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A Review of the Potential of Incorporating Local Wild Fruits into Value-Added Dairy Products.

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ABSTRACT

Wild fruits are a group of natural ingredients that have been widely used in traditional Indian dairy products, including yogurt, basundi, whey beverage, peda, cheese, ice cream, shrikhand, and kulfi. In recent years, there has been a significant increase in the application of wild fruits in value-added dairy products. This article aims to explore the potential of incorporating local wild fruits into value-added dairy products and the necessary considerations for successful integration, allowing smallholders to capitalize on the growing demand for innovative and sustainable agricultural products. In addition, the review paper explores the major groups of vitamins, minerals, and antioxidants found in wild fruits, highlighting their potential health benefits. Furthermore, the study highlights the importance of exploring indigenous fruits to create innovative culinary experiences while preserving cultural heritage and promoting local agricultural resources.

Keywords : Dairy Product, Wild Fruit, Value-added, Antioxidant.

1.INTRODUCTION.

Local wild fruits have been a part of traditional diets in many regions for centuries, and their incorporation into dairy products offer a unique opportunity to combine traditional flavour with modern dairy products. The rich and diverse flavour of local wild fruits can add a unique taste to dairy products, appealing to consumers looking for new and exotic flavors, such as yoghurt, shrikhand, kheer, cheese, ice cream etc. By doing so, we can give a review of the suitability of these fruits for commercial dairy production and the potential impact on product quality and consumer acceptance. Additionally, we will take a review by analyzing the nutritional content and antioxidant properties of the wild fruits to evaluate the potential health benefits they may offer when integrated into dairy products. (*Suresh Chandra et al,2022*) .

Furthermore, the nutritional content of these wild fruits is of particular interest, as they often contain high levels of vitamins, minerals and antioxidants. This presents an opportunity to enhance the health benefits of dairy products by incorporating these fruits. Additionally, the vibrant colour of these fruits can add visual appeal to the dairy products, making them more attractive to consumers.

In recent years, there has been an increasing interest in the incorporation of local wild fruits into value-added dairy products. These fruits, including Falsa, Indian Beal, Singhara, and Jungle Julibe, offer not only unique flavors but also significant nutritional benefits, presenting an exciting opportunity for smallholders in the agricultural economy. However, integrating these wild fruits into dairy products requires careful consideration of various factors, such as seasonality, sensory attributes, shelf life, and processing techniques. This article aims to explore the potential of incorporating wild fruits into value-added dairy products and the necessary considerations for successful integration, allowing smallholders to capitalize on the growing demand for innovative and sustainable agricultural products. The incorporation of local wild fruits, such as Falsa, Indian Beal, Singhara, Jungle Julibe, custard apple, ramphal etc into value-added dairy products offers an opportunity to create unique and nutritionally rich products that cater to evolving consumer preferences (*Rakesh Sharma et al 2014*). Additionally, it helps to support sustainable agricultural practices and promote the consumption of local and indigenous plant species. Research on the suitability of incorporating these wild fruits into dairy products can provide valuable insights into their potential contribution to the overall flavor, texture, and nutritional profile of the final products. To further explore the potential of incorporating wild fruits into value-added dairy products, it is essential to conduct comprehensive sensory evaluations to understand the flavor profiles and textural characteristics that these fruits can impart to the dairy products. This will not only aid in the development of new and innovative dairy products but also help in catering to the diverse and evolving consumer preferences for natural and locally sourced ingredients.

By addressing the factors of seasonality, sensory attributes, shelf life, processing techniques, and sustainable sourcing, smallholders can successfully integrate local wild fruits into value-added dairy products, creating a niche market for unique and nutritionally rich offerings. This approach brings into line with the growing consumer demand for sustainable and ethically produced agricultural products and can contribute to the overall economic and environmental sustainability of smallholder agricultural practices.Therefore, it is important to conduct detailed studies on the nutritive and medicinal value of these fermented products in order to provide valuable information that can guide their wider use and application on a global scale (Narzary et al., 2016).

