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Preparation and Quality Evaluation of Cookies prepared from a blend of Quinoa (*Chenopodium quinoa*) Flour, Rolled Oatmeal (*Avena sativa*) and Bean (*Phaseolus vulgaricus*) Powder

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Abstract: ***Cookies are made in many wide ranges of processing and product characteristics. These cookies are made from Quinoa flour which are grounded into fine powder. Cookies had been made by different methods using different ingredients by different cultures. The main aim for this prepared cookie was to developed a cookie using Quinoa flour with Bean powder supplemented with Rolled Oatmeal. The Quinoa flour and the Bean powder are being treated at different levels. (T_0) is made as normal cookie found in market with white wheat flour by using 65.2g of white wheat flour and other ingredients i.e., Extra virgin olive oil, Brown sugar and baking powder as (65.2:14:20:0.8) which is served as control, in (T_1) with 35.2g of Quinoa flour and 15g of Bean powder i.e., (35.2:15), in (T_2) with 30.2g of Quinoa flour and 20g of Bean powder i.e., (30.2:20), in (T_3) with 25.5g Quinoa flour and 25g Bean powder i.e., (25.2:25). The study was conducted to developed cookies fortified with Quinoa flour, Bean powder and Rolled Oatmeal. Trials were conducted to adjust the most acceptable levels of Quinoa flour (35.2g, 30.2g and 25.2g) and Bean powder (15g, 20g and 25g) on the basis of physio-chemical analysis of the product. The Final optimized product contains 1 which was highly acceptable and can be used to develop a product without adversely affecting the sensory attributes. The cookies prepared without addition of Quinoa flour and Bean powder supplemented with Rolled Oatmeal was treated as Control. The optimized product contains 4.13% Vitamin C, 5.13% Antioxidant and 5.92% Dietary Fiber. The product possesses good level of Vitamin C, Dietary fiber and Antioxidant.***

Keywords: Quinoa flour, bean powder, Rolled oatmeal, Extra virgin olive oil, Baking powder, White wheat flour, Sugar, Cookies, Physico -chemical analysis, Vitamin C, Antioxidant, Dietary fiber.

I. INTRODUCTION

Cookies are ideal for nutrient availability, palatability, compactness and convenience. (Bornare *et al*., *2015*). Cookies are widely consumed and generally, they are rich in carbohydrates, fats and calories, but low in fiber, vitamins and minerals. Currently, fortification of cookies has evolved to improve its nutritional and functional quality.

Cookies are one of the most popular products because of their convenience, ready to eat nature, and long shelf life (Sindhuja *et al*., *2005*). Cookies are widely consumed baked products which can be served as breakfast to bedtime snack. Cookies are appreciated for their taste, aroma, convenience, and long shelf stability due to low moisture content. Recently, increasing consumer demand for healthier foods has triggered the development of cookies made with natural ingredients exhibiting functional properties and providing specific health benefits beyond those to be gained from traditional nutrients (Ingle *et al*., 2017).

Quinoa (*Chenopodium quinoa*) is native to the Andean region and has attracted a global growing interest due its unique nutritional value. The protein content of quinoa grains is higher than other cereals while it has better distribution of essential amino acids. It can be used as an alternative to milk proteins. Additionally, quinoa contains a high amount of essential fatty acids, minerals, vitamins, dietary fibers, and carbohydrates with beneficial hypoglycemic effects while being gluten-free (Angeli *et al*., 2020).

Dried beans health benefits derive from direct attributes, such as their low saturated fat content and high content of essential nutrients and phytochemicals, as well as to displacement effects when they are substituted for animal products in the diet. Beans are rich in a number of important micronutrients, including K, Mg, foliate, Fe, and Zn, and are important sources of protein in vegetarian diets.

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In particular, they are among the only plant foods that provide significant amounts of the indispensable amino acid lysine. They also provide ample amounts of polyphenols, many of which are potent antioxidants. Diets that include beans reduce low-density lipoprotein cholesterol, favorably affect risk factors for metabolic syndrome, and reduce risk of ischemic heart disease and diabetes (Messina, 2014).

