

# Coconut Milk vs. Dairy Milk: A Comparative Nutritional Analysis and Its Application in Vegan Curd Development

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**Abstract**—Plant-based milk alternatives (PBMA) are experiencing a surge in popularity within the food sector, due to health considerations and modern life style trends. There are a number of factors contributing to this growing interest, including the presence of diverse bioactive phytochemicals, substantial energy input given for the production, limited availability of milk in some region, the rise of vegan diets, constraints on resources such as landmass and animal feed, serving as an impetus for propelling the exploration of indispensable milk sources. The present work explains nutritional and sensory aspects of homemade coconut milk in comparison to the marketed cow milk. It also highlights the successful formulation of vegan curd using coconut milk. The findings suggest that while vegan milk may not entirely surpass dairy milk in terms of nutritional richness, it holds significant potential for various applications and serves as a valuable substitute for individuals with dietary restrictions.

**Index Terms**— Plant-based alternatives, Vegan milk, Cow milk, Coconut milk, Nutritional richness, Vegan curd (*key words*)

## I INTRODUCTION

Plant-based milk alternatives are becoming more popular and offer an affordable option for countries with struggling economies. PBMA are opted as it provides wide assortment of types and flavours and because of nutritional restrictions. (1)Plant sources which can be used to extract milk include oat, soy, cashew, coconut, almond, etc.(1)(2) Coconut milk stemmed from grated pulp of mature coconut (*Cocos nucifera*) is used in various culinary and cosmetic applications. Furthermore, it serves as a crucial substitute for milk for individuals with lactose intolerance. From a nutritional standpoint, the milk obtained from coconut is rich in essential minerals and dietary fiber; however, it is low in protein and relatively high in calories(2)(3). These nutritional characteristics are important considerations for consumers based on their individual health needs, dietary goals, and lifestyle choices.

## II MATERIALS AND METHOD

### MATERIALS:

Coconut Milk and green chilies: Coconut and green chilies were sourced from nearby market.

Chemicals and reagent: Fehling's Solution A (Copper (II) sulphate), Fehling's Solution B (Alkaline sodium potassium tartrate), Ninhydrin reagent, Copper (II) sulphate in alkaline solution, typically with sodium hydroxide and potassium tartrate, Ethanol, Dinitrosalicylic acid (DNSA), sodium hydroxide, phenolphthalein indicator, distilled water, Folin-Ciocalteu reagent

Equipments: Test tubes, burner, cotton cloth, colorimeter at respective wavelengths, mixer, pH meter.

Heating and cooling devices: Boiling water bath and refrigerator

### METHODS:

#### Preparation of coconut milk:

The coconut was cut into small pieces. The cut coconut was then added to a mixer along with some distilled water. It was ground, and distilled water was added until the desired consistency was reached. The coconut milk was extracted using a cotton cloth. With the help of a strainer, the milk was strained into a vessel and heated. Finally, the milk was cooled at room temperature, resulting in the vegan milk obtained from coconut.

#### Physiochemical analysis:

1. **Qualitative determination of various components was carried out in the sample** (8), (1).
  - a) **Test for reducing sugars:** When equal amounts of Fehling's A and B were added to the sample, and heated in a water bath, formation of brick red precipitate indicated the presence of reducing sugars. (8)

- b) **Test for amino acids and proteins (compounds with free amino groups):** When ninhydrin solution was added to the sample and heated gently, the appearance of purple or bluish-purple colour confirmed the presence of amino acids and proteins.(1)
- c) **Detection of proteins (presence of peptide bonds):** When sodium hydroxide was added to the sample, along with few drops of copper (II) sulphate solution and mixed, a violet colour indicated the presence of proteins.(1)
- d) **Detection of the presence of fats:** When equal proportion of sample was mixed with ethanol, a white precipitate was formed, indicating the presence of fats.(1)

2. **Qualitative determination of various components was carried out in the sample (8), (7)**

