RESEARCH ARTICLE

PREPARATION AND ANALYSIS OF ABC BISCUITS

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Abstract:

The goal of this research was to develop a wholesome biscuit incorporating apple, beetroot, and carrot, referred to as the "ABC Biscuit." This innovative snack combined the natural sweetness of apples, the earthy flavor of beetroot, and the crunch of carrots, offering a unique taste experience. Notably, the ABC Biscuit was made entirely from natural ingredients, free from artificial preservatives, flavors, and colors. rich in fiber, vitamins, and minerals, the ABC Biscuit presented an excellent option for health-conscious consumers. The beetroot content provided a boost of antioxidants and nitrates, which could help lower blood pressure and improve cardiovascular health. Meanwhile, the apple and carrot ingredients offered a good source of dietary fiber, promoting digestive health and satiety. This work involved testing both the nutritional value and shelf life of the ABC Biscuit. A proximate analysis was conducted to determine its moisture content, protein, fat, fiber, and ash content. The shelf life was evaluated by monitoring the biscuit's texture, flavor, and microbial growth over time. The results of this study provided valuable insights into the biscuit's nutritional benefits and shelf life, underscoring its potential as a healthy, natural snack option.

Keywords: ABC Biscuit, Fiber, Apple, Carrot, Beetroot.

Introduction:

The modern world has witnessed a significant shift in food habits, with an increasing focus on healthy eating. One notable change is the recognition of the large number of byproducts in the food industry, which, if not used in feed production, are considered waste and contribute to environmental pollution (1). Beetroot, for example, has proven to be highly effective in changing color in food products (2). It contains betalains, phenols, vitamins B1, B2, B6, B12, carotenoids, folate, and minerals that offer antioxidant properties, including the inhibition of lipid peroxidation (3).

From a nutritional perspective, new food development focuses on products with fewer calories, increased dietary fiber, and lower levels of salt and additives. This shift aims to improve diet quality

and overall human health (4). A promising new form of apricot, freeze-dried powder, retains the important nutrients and flavor of fresh apricots, potentially offering an alternative use for apricots.

Apples, known for their high fiber content, are another example of a nutritious food (5). Beetroot, in particular, is one of the richest dietary sources of antioxidants and naturally occurring nitrates. The nitrates in beetroot help improve blood flow throughout the body, including to the brain, heart, and muscles. By increasing the production of nitric oxide in blood vessels, beetroot helps open up the vessels and enhances oxygen flow, which can lower blood pressure and decrease the risk of cardiovascular diseases.

Several studies have reported that beetroot, as a dietary inorganic nitrate, can help reduce blood pressure in humans. Coles and Clifton also noted that after consuming beetroot juice, individuals on a low-nitrate diet experienced lowered blood pressure, potentially reducing the risk of cardiovascular events. Additionally, dietary nitrate supplementation has been shown to reduce the oxygen cost of low-intensity exercise in humans (6).

Synergistic Integration of Apple, Beetroot and Carrrot (ABC)

These vibrant ingredients are not merely added for color; they serve as a powerhouse of essential nutrients. Apples contribute dietary fiber and antioxidants, carrots provide beta-carotene (a precursor to vitamin A), and beetroots are rich in nitrates and antioxidants (7). Beyond their nutritional value, these ingredients impart natural sweetness, moisture, and a subtle earthy flavor, reducing the need for excessive added sugars and artificial flavorings.

Substitution of Whole Wheat Flour over Maida

Whole wheat flour retains the bran and germ of the wheat kernel, resulting in a significantly higher fiber content compared to refined maida. This inclusion promotes sustained energy release, improved digestive health, and enhanced satiety.

Utilization of Brown Sugar

Brown sugar offers a less refined sweetening option, containing trace minerals like calcium, potassium, and iron. It also adds a deeper more caramel like flavor profile, than that of white sugar.