Brown sugar is a natural sweetener derived from the sap of palm plants, like aren (Arenga pinnata (Wurmb) Merrill), kelapa (cocos nucivera), and siwalan (Borassus flabellifer L). Productivity of sap from the aren (Arenga pinnata (Wurmb) Merrill) was the highest among the sap of kelapa (cocos nucivera), siwalan (Borassus flabellifer L). Among the types of palm plant, aren (Arenga pinnata (Wurmb) Merrill) produce abundant sap. Average sap of aren is 10-15 liters per tree per day. Aren grows naturally in the tropical regions. Palm sugar is a nutrient-rich, low-glycemic crystalline sweetener that looks tastes, dissolves and melts almost exactly like sugar, but it's completely natural and unrefined and has a far superior taste (Abdullah *et al.*, 2015).

It is observed that a wide range of fat content among varieties in oats varied from 4.9 to 10.5 g 100 g^{-1}. The content of α-tocopherol in oat grain was determined 4.5 – 12.3 mg kg^{-1}, the sum of essential amino acids 35-45gkg^{-1} and unsaturated fatty acids accounted 78–81.5% of total fatty acids content. Alpha-tocopherol is a major antioxidant component in crude oat unaltered when the lipid is refined, noted (Zielinski *et al.*, 2001).

Olive oil mostly consists of triacylglycerol (98–99%). The predominant fatty acid present in olive oil TGAs is monounsaturated oleic acid (up to 83% *w*/*w*). There is also palmitic acid, linoleic acid, stearic acid, and palmitoleic acid making up the remainder of olive oil TGAs. The content of polyphenols ranges from 50 to 1000 mg/kg. The flesh of healthy olives contains about 2–3% of phenolic substances in the form of glucosides and esters (Debicka *et al.*, 2018).

Regular consumption of olive oil is associated with increased longevity. Specific components of olive oil have antihypertensive, antithrombotic, antioxidant, anti-inflammatory and anti-carcinogenic action (Buckland *et al.*, 2015).

A. Health Benefits of Vitamin C

Vitamin C is one of the essential dietary nutrient for the body. Lack of Vitamin C causes Scurvy, a pathological condition leading to blood vessel fragility and connective tissue damage due to failure in porduction of the collagen. It is involved in the prevention of cance and cardiovascular diseases.It also has the potential to counteract inflammation and subsequent oxidative damage that play major role in initiation and progression of several chronic and acute diseases (Grosso *et al.*, 2013).

B. Health Benefits of Antioxidant

Antioxidants arew found in many fruits and vegetables. They are either man-made or natural substances that may prevent or delay some types of cell damage. Antioxidants are widely used in dietary supplements and have been seen for for the prevention of diseases such as cancer, coronary heart disease and altitude sickness. They are also used in food industry in the form of preservatives in foods and cosmetics and to prevent the degradation to rubber and gasoline (Yadav *et al.*, 2016).

C. Health Benefits of Dietary Fiber

Dietary Fiber intake provides many health benefits. High intake of Dietary fiber intake leads to intake of soluble fiber improves glycemia and insulin sensitivity in non-diabetic and diabetic individuals. Fiber supplementation in obese enhances weight loss. It also benefits a number of gastrointestinal disorders. Fiber content also enhances immune function (Anderson *et al.*, 2009).