In the following sections, we will review specific local wild fruits and their potential application in dairy products, as well as the sensory evaluation aspects of incorporation of local wild fruits into dairy products. The sensory attributes include appearance, aroma, taste, and overall consumer acceptance. By conducting their research data. In addition to sensory evaluation, it is essential to review the potential health benefits that local wild fruits can bring to dairy products. As mentioned earlier, these fruits are known to be rich in vitamins, minerals and antioxidants, which can significantly contribute to the nutritional profile of dairy products. By taking a review of incorporating local wild fruits into dairy products, we aim to enhance their nutritional value and offer consumers an additional source of essential nutrients.Antioxidants play a vital role in protecting the body from oxidative stress and reducing the risk of certain chronic diseases.

In conclusion, incorporating local wild fruits into value-added dairy products offers a promising opportunity to enhance flavor and nutritional profiles, support sustainable agricultural practices, promote local biodiversity, and meet the growing consumer demand for natural and locally sourced ingredients (Narzary et

al., 2016). Incorporating local wild fruits into value-added dairy products offers a promising opportunity to enhance flavor and nutritional profiles, support sustainable agricultural practices, and promote local fruit to the consumer.

2. Common wild fruits used in Dairy products.

Wild fruits can contribute significantly to the nutrition of rural people. Although these fruits can be consumed by people throughout the year in fresh and dried form. Wild edible plants include fruits, leaves, flowers and seeds. Following table shows the research that has been done on dairy products using some wild fruits with their reference.

Table 1 Common wild fruit and species used in dairy products.

Name of the wild fruits and species.	Dairy product prepared	Reference
Bael (*Angle marmelos*)	Whey beverage, Kulfi, Shrikhand, Kheer.	*Navdeep et al 2023* Development of protein enriched whey-bael beverage and its evaluation for antioxidant potential.
Singhara (*Eleocharis dulcis*),	Peda	*TA Meshram et al 2019* Effect of singhara (Elecocharis dulcis) flour on sensory quality of peda.
Cactus Pear Fruits (Opuntia dillenii)	Yoghart Drinks	*Marwa M.Desouky 2018* Effect of Using Cactus Pear pulp on the properties of goat milk Bio-yoghurt Drinks.
Ber (*Zizyphus mauritiana*),	Burfi	*Sonika Pandey 2019* Development of spray dried Ber (*Zizyphus mauritiana*) powder and its utilization in value added products.
Falsa (*Grewia asiatica*)	Cheese	*Sakshi Sharma et al 2023* Grewia asiatica fruit extract-based Kalari cheese for enhanced storage stability and functional value.
Red cactus pear (*Opuntia Ficus-indica*)	Ice cream	*S.K.El-Samahy et al 2009* Producing ice cream with concentrated cactus pear pulp: A preliminary study.
Dragon fruit (*Hylocereus spp*.)	Shrikhand	*Mohammad Sameem et al 2018* Studies on preparation of shrikhand by using dragon fruit pulp.
Kiwi fruit (*Actinidia deliciosa)*	Shrikhand	*Shashikant Kushwaha et al 2019* Studies on quality parameters of shrikhand prepared using kiwi fruit pulp.
Ramphal (*Annona reticulata*)	Kulfi	*S.B.Chavan et al* 2023 Sensory quality of kulfi blended with bullock fruit pulp.
Custard apple (*Annona squamosa*)	Basundi	*Gite AS et al 2017* Development and standardization of custard apple basundi.
Baobab fruit or Mandu ki Imli (*Adansonia digitata L*)	Yoghurt	*Nancy Wairimu 2022* Development and Evaluation of Goat milk Yoghurt enriched with Baobab fruit pulp.

3. Major Group of Vitamins, Minerals And Antioxidants

Many wild edible plants are nutritionally rich and can supplement nutritional requirements of humans and livestock, especially the vitamins, minerals and antioxidant properties. For example *(A.K.Mahapatra et al 2009*) Some wild fruits even compare favorably with better known cultivated fruits. For instance, the vitamin C content of oranges is around 57 mg/100g but fruit of the baobab trees has 360 mg/100g and Ziziphus jujube 1000 mg/100g (FAO,1992). Wild fruits contain various antioxidants that contribute to their health promoting properties. Here are some groups of antioxidants commonly found in these fruits.