- a) **Test for carbohydrates by DNSA method:** DNSA is an aromatic compound that reacts with reducing sugars to estimate the amount of carbohydrates. (8) The standard sugar solution was diluted (in  $\mu\text{l}$ ) with various concentration made by transferring respective quantity of sugar from the standard sugar solution and by adding distilled water adjusting it to a total volume of 200  $\mu\text{l}$ . In each of test tubes, 0.5 ml of DNSA reagent was added and the tubes were mixed thoroughly. Then the tubes were kept in a boiling water bath for 15 minutes. The tubes were then cooled and mixed with 0.5 ml of a 40% potassium sodium tartrate solution. Using a colorimeter set to 540nm the absorbance was recorded and sugar concentration of test sample from standard curve of absorbance v/s sugar concentration in  $\mu\text{g}/200 \mu\text{l}$  was found out. (8)
- b) **Test for proteins by Folin-Lowry method:** It is a two-step chemical reaction. First, the peptide bonds in proteins react with copper (II) ions. This is followed by the reduction of the Folin-Ciocalteu reagent. This reduction is catalysed by the copper-protein complex formed in the first step, through oxidation of aromatic amino acids present in the protein. The intensity of the blue colour produced is directly proportional to the protein concentration which is measured at wavelength of 660nm. (7)

3. **Determination of acid value (6)**

Titrate acidity measures how well a substance, like milk, can resist changes in pH when a base is added. This is found by adding a standardized sodium hydroxide solution until a phenolphthalein indicator shows the exact point of neutralization. For milk, a higher acid value indicates spoilage and suggests that milk is unfit for consumption. On the flip side, a lower value means the milk is more stable.

4. **Formulation of vegan curd:**

The coconut was cut into small pieces. The cut coconut was then added to a mixer along with some distilled water. It was ground, and distilled water was added until the desired consistency was reached. The coconut milk was extracted using a cotton cloth. With the help of a strainer, the milk was strained into a vessel and heated. Finally, the milk was cooled at room temperature, resulting in the vegan milk obtained from coconut. With the help of a strainer, the milk was strained into a vessel and boiled for 5 minutes at 80°C. The milk was then cooled at room temperature. Green chilies were added to the milk, and it was allowed to set overnight. The final outcome was vegan curd made out of coconut milk.

### III RESULTS AND DISCUSSION

1. **pH and Sensory Attributes of Coconut milk (5):**

**pH Changes:** The pH of the coconut milk exhibited a significant decrease over time. On Day 1 (day of preparation), the pH was in the range of 5. By Day 4, the pH had dropped to a range of 3.

**Sensory Attributes (Day of Preparation):**

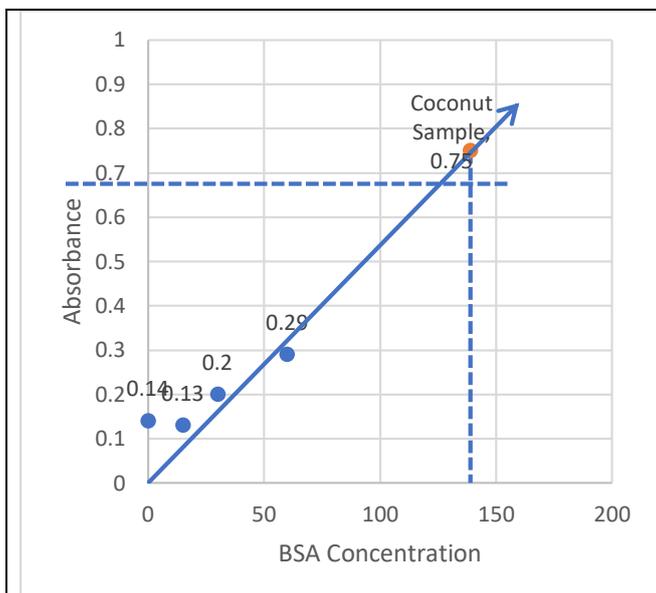
- Colour: The milk was white.
- Texture/Mouthfeel: It was described as creamy, fatty.
- Odour: The smell was noted as sweet.
- Taste: The taste was characterized as coconutty, sweet.
- Consistency: The milk had a smooth consistency.

