studies depending on the place, socio-economic status and regional taboos. Compared to the international statistics on breastfeeding awareness and practices, we are far behind and a great deal of effort needs to be made. The results showed us that only 33 women initiated breastfeeding immediately after birth whereas 67 women didn't. A study was conducted by Ahluwalia et al., who showed that 32% of women did not initiate breastfeeding, 4% started but stopped within the first week, 13% stopped within the first month, and 51% continued for >4 weeks [16]. Our findings indicate a need for extensive after delivery support for breastfeeding, especially for women who may experience difficulties in breastfeeding. Similar results were shown in a study conducted by Al-Benali in 2012. One hundred and nineteen (31%) participants began breastfeeding their children within one hour of birth [17]. Also, a study conducted by Oche et al., in 2011 showed that a total of 54 (31%) of the mothers had adequate knowledge of exclusive breastfeeding with 94 (53%) of them beginning breastfeeding immediately after birth [18]. The results showed that only 10 women considered colostrum as a whole nutritious milk whereas 90 women didn't. Contradictory results were shown in a study conducted by Joshi et al., who found out that 74% of women learned of colostrum, 69% knew it was nutritious milk to feed newborn babies. Nine percent of women were aware of its protective impact and 41 percent knew it helps children develop properly and combat infections. Many women were aware of colostrum's importance, but data still indicates that further efforts are needed to improve colostrum feeding knowledge, attitude and practice [19]. Opposing results were shown in a study conducted by Chattha et al., to check the knowledge of breast feeding and its practices in Sialkot settings in which 146 (97.3%) mothers considered the colostrum to be healthy [11]. A contradictory study conducted by Sohail et al., to evaluate the awareness, behaviors and activities of mothers in relation to colostrum feeding of newborns in the northern province of Sindh showed that approximately 72.1% (n=277) of mothers

proposed colostrum feeding while 27.9% (n=107) of mothers rejected colostrum claiming that colostrum was non-milk, non-nutritive and inducing diarrhea. The mothers who dismissed the colostrum gave honey (n=80/107; 74.8%); water (n=19/107; 17.7%) and herbal preparation (n=8/107; 7.5%) to children for pre-lacteal feeding. In conclusion more than a fifth of mothers do not realize of the safety effects of colostrum and provide pre-lacteal feeding to children. The majority received guidance from health professionals[20].

## CONCLUSIONS

Colostrum, a rich source of protein, minerals, vitamins, and immunoglobulin that is first secreted by the mother and is crucial for children's healthy growth and development. Many expectant mothers were unaware of the importance of colostrum, The findings also showed that only few percentage of females were aware regarding the initiation of breastfeeding immediately after birth. Massive gaps in colostrums feeding behaviours still persist, primarily as a result of ignorance.