II. MATERIALS AND METHODS

The entire study was conducted in Food Technology Laboratory of Department of Food Science and Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj, Uttar Pradesh. Procurement of raw materials such as, Brown sugar, Table Sugar and Baking Powder were purchased from the local market of Prayagraj, Uttar Pradesh. Olive oil, Rolled oatmeal and White wheat flour were collected from supermarket Prayagraj, Uttar Pradesh. Quinoa flour and Bean powder were purchased from the online site Amazon. Four treatments were made by using different proportion of Quinoa flour, Bean powder, White wheat flour, Brown sugar, Rolled oatmeal, Table sugar, Baking powder and Olive oil. The different treatments in the study treatments T0 (White wheat flour 65.2g, Olive oil 14g, Brown sugar 20g and Baking powder 0.8g) T1 (Quinoa flour 35.2g, Bean Powder 15g, Rolled oatmeal 15g, Olive oil 14g, Brown sugar 20g and Baking powder 0.8g), T2 (Quinoa flour 30.2g, Bean Powder 20g, Rolled oatmeal 15g, Olive oil 14g, Brown sugar 20g and Baking powder 0.8g) and T3 (Quinoa flour 25.2g, Bean Powder 25g, Rolled oatmeal 15g, Olive oil 14g, Brown sugar 20g and Baking powder 0.8g). All treatments were replicated three times. Rolled Oatmeal, Olive Oil, Brown Sugar and Baking Powder are constant.

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A. Treatment Combination

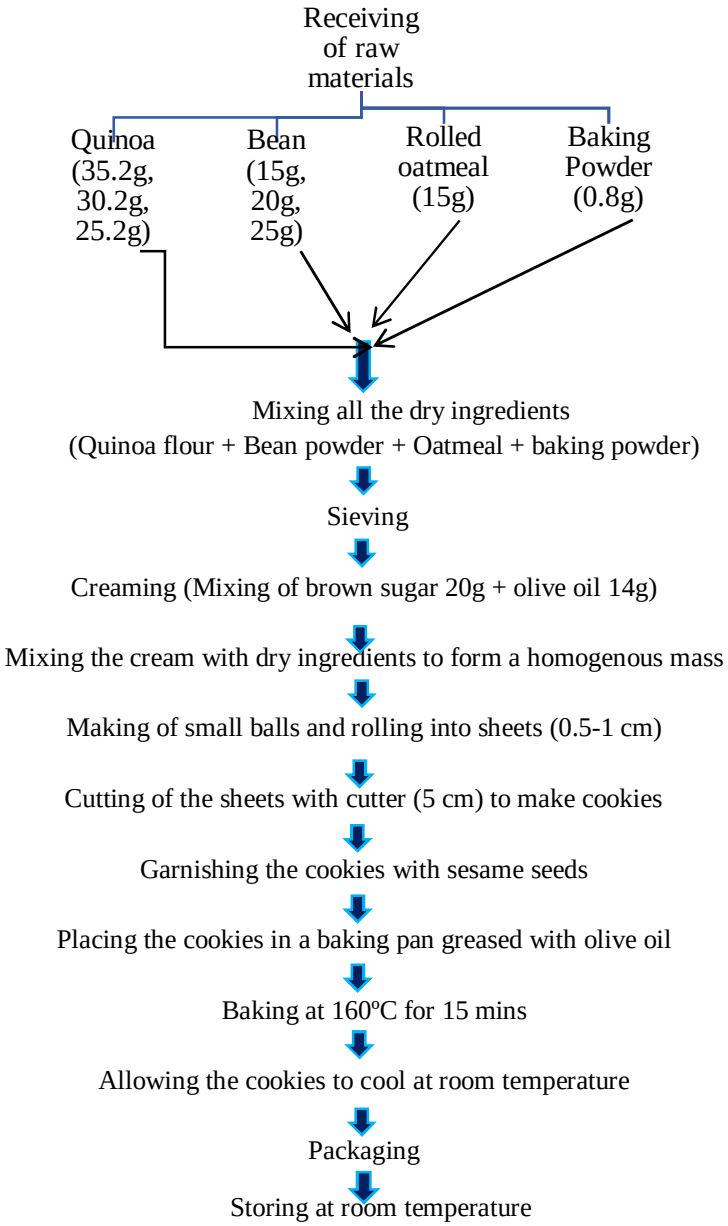
		TREATMENTS					
	Refined wheat flour (Maida) (gm)	Quinoa flour (gm)	Bean powder (gm)	Rolled oatmeal (gm)	Olive oil (ml)	Brown sugar (gm)	Baking powder (gm)
T_0	65.2	-	-	-	14	20	0.8
T_1	-	35.2	15	15	14	20	0.8
T_2	-	30.2	20	15	14	20	0.8
T_3	-	25.2	25	15	14	20	0.8

Note: Rolled oatmeal, Olive oil, Brown sugar and baking powder are considered constant.