2. **Qualitative test (8), (1)**

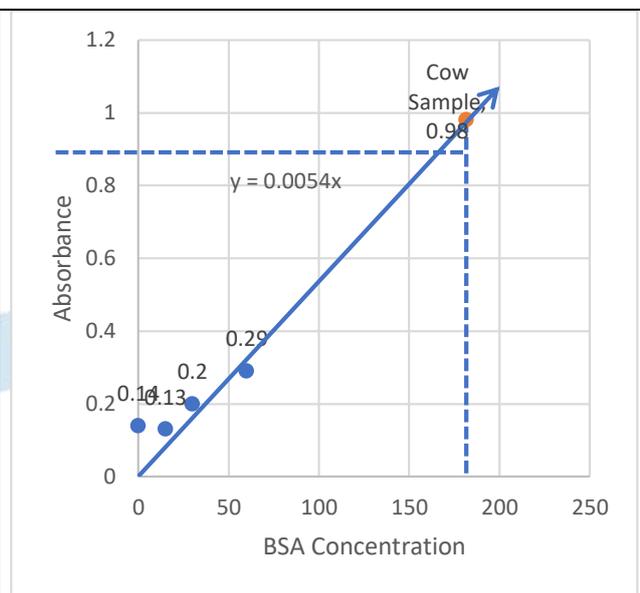
Test	Coconut Milk	Cow Milk
Fehling's Test	+	+
Ninhydrin Test	+	+
Biuret Test	+	+
Alcohol Test	+	+