Incorporation of Cinnamon Powder

Cinnamon powder is added not only for its warm, comforting flavor profile, but also for its potential health benefits. Cinnamon has been shown to have anti-inflammatory and antioxidant properties, and may aid in regulating blood sugar levels. It adds a pleasing aromatic quality to the finished biscuit.

Elimination Of Artificial Preservatives

The formulation prioritizes natural preservation methods, relying on the inherent properties of the ingredients and appropriate baking techniques to extend shelf life. This aligns with the growing consumer preference for clean-label products.

Health Benefits of ABC

Apple:

1. Antioxidant-rich: Apples contain antioxidants like quercetin and catechins, which help protect against cell damage and reduce inflammation.

2. Heart health: Apples' soluble fiber, potassium, and antioxidants help lower cholesterol levels, blood pressure, and risk of heart disease.
3. Cancer prevention: Apples' antioxidants and phytonutrients may help prevent or slow the growth of certain cancers, such as colorectal and lung cancer.
4. Digestive health: Apples' fiber content helps regulate bowel movements, prevent constipation, and support healthy gut bacteria.
5. Weight management: Apples are low in calories and high in fiber, making them a satisfying snack for weight management

Carrot:

1. Vision health: Carrots are rich in beta-carotene, a precursor to vitamin A that helps protect the eyes and prevent age-related macular degeneration.
2. Immune system: Carrots' vitamin A content helps support immune function and protect against infections.
3. Antioxidant properties: Carrots contain antioxidants like beta-carotene, lutein, and zeaxanthin, which help reduce oxidative stress and inflammation.
4. Cancer prevention: Carrots' antioxidants and phytonutrients may help prevent or slow the growth of certain cancers, such as colon and lung cancer.
5. Skin health: Carrots' vitamin A content helps protect the skin from sun damage, promote collagen production, and reduce the appearance of fine lines and wrinkles (10).

Beetroot

1. Blood pressure management: Beetroot's nitrates help relax blood vessels, reduce blood pressure, and improve cardiovascular health (8,9).
2. Antioxidant properties: Beetroot contains antioxidants like betalains, which help reduce oxidative stress and inflammation.
3. Cancer prevention: Beetroot's antioxidants and phytonutrients may help prevent or slow the growth of certain cancers, such as colon and stomach cancer.
4. Detoxification: Beetroot's fiber and antioxidants help support liver function and promote detoxification.
5. Exercise performance: Beetroot's nitrates may help improve exercise performance by increasing blood flow and reducing oxygen consumption.

Combination Benefits

1. Enhanced antioxidant effects: Combining apples, carrots, and beetroots may enhance their antioxidant effects, providing greater protection against cell damage and inflammation (11).
2. Improved cardiovascular health: The combination of these three foods may help lower cholesterol levels, blood pressure, and risk of heart disease.
3. Supports healthy digestion: The fiber content in apples, carrots, and beetroots can help regulate bowel movements, prevent constipation, and support healthy gut bacteria (12,13,14,15).

2. Materials and Methods:

Preparation of ABC Biscuit

Components of ABC Biscuit

- Apple - 150 g
- Beetroot - 75g
- Carrot - 75g
- Milk - 100ml
- Brown sugar - 300g
- Wheat flour - 400g
- Cinnamon powder - 1tbsp
- Baking powder. - ½ tbsp
- Baking soda - ¼ tbsp.

Blend the components Apple, carrot and Beetroot using 50 ml of milk in the ratio of 2:1:1 using a blender.

Method

- To prepare the nutritious ABC Biscuit, add 50 g of butter and mix thoroughly
- Take a mixing bowl and add the dry ingredients Such as wheat flour and Brown Sugar in the ratio of **4:3** with the addition of baking powder of ½ tbsp and baking soda of ¼ tbsp with the natural flavor Enhancer cinnamon powder of 1tbsp, mix the dry ingredients.
- To that dry ingredients add the ABC Extract and knead it in from of chapatti dough using 50 ml of milk.
- Again add 25g of butter and knead until it comes soft.
- Rest the dough in the closed container for around 30 minutes in the refrigerator.
- Spread the 1/3rd portion of the dough to a thin layer by addition of butter and Mold the biscuit and arrange it in the oven tray after garnishing butter or addition of butter paper.
- Preheat the oven for 10 minutes in 175 degrees Celsius to bake the cookies.
- Arrange the pre plated oven tray in the oven and bake it for around 20 to 25 minutes.
- Let the biscuit get cool and its then analyzed.