3.1 *Vitamins.*

Wild fruits like Falsa fruit are renowned for its high vitamin C content, making it a powerful antioxidant that helps protect cells from damage, boost the immune system, fight off infections and promote overall health. Indian Beal is rich in vitamins A,C and B complex. Singhara fruit is rich in vitamin B_6 . Also Madras thorn rich in vitamin C. Custard apple and Ramphal is rich in vitamin C and A. (*Rodriguez-Carrasco et al.2018*)

3.2 *Flavonoids.*

Flavonoids are a group of polyphenolic compounds found in plants that have antioxidant and anti-inflammatory properties. These fruits may contain flavonoids such as quercetin, kaempferol, and catechins which contribute to their antioxidant activity. (*Sharma RK et al.2020*)

3.3 *Carotenoids.*

Some wild fruits, such as Custard Apple and Ramphal contain carotenoids like beta-carotene, lutein and zeaxanthin. Carotenoids act as antioxidants and are important for eye health, immune function and skin protection. (*Rizvi SMD et al.2019*)

3.4 *Phenolic Compounds.*

Phenolic compound are antioxidant found in plant food that have been linked to various health benefits, including reducing inflammation and lowering the risk of chronic diseases, fruit like Bael and Custard Apple contain phenolic compound such as gallic acid, ellagic acid and chlorogenic acid.(*Rana CS et al. 2015).*

3.5 *Tannins.*

Tannins are polyphenolic compounds found in plants that have antioxidant and anti-inflammatory properties. Fruit like Singhara and Bael contain tannin, which contributes to their astringent taste and potential health benefits. (*Nair R et al.2007*)

3.6 *Anthocyanins.*

Some wild fruits, like Falsa, may contain anthocyanins, which are water soluble pigments responsible for the red, purple or blue colour in fruits and vegetables. Anthocyanins have antioxidant anti-inflammatory properties and may offer various health benefits. (*Wallace T.C. et al.2015)*

These antioxidants work synergistically to neutralize free radicals in the body, reduce oxidative stress and protect cells from damage. Including Variety of wild fruits in the diet can provide a diverse range of antioxidants that support overall health and well-being.

4. Work of Antioxidants

Antioxidants are compounds which can inhibit or delay the oxidative damage preventing many diseases (Gulcin I. 2012),also they are substances which are both nutrient viz. vitamin E, C, beta carotene; and non nutrient viz. plant phenols, flavonoids, etc. found naturally in many fruits and vegetables (Wiel & Low, 2014) and other sources, protect cells from harmful oxidation reactions caused by substances like oxygen. They counteract the damage caused by oxygen-centered free radicals and Reactive Oxygen Species (ROS), which can lead to diseases like atherosclerosis, cancer, and neurodegenerative disorders. By inhibiting or delaying oxidative damage, antioxidants help prevent conditions such as aging, cardiovascular diseases, and immune system decline. Both nutrient (e.g., vitamins) and non-nutrient (e.g., plant phenols) antioxidants work together to neutralize free radicals and promote overall health. (*Wiel & Low, 2014).* According to Liguori I. et al., (2018) cell damage caused by free radicals appears to be a major contributor to aging and degenerative diseases such as cancer, cardiovascular diseases, cataracts, diabetes, immune system decline and brain dysfunction to protect the cell from damage caused by free radicals.

5. Application of Wild Fruits and Spices Into Traditional Indian Dairy Products.

In recent years, wild fruit pulp, powder and juices preparations have started due to their antioxidant properties and therapeutic value. Wild fruits have been used as preservatives, flavouring and therapeutic agents to fortify foods. These fruits are low cost commodities, and priceless for several decades. Wild fruit has a significant health benefit and reduces the incidence of different diseases. Dairy products are a special carrier that has been successfully used in our dietary system to carry its therapeutic value and nutrients for health benefits. In milk products, the use of wild fruits and spices is discussed here.