### 3. Quantitative test (8), (7), (6)

#### 3.1 Results obtained for protein estimation by Folin Lowry method for coconut milk and cow milk

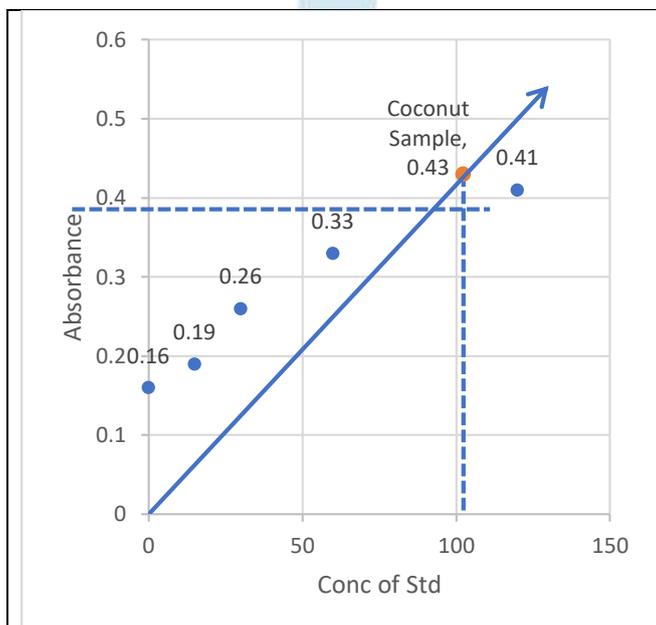


Amount of protein in coconut milk =  $138\mu\text{g/ml}$  i.e **0.138 mg/ml.**

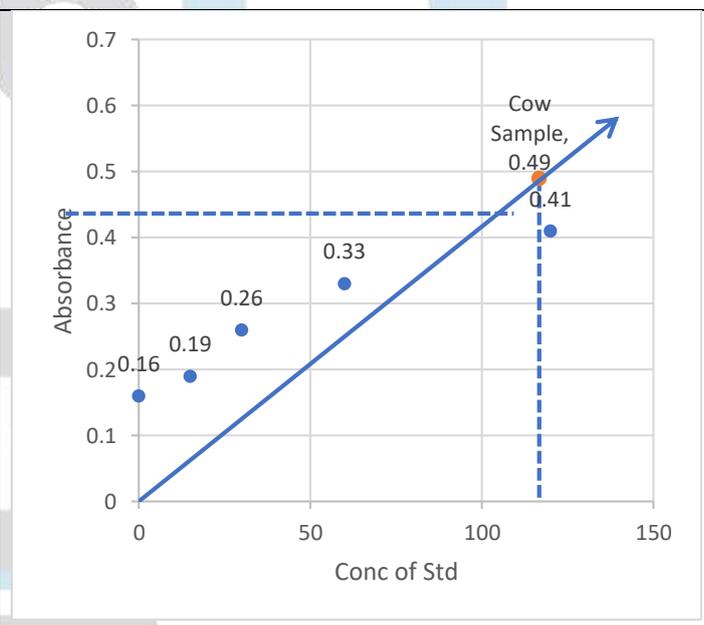


Amount of protein in cowmilk =  $181\mu\text{g/ml}$  i.e **0.181 mg/ml.**

#### 3.2 Results obtained for carbohydrate estimation by DNSA method for coconut milk and cow milk



Amount of carbohydrates in coconut milk =  $102\mu\text{g/ml}$  i.e **0.102 mg/ml.**



Amount of carbohydrates in cow milk =  $116\mu\text{g/ml}$  i.e **0.116 mg/ml.**

### 4. Determination of Acid Value: (4)

On titration, the CBR obtained was = 2ml

Thus, substituting in formula,

$$\text{Acid Value} = \frac{56.1 V \times N}{W}$$

$$= \frac{56.1 \times 2 \times 0.2}{5} = 4.4 \text{ mg NaOH/g}$$

The titratable acidity of coconut milk increases during storage, with a range of 7.02 to 13.44 over a five-day period. A low acid value indicates that that the coconut milk is likely in good condition.

### 5. pH and Sensory Attributes of Vegan Curd (5):

**pH Changes:** The pH of the vegan curd remained consistent over the observation period. On Day 1 (day of preparation), the pH was 4, and it maintained this pH range of 4 by Day 4. This stability suggests a controlled fermentation process.

#### Sensory Attributes:

- Colour: The curd was uniformly White.
- Texture/Mouthfeel: It was described as Creamy.
- Odour: A distinct Sour aroma was noted, which is typical for fermented products like curd.
- Taste: The taste was characterized as Coconutty, indicating the base ingredient, and likely complemented by the sour notes from fermentation.

- Consistency: The curd had a thick consistency, as expected for a fermented dairy alternative.

#### IV CONCLUSION:

Milk remains an irreplaceable commodity in many diets due to its comprehensive nutritional profile. Plant-based milk alternatives have an enormous expansion prospective for health food market, needs to be extensively delved through the development of advanced processing, technological interventions, fortification techniques to develop a nutritionally complete beverage.

The primary focus of this project was to provide a detailed comparison of the nutritional profiles of vegan milk (specifically coconut milk) and dairy milk, analysing their respective levels of proteins, fats, and carbohydrates. The study also emphasized the physical and chemical attributes of both vegan and dairy milk.

This investigation specifically analyzed the physical and chemical properties of coconut and dairy milk. pH and sensory evaluation of coconut milk revealed its distinct taste, sweet odor, creamy texture, and overall stability characteristics. Qualitative analysis, based on observable color changes and precipitate formation, confirmed the presence of carbohydrates, proteins, amino acids, and fats in both coconut and cow milk. Quantitative tests further determined that cow milk consistently contained higher levels of proteins and carbohydrates compared to coconut milk. Additionally, a coconut-grounded curd was successfully formulated, demonstrating a remarkable 4-day shelf life without the need for added preservatives.

The findings suggest that while coconut milk is less nutritionally complete than dairy milk and thus requires further fortification to serve as a primary milk source, it offers a unique flavor profile that significantly enhances various culinary operations. This positions coconut milk as a valuable and versatile component in the growing plant-based food industry.

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