International Journal of Food Science and Nutrition
www.foodsciencejournal.com
ISSN: 2455-4898
Received: 25-09-2022, Accepted: 11-10-2022, Published: 28-10-2022
Volume 7, Issue 4, 2022, Page No. 37-46

Sensory evaluation of quinoa flour cookies

Dnyaneshwar B Shinde[1], Sandeep G M Prasad[2*], John David[3], Manisha Prasad[4]

[1] PhD Scholar, Food Science and Technology, WCDT, SHUATS, Allahabad, Uttar Pradesh, India
[2] Associate Professor, WCDT, SHUATS, Allahabad, Uttar Pradesh, India
[3] Dean, WCDT, SHUATS, Allahabad, Uttar Pradesh, India
[4] Assistant Professor, Lucknow Christian College, Lucknow, Uttar Pradesh, India

Abstract
The present investigated was carried out to standardize recipe for preparation of cookies from different combination of quinoa and wheat flour. The main aims and objectives of this study to evaluate sensory assessment of quinoa flour cookies. After analysis it was found that the F. Cal. Value is higher than the F. Tab. value at 5 % significant level on their respective d.f. due to treatments and temperature. It was also showed significant difference ($P \leq 0.05$) between different treatments of all parameters.

Keywords: quinoa, colour, flavour, overall acceptability, cookies, bakery, wheat flour

Introduction

The seed-producing crop quinoa (Chenopodium quinoa Willd.) has been grown in the Andes for an exceptionally long time. It was a common food in some ancient cultures, including the Aztec, Mayan, and Incan (Caperuto *et al*., 2001) [2]. Quinoa was first grown seven thousand years ago in South America, and it is now becoming more and more popular as a substitute crop throughout the world (Caperuto *et al*., 2001; Comai *et al*., 2007; Gely and Santalla, 2007) [2, 3, 9]. Production of quinoa has increased significantly during the past 20 years, especially in Bolivia. The top three producers are Bolivia, Peru, and Ecuador, who produced 61,490 tonnes in 2007 compared to 19,000 tonnes in 1973 (FAOSTAT, 2008) [7]. Bolivia produced 26,800 tonnes, Ecuador produced 690 tonnes, while Peru produced 34,000 tonnes of quinoa in 2007. (FAOSTAT, 2008) [7]. In recognition of the great potential of quinoa, the United Nations declared 2013 to be the International Year of Quinoa. Quinoa has a high protein content, contains all nine necessary amino acids, is naturally gluten-free, and has a low glycemic index (GI). It also contains vitamins, minerals, and other beneficial compounds. Quinoa is a readily prepared, adaptable grain (Tang *et al*., 2015) [13].

Quinoa is advantageous for a range of target demographics since it is rich in calcium, iron, zinc, magnesium, and manganese as well as vitamins A, B2, and E. For instance, both adults and children benefit from iron for blood processes and calcium for their bones (Kozio, 1992; Repo-Carrasco *et al*., 2003). Quinoa is a pseudocereal that has high-quality proteins, health-promoting phytosteroids, and omega-3 and 6 fatty acids (Farinazzi-Machado *et al*., 2012) [8]. The edible seed of the quinoa plant has been referred to as both a pseudo-cereal and a pseudo-oil seed due to its unusual nutritional makeup. The nutrient profile is superior to that of regular cereals (Demir, 2014) [4]. According to Vega-Gálvez *et al*. (2010) 2010, the percentage of quinoa oil varies from 1.8 to 9.5 percent. It has been found to include linoleic (38.9%) and oleic acids (27.7%), making up roughly 70% of the unsaturated fatty acids (Dini *et al*.,2010) [6]. Methionine, lysine, and cysteine are abundant in the amino acids found in quinoa protein. A gluten-free, incredibly healthful dish from the twenty-first century is quinoa (Valencia- Chamorro, 2003) [15]. In the twenty-first century, the FAO has identified quinoa as a viable alternative crop for providing food security and reducing poverty (FAO, 2013; Miranda *et al*., 2014; Ruiz *et al*., 2014). Thus, 2013 was proclaimed the International Year of Quinoa by the United Nations General Assembly (FAO, 2013).