Nutrient Analysis of Biscuits

Determining of Moisture in Bakery Products

FSSAI manual 03, S. No: 025.2023

Ash refers to the inorganic residues remaining after either ignition or complete oxidation of organic matter. A routine reference method for the determination of the Total Ash content of cereals and cereals products. It is applicable to all food grains and produces: wheat, durum wheat, rice, barley, millet rye, oats, triticale, sorghum and kaffir in the form of grains, milled grains, semolina or flour, biscuits and other bakery ware etc.

Total ash on dry basis (% by weight) $= \frac{W2-W}{W1-W} \times 100$

where,

W = Mass in g of empty dish

W1 = Mass in a g of the dish with the dried material (moisture free) taken for test

W2 = Mass in g of the dish with the ash

Determination of Protein

Is: 7219: 1989 (RA: 2020)

This standard prescribes Kjeldahl method for the determination of total nitrogen content and specifies the factors used in converting nitrogen to protein for various foods and feeds. Total protein, by the Kjeldahl method, is defined as the amount of nitrogen experimentally found and multiplied by an appropriate conversion factor.

Calculation of Total Protein

$$\text{Protein, percent by mass} = \frac{\text{N} \times 100 \times \text{Conversion factor}}{\text{W}}$$

where:

N = mass of nitrogen content in g of original sample,

W = mass of sample in g.

Determination of Total Ash Content

FSSAI manual 03, S. NO: 011.2023

Ash refers to the inorganic residues remaining after either ignition or complete oxidation of organic matter. A routine reference method for the determination of the Total Ash content of cereals and cereal products.

Total ash on dry basis (% by weight) $= \frac{W2-W}{W1-W} \times 100$

Where,

W = Mass in g of empty dish

W1 = Mass in a g of the dish with the dried material (moisture free) taken for test

W2 = Mass in g of the dish with the ash

Determination of Fat

Is: 12711 – 1989 (RA 2020)

This standard prescribes the methods and content of Analysis of bakery products.

Determining of Energy and Carbohydrate

To estimate the amount of carbohydrate and energy in bakery products.

Carbohydrate and energy are estimated by the calculate value of fat, protein and ash, moisture content.

Carbohydrate (g/100g) = 100 - (Moisture + Ash + Protein + Fat)

Reference: IS 1656: 2022 - Infant Food — Milk-Cereal Based Complementary Foods

Energy (kcal/100g) = (fat x 9+ carbohydrate x 4+ protein x 4)

Reference: Food Energy Methods of Analysis and Conversion Factors (FAO).

Microbial Analysis

Enumeration of Coliforms

This International Standard gives general guidelines for the detection and the enumeration of coliforms. It is Applicable to products intended for human consumption and for the feeding of animals, and environmental samples in the area of food production and food handling. Enumeration is carried out by calculation of the most probable number (MPN) after incubation in a liquid Medium at 30 °C or 37 °C. The temperature of incubation is 30 °C.

Detection of Coliforms

Determination of the presence or absence of these bacteria, in a particular quantity of product, when tests are carried out in accordance with the method specified in this International Standard.

Enumeration of Coliforms

Most probable number of coliforms found per milliliter or per gram of the test sample, when the test is carried out in accordance with the method specified in this International Standard.

Calculation and Expression of Results

In accordance with the results of the interpretation (see 9.1.4), indicate the presence or absence of coliforms in a test portion of x g or x ml of product (see ISO 7218). Calculate the most probable number from the number of positive tubes at each dilution.