## REFERENCES

- [1] Alimoradi F, Javadi M, Barikani A, Kalantari N, Ahmadi M. An overview of importance of breastfeeding. *Journal of Comprehensive Pediatrics*. 2014 May; 5(2). doi: 10.5812/jcp.14028
- [2] Victora CG, Bahl R, Barros AJ, França GV, Horton S, Krusevec J, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *The Lancet*. 2016 Jan; 387(10017):475-90. doi: 10.1016/S0140-6736(15)01024-7.
- [3] McDowell MA, Wang CY, Kennedy-Stephenson J. Breastfeeding in the United States: findings from the national health and nutrition examination surveys, 1999-2006. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2008. doi: 10.1037/e455822008-001
- [4] Rollins NC, Bhandari N, Hajeerhoy N, Horton S, Lutter CK, Martines JC, et al. Why invest, and what it will take to improve breastfeeding practices?. *The Lancet*. 2016 Jan; 387(10017):491-504. doi: 10.1016/S0140-6736(15)01044-2.
- [5] Croke LM. AAFP releases position paper on breastfeeding. *American Family Physician*. 2015 Jan; 91(1):56-7.
- [6] Leavitt G, Martínez S, Ortiz N, García L. Knowledge about breastfeeding among a group of primary care physicians and residents in Puerto Rico. *Journal of Community Health*. 2009 Feb; 34(1):1-5. doi: 10.1007/s10900-008-9122-8.
- [7] Uruakpa FO, Ismond MA, Akobundu EN. Colostrum and its benefits: a review. *Nutrition research*. 2002 Jun; 22(6):755-67. doi: 10.1016/s0271-5317(02)00373-1
- [8] Loureiro I, Frankel G, Adu-Bobie J, Dougan G, Trabulsi LR, Carneiro-Sampaio MM. Human colostrum contains IgA antibodies reactive to enteropathogenic *Escherichia coli* virulence-associated proteins: intimin, BfpA, EspA, and EspB. *Journal of Pediatric Gastroenterology and Nutrition*. 1998 Aug; 27(2):166-71. doi: 10.1097/00005176-199808000-00007
- [9] Godhia ML and Patel N. Colostrum-its Composition, Benefits as a Nutraceutical-A Review. *Current Research in Nutrition and Food Science Journal*. 2013 Aug; 1(1):37-47. doi:10.12944/crnfsj.1.1.04
- [10] Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. *Pediatrics*. 2001 Oct; 108(4):E67. doi: 10.1542/peds.108.4.e67
- [11] Tadele N, Habta F, Akmel D, Deges E. Knowledge, attitude and practice towards exclusive breastfeeding among lactating mothers in Mizan Aman town, Southwestern Ethiopia: descriptive cross-sectional study. *International Breastfeeding Journal*. 2016 Feb; 11:3. doi: 10.1186/s13006-016-0062-0
- [12] Daly A, Pollard CM, Phillips M, Binns CW. Benefits, barriers and enablers of breastfeeding: factor analysis of population perceptions in Western Australia. *PLoS One*. 2014 Feb; 9(2):e88204. doi: 10.1371/journal.pone.0088204
- [13] Saied H, Mohamed A, Suliman A, Al Anazi W. Breastfeeding knowledge, attitude and barriers among Saudi women in Riyadh. *Journal of Natural Sciences Research*. 2013; 3(12):6-13.
- [14] Mbada CE, Olowookere AE, Faronbi JO, Oyinlola-Aromolaran FC, Faremi FA, Ogundele AO, et al. Knowledge, attitude and techniques of breastfeeding among Nigerian mothers from a semi-urban community. *BMC Research Notes*. 2013 Dec; 6:552. doi: 10.1186/1756-0500-6-552
- [15] Chattha MN, Mazhar I, Ahmad SA, Latif A, Rai ME. Breast feeding knowledge and practices in Sialkot. *Pakistan Journal of Medical and Health Sciences*. 2016 Oct; 10:1272-5.
- [16] Ahluwalia IB, Morrow B, Hsia J. Why do women stop breastfeeding? Findings from the Pregnancy Risk Assessment and Monitoring System. *Pediatrics*. 2005 Dec; 116(6):1408-12. doi: 10.1542/peds.2005-0013
- [17] Al-Binali AM. Breastfeeding knowledge, attitude and

- practice among school teachers in Abha female educational district, southwestern Saudi Arabia. *International Breastfeeding Journal*. 2012 Aug; 7(1):10. doi: 10.1186/1746-4358-7-10
- [18] Oche MO, Umar AS, Ahmed H. Knowledge and practice of exclusive breastfeeding in Kware, Nigeria. *African Health Sciences*. 2011 Sep; 11(3):518-23.
- [19] Joshi SK, Barakoti B, Lamsal S. Colostrum feeding: knowledge, attitude and practice in pregnant women in a teaching hospital in Nepal. *WebmedCentral MEDICAL EDUCATION* 2012;3(8):WMC003601. doi: 10.9754/journal.wmc.2012.003601
- [20] Sohail J and Khaliq A. Knowledge, Attitude and Practice Of Mothers Regarding Colostrum Feeding To Newborns In Rural Pakistan: A Cross-Sectional Study. *Khyber Medical University Journal*. 2017 Oct; 9(4).