Because of the rheological and baking properties of gluten, wheat is one of the most consumed and researched cereals. It has been investigated whether mixes of QF and wheat flour (WF) are suitable for producing bread. Alvarez-Jubete (2010) [16] as well as associates one of the most significant segments of the food processing sector in India is the baking sector. Due to their accessibility, ready-to-eat convenience, and lengthy shelf life, baked foods are becoming more and more well-liked. Due to their variety of flavours, crispiness, and digestibility, cookies are a common snack food. A variety of ingredients, including sugars, spices, chocolates, butter, peanut butter, almonds, and dried fruits are used to make cookies. Cookies have become one of the most popular snacks for people of all ages due to its low manufacturing cost, convenience, long shelf life, good eating quality, and ability to function as a carrier for essential nutrients (Demir & Klnç, 2017) [5]. In addition to choosing healthy choices, consumers are buying products that satisfy their palates. Due to the huge variety of bakery items available, people are increasingly looking for premium and exotic products to satiate their urge to indulge. This has made the taste enjoyment component of the market crucial. Cakes, pastries, biscuits, and cookies are among the typical luxurious products in the bakery industry. Because they are ready to eat, convenient, and inexpensive, cookies are one of the most popular and widely consumed produced food products in India (Shukla and Choudhary, 2022) [12]. Customers In terms of baked goods, cookies are the most widely consumed snack food worldwide (Awasthi and

Yadav, 2000). Due to their wide variety of tastes, crispiness, digestibility, and longer shelf life, cookies are a favourite among bakery goods and snack foods.

In the bread market, quinoa faces off against less expensive ancient grains like spelt, barley, and millet. In the market for more expensive consumer items, it has improved its position. The uncooked form of the nutrient-dense grain quinoa is less frequently used. Cookies are increasingly frequently consumed in households as a delicious treat; thus, it is important to make them healthy. Cookies have the benefits of being convenient, tasty, compact, and nutrient-rich. They differ from other bakery goods like bread and cakes in that they have a long shelf life, little microbiological decomposition, and little moisture content. Cookies have become one of the most popular snacks for people of all ages due to its low manufacturing cost, ease, long shelf life, good eating quality, and ability to function as a carrier for important nutrients (Tewari, 2019) [14]. Quinoa is consequently used to make cookies, even though no studies have been done on the analysis of cookies prepared with Quinoa. Investigating the health advantages of quinoa cookies is thus necessary.

Customers in India are getting more and more conscious of the need of a balanced diet. Quinoa is an excellent illustration of the wholesome "superfoods" that have gained a lot of attention recently. Consumer perceptions of the grain's health benefits and nutritional value account for a large portion of the rise in quinoa imports.

Better-for-you foods will become more and more popular. Quinoa isn't the only new healthy grain available, but it's still expected to do well in niche areas like gluten-free. Quinoa is a distinctive product that can be utilised in place of high-value ingredients in grain blends and processed foods, as well as common grains like rice or wheat. The basis for this research is this study.

Objective

1. To evaluate sensory assessment of final prepared cookies.

Materials and Methods

The experiments related to “Assessment of Nutritional Value and Effect of Baking time and Temperature on Quality of Quinoa Cookies for Flour Cookies” carried out in the research laboratory of Food science and Technology, Warner college of Dairy Technology, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (U.P.).

- **Procurement of raw material**

For preparation of Quinoa Flour Cookies, the raw ingredients like Wheat Flour, Quinoa flour, sugar, Fat, Baking Powder were purchased from local market of Pryagraj.

Procurement and collection of ingredients

1. **Quinoa:** purchased from local market of Prayagraj.
2. **Wheat flour:** purchased from local market of Prayagraj.
3. **Sugar:** Sugar will be collected from local stores of Prayagraj.
4. **Fat:** purchased from local market of Prayagraj.
5. **Baking powder:** It will be collected from local market of Prayagraj.

Table 1: The composition blend flour cookies where prepared using the basic formula developed.