5.1 Yoghurt.

Yoghurt is a fermented dairy product made from milk in which cultures of two bacteria *lactobacillus bulgaricus and streptococcus thermophilus* have been added. *Nancy Wairimu et al.2022* study to develop probiotic yoghurt enriched with various concentrations of baobab fruit (*Adansonia digitata L.)* pulp. According to this study, there was an increase in physicochemical properties of different formulations of yoghurt samples. The addition of 3% baobab fruit pulp increased total solids and syneresis compounds. The PH of the fresh milk decreased as the proportion of baobab powder increased. The hedonic rating, the yoghurt sample with the highest baobab pulp scored the highest taste, texture, aroma, colour and overall acceptability. They also state that there is a need for further studies on the use of baobab pulp for value addition in yoghurt and examine and analyze the activities of the compounds present.

5.2 Basundi.

Basundi is sweetened condensed milk made by boiling milk on low heat until the milk is reduced by half. Most popular in India particularly in Maharashtra and Gujarat state. *Gite AS et al.2017* study on preparation of basundi using different levels of custard apple pulp (*Annona squamosa L.*) with a view to optimize the process for its manufacture and study chemical and sensory qualities. They investigate that 30% custard apple pulp blended with basundi shows the highest sensory sensory score for each sensory attribute. Hence they concluded that custard apple basundi gives superior taste, flavour and acceptability than plain basundi.

5.3 Whey beverage.

Whey is the by-product obtained during manufacturing of paneer, cheese, casein and shrikhand. Whey-beverage prepared from these with the addition of sugar. *Navdeep JP et al.2022* study on to develop and to evaluate the antioxidant potential of whey based bael fruit beverage fortified with whey protein. Whey Bael beverage was analysed for physico-chemical characteristics and antioxidant activity. The level of bael pulp increased from 6% to 12% the sensorial score increases, addition of 14% pulp did not affect the sensorial score. The antioxidant activity of beverages increases with increase in addition of the bael pulp. The protein enrich activity and high acceptable sensory attributes could be developed by incorporation bale pulp in whey. They also state that further antioxidant activity through in-vivo studies needs to be carried out for proof of the health benefits of developed whey-bael beverages.

5.4 Peda.

Khoa is used as base material for production of traditional dairy product peda. *TA Meshram et al.2019* the research work carried on different levels of singhara (*Eleocharis dulcis*) floour on sensory quality, composition of peda. They study that superior, nutritional and medicinal quality singhara pede prepared by addition of 5 parts of singhara flour 95 parts buffalo milk khoa with 30% sugar level which have mild pleasant flavour, soft, smooth body with grained texture and light yellowish to brown colour. 5% singhara flower successfully and economically used for preparation of peda.

5.5 Cheese.

The study focuses on the development and evaluation of kalari cheese enriched with Grewia asiatica fruit extract to enhance its storage stability and functional value. The study, led by Sakshi Sharma et al.2023, by discussing the methodology for incorporating Grewia asiatica fruit extract into kalari cheese, outlining the extraction process and the subsequent blending of the extract with the cheese matrix. They then explore the effects of the extract on the sensory attributes, shelf-life, and functional properties of the enriched cheese.

The review paper highlights the potential health benefits of consuming Grewia asiatica extract-enriched kalari cheese, such as its antioxidant properties, enhanced nutritional value, and extended shelf-life. Overall, the paper provides valuable insights into the development and evaluation of Grewia asiatica extract-based kalari cheese, showcasing its potential as a nutritious and shelf-stable dairy product with enhanced functional value.

5.6 Ice Cream.

The study conducted by *S.K. El-Samahy et al. 2009* explored the feasibility of incorporating concentrated cactus pear pulp into ice cream formulations. The researchers aim to evaluate the potential of cactus pear pulp as a natural ingredient to enhance the sensory attributes and nutritional value of ice cream.