## Original Article

## Chemical Characterization of Tamarind Plum Squash

Muhammad Yasir Rafique<sup>1</sup>, Misbah Arshad<sup>1\*</sup>, Zainab Sharmeen<sup>1</sup>, Shahid Bashir<sup>1</sup>, Majida Umar Nasib<sup>2</sup> and Noor ul Huda<sup>3</sup>

<sup>1</sup>University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan

<sup>2</sup>Department of Human Nutrition and Dietetics, Knowledge Unit Health Sciences, University of Management and Technology, Sialkot, Pakistan

<sup>3</sup>University of Agriculture, Toba Tek Singh, Pakistan

## ARTICLE INFO

## Key Words:

Storage stability, Functional drink, Tamarind Plum, Quality Characterisation

## How to Cite:

Yasir Rafique, M. ., Arshad, M. ., Sharmeen, Z. ., Umar Nasib, M. ., & Huda, N. ul. (2022). Chemical Characterisation of Tamarind Plum Squash: Chemical characterisation of tamarind plum squash. DIET FACTOR (Journal of Nutritional & Food Sciences), 3(1).  
<https://doi.org/10.54393/df.v3i1.49>

## \*Corresponding Author:

Misbah Arshad  
University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan  
[fatimamishbah10@gmail.com](mailto:fatimamishbah10@gmail.com)

Received Date 3<sup>rd</sup> June, 2022

Acceptance Date: 19<sup>th</sup> June, 2022

Published Date: 30<sup>th</sup> June, 2022

## ABSTRACT

Tamarind plum comprising of red flesh contains high-level of multiple bio-active compounds. These compounds showcasing extremely beneficial compositions, include anthocyanins and other additional polyphenolic compounds, having high anti-oxidant ability. These natural bio-active compounds have the tendency to avert major diseases, such as diabetes and even cancer. **Objective:** In this study squash was prepared with tamarind plum to evaluate the quality and shelf life extension of the fruit at different concentrations. **Methods:** The tamarind plum was used to prepare squash with different percentages of tamarind juice and plum juice but at same percentages of sugar, water, and sodium benzoic acid. Prepared squash was filled in polyethylene terephthalate bottles and analysed after 0, 15, 30, 45, 60, 75, and 90 days of storage. The tamarind plum squash was subjected to total phenolic compounds, pH, titratable acidity, TSS, sugar acid ratio, and non-reducing and reducing sugars. **Results:** Maximum TSS (49.54), ascorbic acid (33.46), pH (2.29), titratable acidity (2.11), reducing sugar (24.29), and non-reducing sugar (37.64) was observed in squash prepared using tamarind juice (350ml), plum juice (400), sodium benzoic acid, sugar and water (2g, 1kg and 250ml). Storage showed significant effect on reducing sugar and non-reducing sugar, ascorbic acid, pH and titratable acidity during nineteen-day storage. **Conclusion:** Based on the results concluded from this study that the sample TPS3 demonstrated exceptional storage quality. Thus, the conclusions on TPS3 basis of tamarind plum's blended squash makes it more recommendable for commercial utilization and for large-scale industrial manufacturing.

## INTRODUCTION

*Tamarind indica* L. member of the Caesalpiniaceae family, grows mostly in the tropical African region but has been since subsequently found in South/North America pertaining to Florida and Brazil. Except from these parts of the world, it is also reported to be found in India, Thailand, Indonesia, subtropical China, Philippines, Spain, and Pakistan [1]. Based on multiple reported benefits, the tamarind fruit can be used for different reasons, which may include digestive, laxative, tonic blood, carminative, and expectorant purposes [2]. Till now, tamarind is being used in my different regions because of medicinal purposes, these regions involve African, Asian, and American parts of

the world. The juice produced from the tamarind fruit has a little bit of disadvantages as well, such as loss of freshness, unappetising colour, and the capacity to get spoiled after hypoglycemic activities [3]. Based on the regions that it is being used in, the tamarind pulp is majorly utilized as a food souring entity for different food products, including sambar, sauces, chutneys, sauces, and curries. Other than that, it can also be used for the production of jams, ice-creams, jellies, beverages, syrups, canned juices, and other products [4]. By conducting thermal processing, the pulp of the tamarind can be used with original flavour in it. This fruit is regularly processes worldwide into nectars,