Ingredients	Quantity (%)
Wheat flour	60
Sugar	19
Fat	21
Sodium Bicarbonate	0.2
Ammonium	O.2
Water	As per requirements

Treatment combination

T_0= Quinoa Flour (0%): Wheat Flour (100%) + Baking at 175^0C for 15 Mins
T_1= Quinoa Flour (10%): Wheat Flour (90%) + Baking at 175^0C for 15 Mins
T_2= Quinoa Flour (20%): Wheat Flour (80%) + Baking at 175^0C for 15 Mins
T_3= Quinoa Flour (30%): Wheat Flour (70%) + Baking at 175^0C for 15 Mins
T_4= Quinoa Flour (40%): Wheat Flour (60%) + Baking at 175^0C for 15 Mins
T_5= Quinoa Flour (50%): Wheat Flour (50%) + Baking at 175^0C for 15 Mins
T_6= Quinoa Flour (60%): Wheat Flour (40%) + Baking at 175^0C for 15 Mins
T_7= Quinoa Flour (10%): Wheat Flour (90%) + Baking at 180^0C for 15 Mins
T_8= Quinoa Flour (20%): Wheat Flour (80%) + Baking at 180^0C for 15 Mins
T_9= Quinoa Flour (30%): Wheat Flour (70%) + Baking at 180^0C for 15 Mins
T_{10}= Quinoa Flour (40%): Wheat Flour (60%) + Baking at 180^0C for 15 Mins
T_{11}= Quinoa Flour (50%): Wheat Flour (50%) + Baking at 180^0C for 15 Mins
T_{12}= Quinoa Flour (60%): Wheat Flour (40%) + Baking at 180^0C for 15 Mins
T_{13}= Quinoa Flour (10%): Wheat Flour (90%) +Baking at 185^0C for 10 Mins
T_{14}= Quinoa Flour (20%): Wheat Flour (80%) + Baking at 185^0C for 10 Mins
T_{15}= Quinoa Flour (30%): Wheat Flour (70%) + Baking at 185^0C for 10 Mins
T_{16}= Quinoa Flour (40%): Wheat Flour (60%) + Baking at 185^0C for 10 Mins
T_{17}= Quinoa Flour (50%): Wheat Flour (50%) + Baking at 185^0C for 10 Mins
T_{18}= Quinoa Flour (60%): Wheat Flour (40%) + Baking at 185^0C for 10 Mins
Heat Treatment$_1$/HT_1= Baking at 175^0C for 15 Mins
Heat Treatment$_2$/HT_2= Baking at 180^0C for 15 Mins
Heat Treatment$_3$/HT_3= Baking at 185^0C for 10 Mins
No. of Treatment: 18 +1 =19
No of replication: 05
Total no of trials: 95

Sensory Evaluation

A semi-trained panel of 10 judges assessed the cookies' sensory qualities using a 9-point hedonic scale.

- Colour and appearance
- Body and texture
- Flavour and Taste
- Mouth feel
- Overall acceptability

Statistical analysis

To determine the statistical significance of the research data, Factorial Analysis and Critical difference (C.D) used for physico-chemical and antioxidant parameters for developed cookies and Two-Way Analysis of Variance (ANOVA) technique and Critical difference (C.D) was used for developed dough. Means & SD's were calculated for all analysis. All values are expressed as mean and standard deviation of five parallel measurements.

Result and Discussion

The present study entitled "Sensory evaluation of Quinoa flour cookies" was conducted to Standardize recipe for preparation of cookies from different combination of quinoa and wheat flour, to evaluate sensory assessment of final prepared cookies.

The results obtained are presented and discussed under following headings:

Table 2: Organoleptic properties of cookies

Treatment Combination	Colour & appearance	Body & texture	Flavor & taste	Mouth feel	Over all acceptability
Baking at 175 ^{0}C for 15 Mins					
T_0	6.00	7.00	6.00	7.00	6.50
T_1	7.00	7.00	8.00	7.00	7.25
T_2	8.00	7.00	8.00	8.00	7.75
T_3	7.00	6.00	6.00	7.00	6.50
T_4	8.00	7.00	7.00	7.00	7.25
T_5	7.00	8.00	8.00	7.00	7.50
T_6	8.00	9.00	9.00	8.00	8.50
Baking At 180^{0}C for 15 Mins					
T_7	6.00	6.00	6.00	7.00	6.25
T_8	6.00	5.00	5.00	6.00	5.50
T_9	6.00	5.00	6.00	6.00	5.75
T_{10}	6.00	5.00	5.00	5.00	5.25
T_{11}	5.00	6.00	6.00	5.00	5.50
T_{12}	5.00	6.00	5.00	5.00	5.25
Baking At 185^{0}C for 10 Mins					
T_{13}	6.00	5.00	5.00	5.00	5.25
T_{14}	6.00	5.00	5.00	6.00	5.50
T_{15}	5.00	5.00	6.00	6.00	5.50
T_{16}	5.00	5.00	5.00	6.00	5.25
T_{17}	6.00	6.00	7.00	6.00	6.25
T_{18}	6.00	5.00	6.00	5.00	5.50