B. Preparation of Control

Receiving of raw ingredients
(Refined wheat flour 65.2g + baking powder 0.8g)
↓
Mixing all the dry ingredients
(Refined wheat flour 65.2g + baking powder 0.8g)
↓
Sieving
↓
Creaming
(Mixing of brown sugar 20g + olive oil 14g)
↓
Mixing the cream with dry ingredients to form a homogenous mass
↓
Making of small balls and rolling into sheets (0.5-1 cm)
↓
Cutting of the sheets with cutter (5 cm) to make cookies
↓
Garnishing the cookies with sesame seeds
↓
Placing the cookies in a baking pan greased with olive oil
↓
Baking at 160ºC for 15 minutes
↓
Allowing the cookies to cool at room temperatures
↓
Packaging
↓
Storing at room temperature

C. Preparation of Experimental



III. RESULTS AND DISCUSSION

The data collected and tabulated under the study are presented with appropriate illustration and discussed in this chapter.

Parameters	T_0	T_1	T_2	T_3	C.D
Vitamin C	0	2.50	3.32	4.13	11.01
Antioxidant	0.52	2.45	3.06	5.13	15.5
Dietary Fiber	1.19	7.35	6.73	5.92	27.2

A. Chemical Characteristics

1) Vitamin C: The average for Vitamin C percent was recorded in sample T0 (0) followed by T1 (2.50), T2 (3.32) and T3 (4.13). The difference in Vitamin C was due to the composition difference of Quinoa flour and bean powder which are used in different proportions and in different treatments. There was a significant difference.

2) Antioxidant: The average for Antioxidant percent was recorded in sample T0 (0.52) followed by T1 (2.45), T2 (3.06) and T3 (5.13). The difference in Antioxidant was due to the composition difference of Quinoa flour and bean powder which are used in different proportions and in different treatments. There was a significant difference.

3) Dietary Fiber: The average for Dietary Fiber percent was recorded in sample T0 (1.19) followed by T1 (7.35), T2 (6.73) and T3 (5.92). The difference in Dietary Fiber was due to the composition difference of Quinoa flour and bean powder which are used in different proportions and in different treatments. There was a significant difference.