concentrates, juices, glaze, and crystallized fruit forms [5]. Based on various studies, it has been reported that the tamarind fruit contains a bit of a low water content, which makes it difficult to extract fruit pulp. The pulp of tamarind fruit can easily be extracted by different conventional processes procedures, including soaking, straining, and maceration [6]. The tamarind pulp along with various beneficial properties contain reducing sugars, tartaric acid, fibre, pectin, and other cellulosic materials. Whereas, the sugar and acidic content can vary based on samples, for instance, reducing sugars are from 25% to 45%, the tartaric acid ranges between 8% to 18%, pectin ranges between 2% to 3.5%, and proteins between 2% to 3% [7]. Tamarind pulp does have a major odour with an enjoyable acidified flavour, and it is commonly used as a primary souring agent [8]. The pulp is also utilized as an unprocessed substance in the manufacturing of wine-like beverages. *Prunus domestica* L., commonly known as plum is a seasonal fruit with a shorter shelf life at optimum temperatures [6]. Fast ripening and mould growth can account for the plum fruit to decay during storage. Plum life span can be prolonged via adequate processing, transportation, and promotional chain, as well as keeping the fruit in low-temperature conditions to lengthen post-harvest quality. Plums have an elevated concentrations of bioactive components, such as anthocyanins as well as other polyphenols with an elevated antioxidant activity. Plum contains natural compounds that assist in avoiding diseases like diabetes and melanoma. They may serve as a low-cost cause of various materials that would be beneficial for food, cosmetics, and medical drugs [9]. Condensed soft drinks, which comprise of a specific proportion of juice, are utilized for refreshing and are very prevalent drinks [10]. Manufacturing, preservation, and sales of these products play a major role in commercial significance of countries. Fruit beverages are made up of pulp, juice, and water, in addition to added sugar, colouring, flavouring, and additives [11]. Even though fruit does have a dominant contribution to the flavour and general character in beverages, such product lines vary from fruit juices and are properly labelled [12].

## METHODS

Tamarind fruits were bought from a local market. After that plum and tamarind squash was prepared in the lab of University of Lahore. The substances were added based on the 4:3:1 ratio of sugar, pulp, and water. TSS (°brix) was evaluated by the AOAC methodology 932.14 and 932.12. Hand refractometer was utilized to assess the TSS (°brix) of blended squash. A small quantity of blended squash was added to the calibrated instrument to take accurate and validated readings [13, 14]. 0.1 N NaOH standard solution

was produced by taking 4.5g of NaOH and 6.30g of oxalic acid in a certain volumetric flask. This step was followed by taking 10ml 0.1N NaOH and titrating it against 0.1N oxalic acid. After that three phenolphthalein indicator drops were added and the experiment was repeated three times while taking readings after formulation of pink colour. The sample titration was done by taking 10ml squash sample and dissolving it in distilled water to allow the final volume to reach 100ml. Two drops of phenolphthalein were added to the 10ml sample solution and was titrated with 0.1N NaOH solution. The experiment was again repeated three times [13].

$$\text{Acidity (\%)} = \frac{\text{CF} \times \text{N} \times \text{T} \times \text{D} \times 100}{\text{V} \times \text{S}}$$

Correction Factor for acidity (CF), Normality (N), ml of sodium hydroxide (T), Dilution Factor (D), Sample for dilution (V), and Sample for titration (S). Calculation of sugar and acid ratio was done by:

$$\text{Sugar acid ratio} = \frac{\text{Total Soluble Solids (TSS)}}{\text{Titrateable acidity \%}}$$

Standard method of AOAC 920.183 was used to evaluate reducing sugar of blended squash and tamarind plum [13]. Multiple reagents were used for different purposes, including a) Fehling A; by dissolving 500ml of distilled water with 34.65g of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , and b) Fehling B; by taking 50g of NaOH with 173g of potassium titrate in beaker which was further dissolved in 10ml of water. The solution thus produced was added into 500ml conical flask and the complete volume was achieved by adding distilled water. An indicator named Methylene blue was prepared by taking 0.2g of methylene blue in 100ml flask and was dissolved in 150ml of distilled water. For the complete process, 10ml of squash sample mixed with distilled water was added to for the achievement of 100ml total volume. 5ml each of Fehling solutions were taken with 10ml distilled water. The flask containing the solutions was heated up to the boiling point. To make the overall colour brick red, the solutions from the burette were drop by drop. In the boiled up solution, two drops of methylene blue were added, to comprehend the presence of enough quantity of plum solution. Fehling A amount is 5ml + % ml of Fehling B = X ml making the 10% of sample being equal to 0.05g of reducing sugar × 100ml of 10% sample solution.