Table 3: Table observing the total Colour and Appearance level of final Cookies.

Treatments	Colour & appearance			
	Baking at 175 ^{0}C for 15 Mins	Baking At 180^{0}C for 15 Mins	Baking At 185^{0}C for 10 Mins	Mean
T_0	6.00	6.00	6.00	6.00
T_1	7.00	6.00	6.00	6.33
T_2	8.00	6.00	6.00	6.66
T_3	7.00	6.00	5.00	6.00
T_4	8.00	6.00	5.00	6.33
T_5	7.00	5.00	6.00	6.00
T_6	8.00	5.00	6.00	6.33
	Result	S. Ed. (±)	C.D. at 5%	
Owing to replicate	NS	0.118	0.252	
Owing to Treatments	S	0.283	0.602	
Owing to Temp	S	0.163	0.347	

The beyond table is display that the cookies that are treated with 175^{0}C, contains high Colour and Appearance level than 180^{0}C and 185^{0}C heat treatment process. In case of 180^{0}C and 185^{0}C heat treatment process, the cookies contain lower energy. The highest mean value in 175^{0}C, T_2 has high Colour and Appearance level.

Table 4: Table display the critical distinction in Colour and Appearance level of final prepared Cookies

Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6
T_0		0.33	0.67	0.00	0.33	0.00	0.33
T_1			0.33	0.33	0.00	0.33	0.00
T_2				0.67	0.33	0.67	0.33
T_3					0.33	0.00	0.33
T_4						0.33	0.00
T_5							0.33
CD=	0.602						

Table 5: Table observing the ANOVA of Colour & appearance level of final Cookies.

Anova						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. tabulated 5%	Result
Owing to replicate	4	0.0180	0.0045	0.016	2.47	NS
Owing to Treatments	6	5.7143	0.9524	3.402	2.20	S
Owing to Temp	2	57.6190	28.8095	102.9209	3.10	S
Error	92	25.7526	0.2799	-	-	-
TOTAL	104	89.10	-	-	-	-

The beyond ANOVA table is display that the F. Cal. Value is maximum than the F. tabulated value at 5 % significant level on their respective d.f. owing to treatments and temperature. The beyond table moreover display significant distinction ($P<0.05$) among various approaches.