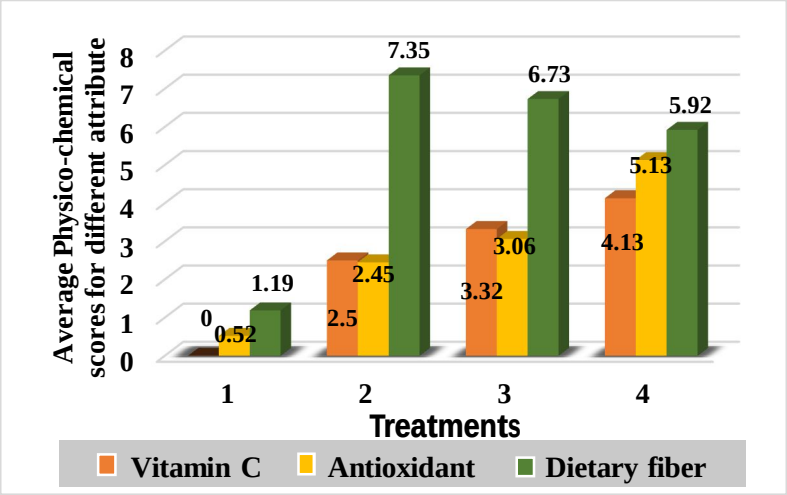


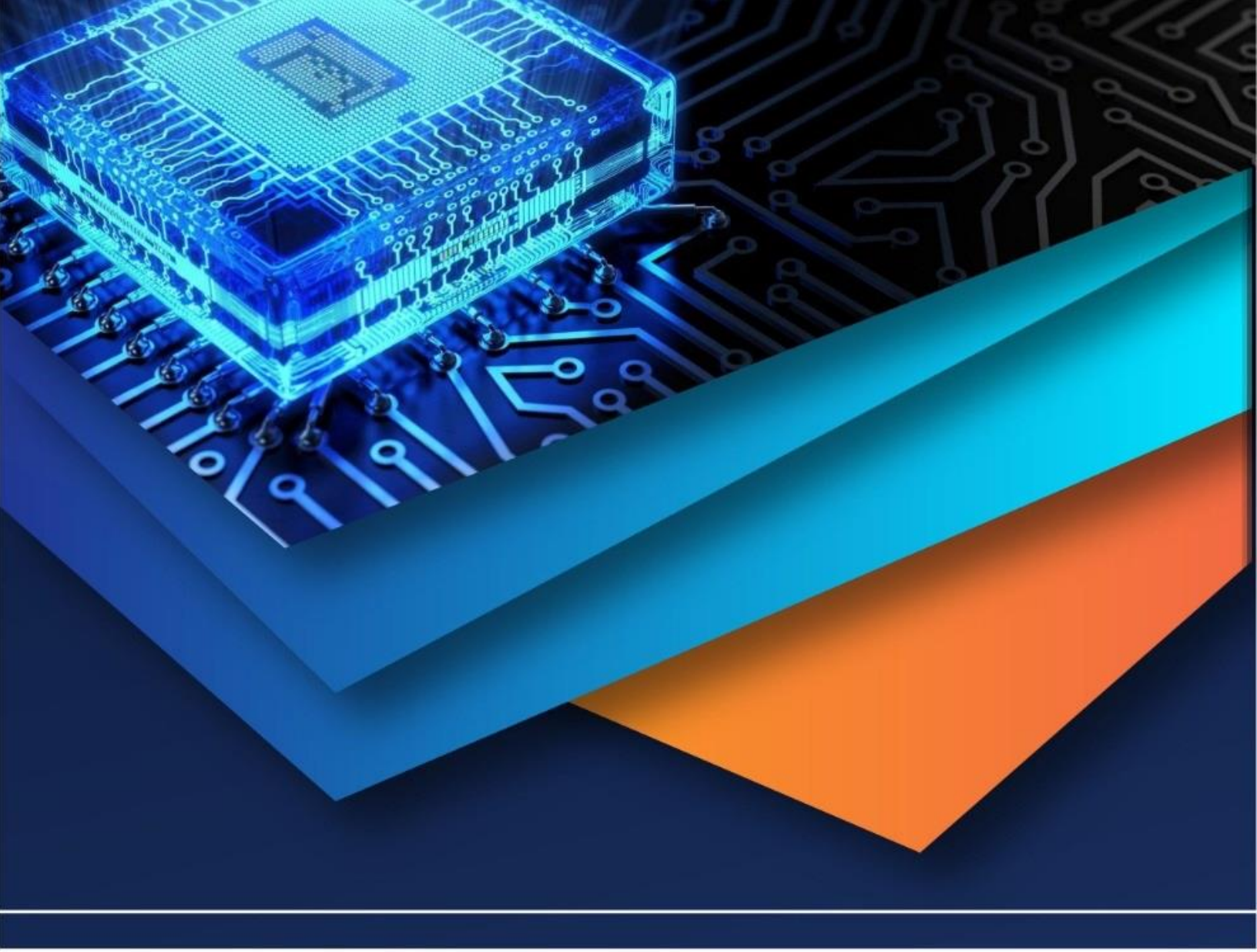
Fig: Average physico-chemical parameters for control and experimental cookies.

IV. CONCLUSION

The present study of Cookies using Quinoa Flour, Bean powder and Rolled Oatmeal was carried out and was found that the product has a higher content of antioxidant, dietary fiber and Vitamin C. Oatmeal it was found that it has a higher content of dietary fiber and antioxidant. We can see the difference in each product used by different treatment. It was obtained that the highest score was the addition of 25g Bean powder and 15g Rolled Oatmeal (T3).

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