$$\begin{aligned} 100\text{ml of } 10\% \text{ solution will contain} &= \frac{0.05 \times 100}{X} = Y \text{ g of} \\ \text{reducing sugar} & \\ \text{Reducing sugar (\%)} &= \frac{Y \times 100}{10} \end{aligned}$$

To investigate non-reducing sugar of plum blended squash, AOAC 920.184 was applied [13]. 10ml of sample was subjected in a flask and 100ml volume was achieved with distilled water. Dilution of 10ml 1N HCl was conducted after taking 20ml solution. After that, the complete mixture was

heated until boiled. 10ml of 1N NaOH was added after that and the volume was increased up to 250ml. 5ml each Fehling A and B solutions were diluted with 10ml water and the solution was heated until boiled. The plum was added to solution in drop by drop manner until it was brick red in colour. Two methylene blue drops were added to evaluate the reaction completion. Solution  $X_{ml} = 0.05g$  reducing sugars,  $250ml$  of sample  $= 259 \times 0.05/ml = Y$  g reducing sugars. Sample solution comprises of  $Y \times 100/20 = P$  g reducing sugar.  $10ml$  of sample has  $= P$  g of reducing sugar.  $100$  ml of sample has  $= P \times 100/10 = Q$  g of total reducing sugar.  $Q$  g of reducing sugar = free reducing sugar + inverted sugar. Non-reducing sugar can be calculated as; total reducing sugar – free reducing sugar.

## RESULTS

The following tables demonstrate pH, titratable acidity, sugar acid ratio, reducing and non-reducing sugars, and total soluble solids, that were analysed during the entire study.

Treatment	Storage at different Concentration							Decrease (%)	Mean±SD
	00	15	30	45	60	75	90		
TPS1	1.07	1.04	1.02	0.97	0.96	0.95	0.93	11.431	2.27±0.03ab
TPS2	1.07	1.05	1.04	1.02	1.01	0.99	0.97	0.09	2.13±0.03aa
TPS3	1.08	1.07	1.07	1.05	1.01	1.02	1.00	9.84	2.11±0.04a
Mean	1.07	1.05	1.04	1.01	0.99	0.98	0.96	-	-

**Table 1:** The titratable acidity of the Juice ready by mixing the juice of plum and tamarind at various stages. a-g Values of alphabets demonstrate (P less than 0.05) difference.

Treatment	Storage at different Concentration							Increase (%)	Mean±SD
	00	15	30	45	60	75	90		
TPS1	47.41	47.53	47.64	47.73	47.85	47.94	48.05	1.34	47.73±0.02c
TPS2	48.32	48.43	48.55	48.63	48.74	48.83	48.93	1.26	48.63±0.03b
TPS3	49.22	49.31	49.43	49.54	49.63	49.74	49.82	1.21	49.54±0.01a
Mean	48.31	48.42	48.53	48.7	48.74	48.83	48.94	-	-

**Table 2:** Total soluble solids of juice ready by blending juice of plum and tamarind at various stages. a-g values of alphabets demonstrate (P less than 0.05) difference.

Treatment	Storage at different Concentration							Increase (%)	Mean±SD
	00	15	30	45	60	75	90		
TPS1	17.28	18.09	21.29	24.32	26.45	28.54	31.46	45.07%	24.03±0.06bac
TPS2	17.22	20.02	22.25	25.32	28.45	30.21	33.23	48.18%	25.27±0.05b
TPS3	17.24	19.25	22.87	24.54	26.93	28.54	30.65	43.75%	24.29±0.07a
Mean	17.24	19.12	22.13	24.72	27.27	29.09	31.78	-	-

**Table 4:** The reducing sugar of Juice ready from mix of fruit juice at various stages. a-g Values of alphabets demonstrate (P less than 0.05) difference.