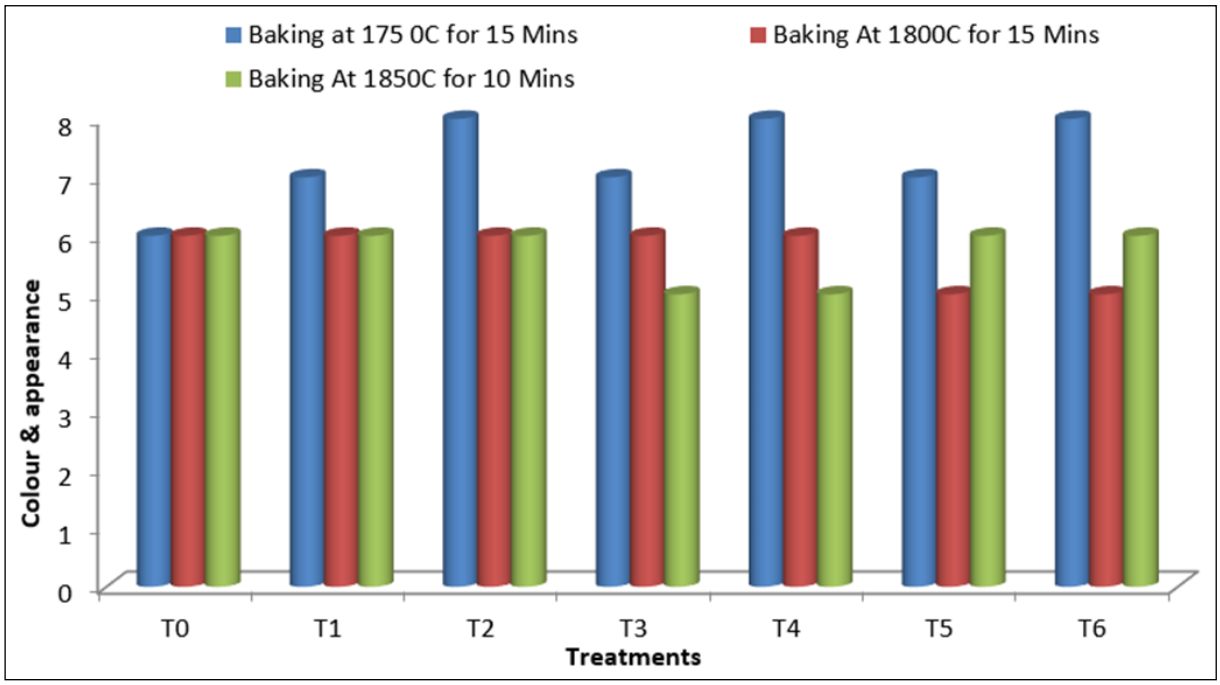

Fig 1: Graphical representation of Colour and Appearance level of final prepared Cookies.

Table 6: Table observing the Body & texture level of final Cookies.

Treatments	Body & texture			
	Baking at 175 ^{0}C for 15 Mins	Baking At 180^{0}C for 15 Mins	Baking At 185^{0}C for 10 Mins	Mean
T_0	7.00	7.00	7.00	7.00
T_1	7.00	6.00	5.00	6.00
T_2	7.00	5.00	5.00	5.66
T_3	6.00	5.00	5.00	5.33
T_4	7.00	5.00	5.00	5.66
T_5	8.00	6.00	6.00	6.66
T_6	9.00	6.00	5.00	6.66
	Result	S. Ed. (±)	C.D. at 5%	
Owing to replicate	NS	0.120	0.256	
Owing to Treatments	S	0.288	0.613	
Owing to Temp	S	0.166	0.354	

The beyond table is display that the cookies that are treated with 175^{0}C, contains high Body & texture level than 180^{0}C and 185^{0}C heat treatment processes. In case of 180^{0}C and 185^{0}C heat treatment process, the cookies contain lower Body & texture level. The highest mean value in 175^{0}C, 180^{0}C and 185^{0}C; T_0 has high Body & texture level.

Table 7: Table display the critical distinction in Body & texture level of final prepared Cookies

Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6
T_0		1.00	1.33	1.67	1.33	0.33	0.33
T_1			0.33	0.67	0.33	0.67	0.67
T_2				0.33	0.00	1.00	1.00
T_3					0.33	1.33	1.33
T_4						1.00	1.00
T_5							0.00
CD=	0.613						

Table 8: Table observing the ANOVA of Body & texture level of final Cookies.

ANOVA:						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. tabulated 5%	Result
Owing to replicate	4	0.0171	0.0043	0.015	2.47	NS
Owing to Treatments	6	36.1905	6.0317	20.779	2.20	S
Owing to Temp	2	70.0000	35.0000	120.5728	3.10	S
Error	92	26.7059	0.2903	-	-	-
TOTAL	104	132.91	-	-	-	-

The beyond ANOVA table is display that the F. Cal. Value is maximum than the F. tabulated value at 5 % significant level on their respective d.f. owing to treatments and temperature. The beyond table moreover display significant distinction ($P<0.05$) among various approaches.