Detection and Enumeration of Total Plate Count

This International Standard specifies a horizontal method for the enumeration of microorganisms, by counting the colonies growing in a solid medium after aerobic incubation at 30 °C. Subject to the limitations discussed in the introduction, this International Standard is applicable to products intended for human consumption or the feeding of animals. The applicability of this International Standard to the examination of certain fermented food and animal Feeding stuffs is limited. For the examination of fermented food and animal feeding stuffs, other media and or incubation conditions might be more appropriate.

Results

Preparation of ABC Biscuit

The biscuit is prepared with usual bakery procedure with wheat flour and brown sugar over maida and crystal sugar. The biscuits appear to be crispy and tasty.



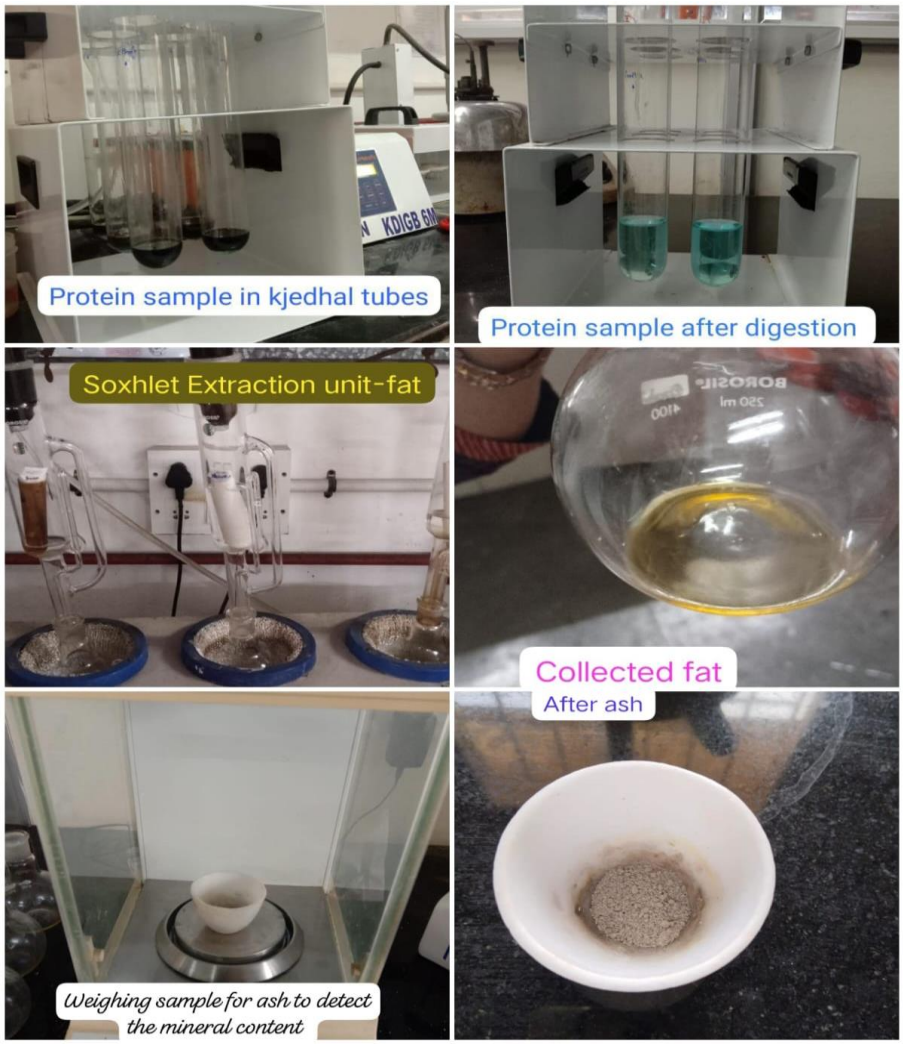
Quantative Nutritional Analysis

The result shows,

- Moister content to be 7.54
- Protein content to be 8.29

- Fat content to be 13.71
- Ash content to be 2.18
- Carbohydrate (g/100) = 100 – (Moisture + Protein + Ash + Fat) = 68.28
- Energy (Kcal / 100g) = (Fat × 9 + Carbohydrate × 4 + Protein × 4)