Treatment	Storage at different Concentration							Increase (%)	Mean±SD
	00	15	30	45	60	75	90		
TPS1	44.95	42.01	38.65	34.21	30.24	23.46	20.25	54.95%	33.41±0.04c
TPS2	45.98	43.25	40.13	35.65	31.35	25.78	21.98	52.2%	34.87±0.06b
TPS3	47.01	45.24	41.21	39.19	34.99	30.01	25.65	45.54%	37.64±0.05a
Mean	45.98	43.5	39.99	36.35	32.19	26.41	22.62	-	-

**Table 5:** The non-reducing sugar of Juice ready by mixing of juice at various stages. a-g values of alphabets demonstrate (P less than 0.05) difference.

## DISCUSSION

Highest mean value of titratable acidity was 2.27% having the concentration of tamarind juice 550 ml and plum juice 200 ml in the squash. The lowest titratable acidity (2.11%) was noted in squash of tamarind juice 350 ml and plum juice 400 ml. Range of titratable acidity was 0.93% to 1.00% during storage period of 90 days. Hydrolysis of polysaccharides is the main reason for change in acidity, conversion of non-reducing sugars into reducing sugars also responsible for this [15]. The loss of acidity might be attributed to the chemical interaction between the organic constituents of juice induced by temperature and the action of enzymes. A study observed the increase of titratable acidity at 90-days storage study in Tamarind Plum at ambient temperature. Highest mean value of TSS was 49.54% having the concentration of tamarind juice 350 ml and plum juice 400 ml in the squash. The lowest TSS (47.73) was noted in squash concentration of tamarind juice 550 ml and plum juice 200 ml. Range of TSS was 48.05% to 48.94% during storage period of 90 days. During storage study of drink, it is analysed that for better squash quality increase in a minimum quantity of TSS value is desirable for squash [16]. Proportion sugar corrosive of Juice tests was in the scope of 44.36 (TPS3) to 44.89 (TPS1) at beginning day, while demonstrated an expanding pattern of 51.72 (TPS1) to 49.75 (TPS1) in three months stockpiling span. Beginning day stockpiling mean was 44.59, which increment to 50.66. Test TPS1 (48.11) show high mean worth, while the example TPS3 (47.11) with most reduced estimation of mean. Test TPS1 indicated % expansion of most extreme (13.02), while TPS3 (10.76) demonstrated the base increment in percent sugar corrosive proportion [17]. Diminishing sugar of fruit Juice was in the middle of 17.24 (TPS3) to 17.28 (TPS1) at beginning day. There demonstrates an expanding pattern of 30.65 (TPS3) to 33.23 (TPS1) in three months of capacity timespan. Beginning of the value of fruit was 17.24, which shows steady increment of 31.78 through the capacity timespan. Fruit test TPS2 (25.27) demonstrated the most extreme value worth, anyway test TPS1 (24.01) had least mean worth. Juice test TPS2 (48.18) found with greatest percent expansion, while the example TPS3 (43.75) with most minimal percent expansion in diminishing sugar [18]. The information of Juice tests was in the scope of 44.95 (TPS1) to 47.01 (TPS3) at starting. Through during capacity time, the non-diminishing sugar decline bit by bit from 20.25 (TPS1) to 25.65 (TPS3) at 90 days of stretch. Beginning mean information was 45.98, which shows a lessening pattern of 22.62. fruit mixed example TPS3 (37.64) with most extreme mean, while Juice test TPS1 (33.41) with least mean. High percent decline (54.95), for test TPS1. Be that as it may, TPS3 (45.54) demonstrated the base % decline [19, 20].



## CONCLUSIONS

Tamarind plum mixed juice was done with various extents. Concoction additives were utilised to hinder the development of microbial action in mixed juice. The tamarind juice drink has high content of vitamin C, antioxidant activity and total phenol. However, these compounds were lost during 3 months of storage at 28°C. As the supplementation level of tamarind plum squash increase from tamarind juice 350 ml and plum juice 400 ml pH, titratable acidity, ascorbic acid and TSS was increased. It is presumed that total soluble solids of fruit mixed juice expanded with perseverance and handling. The data had a critical impact on taste colour & overall acceptability through capacity and cure time spans. Mix juice is more suggested regarding business use and for huge scope mechanical creation.