The study concludes that incorporating concentrated cactus pear pulp into ice cream formulations is feasible and offers potential benefits in terms of sensory appeal and nutritional value. However, further research is needed to optimize the concentration of cactus pear pulp and its effects on the stability and shelf-life of the ice cream product.

Overall, the preliminary study provides valuable insights into the utilization of cactus pear pulp as a natural ingredient in ice cream production, highlighting its potential to create innovative and health-promoting frozen desserts.

5.7 Shrikhand

The paper authored by *Mohammad Sameem et al. 2018* into the utilization of dragon fruit pulp as an innovative ingredient in the preparation of shrikhand, a traditional Indian dessert. The study aims to investigate the feasibility of incorporating dragon fruit pulp into shrikhand and assess its impact on sensory attributes, nutritional composition, and consumer acceptability.

The results of the study indicate that the addition of dragon fruit pulp to shrikhand formulations positively influences its sensory attributes, imparting a vibrant color, unique flavor, and creamy texture to the dessert. Furthermore, the nutritional analysis reveals that dragon fruit pulp enriches the shrikhand with antioxidants, vitamins, and dietary fiber, enhancing its health-promoting properties.

Overall, the paper provides valuable insights into the potential of dragon fruit pulp as a novel ingredient in shrikhand preparation, offering an innovative twist to this traditional dessert. The study underscores the importance of exploring unconventional ingredients to create new culinary experiences while promoting health and wellness through traditional foods.

5.8 Kulfi.

The study conducted by *S.B. Chavan et al. 2023* investigated the sensory quality of kulfi, a traditional Indian frozen dessert, enriched with bullock fruit pulp. The research aims to assess the feasibility of incorporating bullock fruit pulp into kulfi and evaluate its impact on sensory attributes, taste, and overall consumer acceptability.

The results of the study suggest that the addition of bullock fruit pulp to kulfi formulations positively influences its sensory quality, imparting a unique flavor profile, subtle sweetness, and smooth texture to the frozen dessert. Furthermore, the incorporation of bullock fruit pulp enhances the visual appeal of kulfi, with its vibrant color and attractive appearance.

Overall, the paper provides valuable insights into the potential of bullock fruit pulp as a novel ingredient in kulfi preparation, offering a delightful twist to this traditional Indian dessert. The study underscores the importance of exploring indigenous fruits to create innovative culinary experiences while preserving cultural heritage and promoting local agricultural resources.

6 Conclusion.

A Review" explores the incorporation of local wild fruits into various dairy products to enhance their taste, nutritional value, and consumer appeal. The introduction highlights the rich flavor and nutritional content of wild fruits, making them ideal candidates for integration into dairy products. By analyzing existing literature and research studies, aims to evaluate the suitability of wild fruits for commercial dairy production and their potential impact on product quality and consumer acceptance. Identifies common wild fruits used in dairy products, including Bael, Singhara, Cactus Pear, Ber, Falsa, Dragon fruit, Jungle Jalebi, Ramphal, Custard apple, and Baobab fruit. For each fruit, specific dairy products incorporating them are discussed along with relevant references.

Additionally, the review explores the major groups of vitamins, minerals, and antioxidants found in wild fruits, highlighting their potential health benefits. These include vitamins C, A, B complex, flavonoids, carotenoids, phenolic compounds, tannins, and anthocyanins, which work synergistically to neutralize free radicals, reduce oxidative stress, and protect cells from damage.

The application of wild fruits in traditional Indian dairy products is discussed in detail, covering products like yogurt, basundi, whey beverage, peda, cheese, ice cream, shrikhand, and kulfi. Each section provides insights into the formulation, sensory evaluation, nutritional benefits, and potential health effects of incorporating wild fruits into these dairy products.

Overall, the review highlights the importance of exploring indigenous fruits to create innovative dairy products that provide consumer preferences for natural and locally sourced ingredients. By integrating wild fruits into dairy products, producers can enhance flavour, nutritional profiles, and market appeal while promoting sustainable agricultural practices and supporting local communities.

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