Parameters	**Test Method**	**Unit**	**Result**
Moisture	FSSAI manual 03, S.No: 025.2023	g/100	7.54
Protein	Is: 7219: 1989 (RA: 2020)	g/100	8.29
Fat	Is: 12711 – 1989 (RA: 2020)	g/100	13.71
Ash	FSSAI manual 03, S.No: 011.2023	g/100	2.18
Carbohydrate	BGLS/CH-F/SOP-01	g/100	68.28
Energy	BGLS/CH-F/SOP-02	Kcal/100	429.67



Quantative Microbial Analysis:

The result shows to be,

- Coliform count to be <10 Cfu/g

Interpretation

For each dilution, count the total number of tubes in which gas formation is observed in 9.2.3 (positive tubes) After 24 h ± 2 h and (if used) 48 h ± 2 h.

Calculation and Expression of Results

In accordance with the results of the interpretation (see 9.1.4), indicate the presence or absence of coliforms In a test portion of x g or x ml of product (see ISO 7218). Calculate the most probable number from the number of positive tubes at each dilution

The result shows to be,

- Total plate count is 2000 Cfu/g

Interpretatin of Result (TPC)

General

The precision data were evaluated for dishes containing more than 15 and fewer than 300 colonies. The Precision data depend on the flora association and the sample matrix. The data presented are derived from Collaborative studies and are valid for raw and pasteurized milk. They may be used as estimates when colony counts in other products are determined.

Repeatability

The absolute difference between two independent single test results, obtained using the same method on Identical test material in the same laboratory by the same operator using the same equipment within a short Interval of time, should not be greater than the repeatability limit, r = 0,25 in log10 microorganisms per milliliter (corresponding to 1,8 on the normal scale in microorganisms per milliliter).

Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test, Material in different laboratories with different operators using different equipment, should not be greater than the reproducibility limit, R = 0,45, in log10 microorganisms per milliliter (corresponding to 2,8 on the normal Scale in microorganisms per milliliter).

- The result fount to be, E. Coli is <10 Cfu/g

Parameters	Test Method	Test Result	Unit
Coliform	IS 5401 (Part) 2012 (Reaf 2018	<10	Cfu/g
Plate count	IS 5420 Part: 1 2021	2000	Cfu/g
E. Coli	IS 5887 (Part) 1976 (Reaf 2018	<10	Cfu/g

Discussion:

The nutritional focus of the Apple, Beetroot, and Carrot (ABC) Biscuits project is to create a snack that delivers both taste and health benefits, particularly for children and health-conscious consumers. Each of the three core ingredients contributes unique nutritional value: apples provide natural sweetness along with dietary fiber and vitamin C; beetroots are rich in antioxidants, folate, and nitrates that support heart health and blood circulation; and carrots are an excellent source of beta-carotene, vitamin A, and other essential micronutrients for eye and immune health (14). By using these whole-food ingredients in biscuit form, the product aims to offer a convenient, nutrient-dense

alternative to traditional sugary or processed snacks. The biscuits will be low in added sugars, made with whole grains, and free from artificial additives, appealing to those seeking clean-label, functional foods. Additionally, the use of naturally vibrant vegetable colors eliminates the need for synthetic dyes, making the product more appealing to parents and educators who are mindful of children's diet quality (15). Overall, ABC Biscuits are positioned as a smart, wholesome choice that supports daily nutrition while encouraging healthy snacking habits (16).

Conclusion:

In conclusion, the development of Apple, Beetroot, and Carrot (ABC) nutritional biscuits represents a successful fusion of health, taste, and innovation. By harnessing the natural benefits of these three wholesome ingredients, the project delivers a product that not only appeals to children and parents but also aligns with growing consumer demand for clean-label, nutrient-rich.

Declaration of Competing Interest:

The authors claim that no known conflicting financial interests or personal relationships appeared to have an impact on the work that was published in this paper.

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