## REFERENCES

- [1] Khan I, Rehman AU, Khan SH, Qazi IM, Arsalan Khan SF, Rehman TU. Development and Quality Evaluation of Tamarind Plum Blended Squash During Storage. *International journal of food processing technology*. 2017; 8(662):2. DOI: 10.4172/2157-7110.1000662
- [2] Hassan SM. Production and quality evaluation of vinegar from tamarind (*Tamarindus indica* L.) fruit pulp (Doctoral dissertation, University of Gezira). 2014.
- [3] Aengwanich W, Suttajit M. Effect of polyphenols extracted from Tamarind (*Tamarindus indica* L.) seed coat on physiological changes, heterophil/lymphocyte ratio, oxidative stress and body weight of broilers (*Gallus domesticus*) under chronic heat stress. *Animal science journal*. 2010 Apr; 81(2):264-70. doi:10.1111/j.1740-0929.2009.00736.x
- [4] Silva FM, Leite MF, Spadaro AC, Uyemura SA, Maistro EL. Assessment of the potential genotoxic risk of medicinal *Tamarindus indica* fruit pulp extract using in vivo assays. *Genetics and Molecular Research*. 2009 Sep; 8(3):1085-1092. doi: 10.4238/vol8-3gmr630.
- [5] El-Siddig K. Tamarind: *Tamarindus Indica* L. Crops for the Future; 2006.
- [6] Obulesu M, Bhattacharya S. Color changes of tamarind (*Tamarindus indica* L.) pulp during fruit development, ripening, and storage. *International Journal of Food Properties*. 2011 Mar; 14(3):538-49. doi: 10.1080/10942910903262129
- [7] Muzaffar K, Kumar P. Parameter optimization for spray drying of tamarind pulp using response surface methodology. *Powder Technology*. 2015 Jul 1; 279:179-84. doi: 10.1016/j.powtec.2015.04.010
- [8] Pattar AS. Studies on Extraction of Tamarind Pulp and Value Addition. Doctoral Dissertation, University of horticulture Sciences, Bagalkot. 2012 Feb.
- [9] Cantin CM, Moreno MA, Gogorcena Y. Evaluation of the antioxidant capacity, phenolic compounds, and vitamin C content of different peach and nectarine [*Prunus persica* (L.) Batsch] breeding progenies. *Journal of agricultural and food chemistry*. 2009 Jun; 57(11):4586-92. doi:10.1021/jf900385a
- [10] Rajauria G, editor. Fruit juices: Extraction, composition, quality and analysis. Academic press; 2017 Nov.
- [11] Kregiel D. Health safety of soft drinks: contents, containers, and microorganisms. *BioMed research international*. 2015 Jan; 2015. doi: 10.1155/2015/128697
- [12] Snowden AL. Post-harvest diseases and disorders of fruits and vegetables: Volume 1: general introduction and fruits. CRC Press; 2008 Feb. doi: 10.1201/b18214.
- [13] Anurag S, Pragati K, Ashutosh U. Bael (*Aegle marmelos* Correa) products processing: A review. *African journal of food science*. 2014 May; 8(5):204-15. doi: 10.5897/AJFS2013.1119.
- [14] Larmond E. Laboratory methods for sensory evaluation of food. Publication 1637. Canada Department of Agriculture, Ottawa. 1977.
- [15] Harborne JB. Methods in plant biochemistry. Volume 1. Plant phenolics. Academic Press Ltd.; 1989.
- [16] Horwitz W, Latimer G. AOAC-Association of official analytical chemists. Official Methods of Analysis of AOAC International 18th edition, Gaithersburg, Maryland, USA. 2005; 45:75-6.
- [17] Barbosa-Cánovas GV. Handling and preservation of fruits and vegetables by combined methods for rural areas: technical manual. *Journal of the Science of Food and Agriculture*; 2003.
- [18] Chang TS, Siddiq M, Sinha NK, Cash JN. Plum juice quality affected by enzyme treatment and fining. *Journal of Food Science*. 1994 Sep; 59(5):1065-9. doi: 10.1111/j.1365-2621.1994.tb08191.x.
- [19] Omer HA. The Potential of Tamarind (*Tamarindus indica* L.) Kernels as a Substitute Source of Pectic Substances. Doctoral dissertation, UOFK.
- [20] Davis RH. Aloe vera: A scientific approach. Vantage Press; 1997.