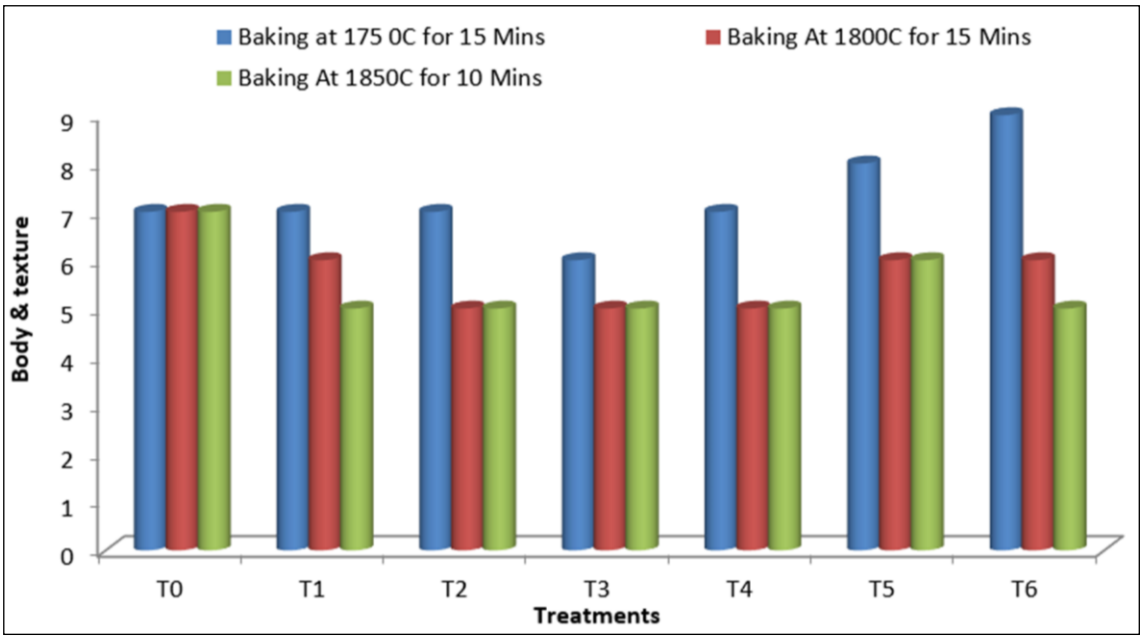

Fig 2: Graphical representation of Body & texture level of final prepared Cookies.

Table 9: Table observing the Flavor & taste level of final Cookies

Treatments	Flavor & taste			
	Baking at 175 ^{0}C for 15 Mins	Baking At 180^{0}C for 15 Mins	Baking At 185^{0}C for 10 Mins	Mean
T_0	6.00	6.00	6.00	6.00
T_1	8.00	6.00	5.00	6.33
T_2	8.00	5.00	5.00	6.00
T_3	6.00	6.00	6.00	6.00
T_4	7.00	5.00	5.00	5.66
T_5	8.00	6.00	7.00	7.00
T_6	9.00	5.00	6.00	6.66
	Result	S. Ed. (±)	C.D. at 5%	
Owing to replicate	NS	0.157	0.334	
Owing to Treatments	S	0.375	0.798	
Owing to Temp	S	0.216	0.461	

The beyond table is display that the cookies that are treated with 175^{0}C, contains high Flavor & taste level than 180^{0}C and 185^{0}C heat treatment processes. In case of 180^{0}C and 185^{0}C heat treatment process, the cookies contain lower Flavor & taste level. The highest mean value in 175^{0}C, 180^{0}C and 185^{0}C; T_5 has high Flavor & taste level.

Table 10: Table display the critical distinction in Flavor & taste level of final prepared Cookies

Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6
T_0		0.33	0.00	0.00	0.33	1.00	0.67
T_1			0.33	0.33	0.67	0.67	0.33
T_2				0.00	0.33	1.00	0.67
T_3					0.33	1.00	0.67
T_4						1.33	1.00
T_5							0.33
CD=	0.798						

Table 11: Table observing the ANOVA of Flavor & taste level of final Cookies.

ANOVA:						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. tabulated 5%	Result
Owing to replicate	4	0.0563	0.0141	0.029	2.47	NS
Owing to Treatments	6	19.0476	3.1746	6.456	2.20	S
Owing to Temp	2	74.7619	37.3810	76.0211	3.10	S
Error	92	45.2381	0.4917	-	-	-
TOTAL	104	139.10	-	-	-	-

The beyond ANOVA table is display that the F. Cal. Value is maximum than the F. tabulated value at 5 % significant level on their respective d.f. owing to treatments and temperature. The beyond table moreover display significant distinction (P<0.05) among various approaches.

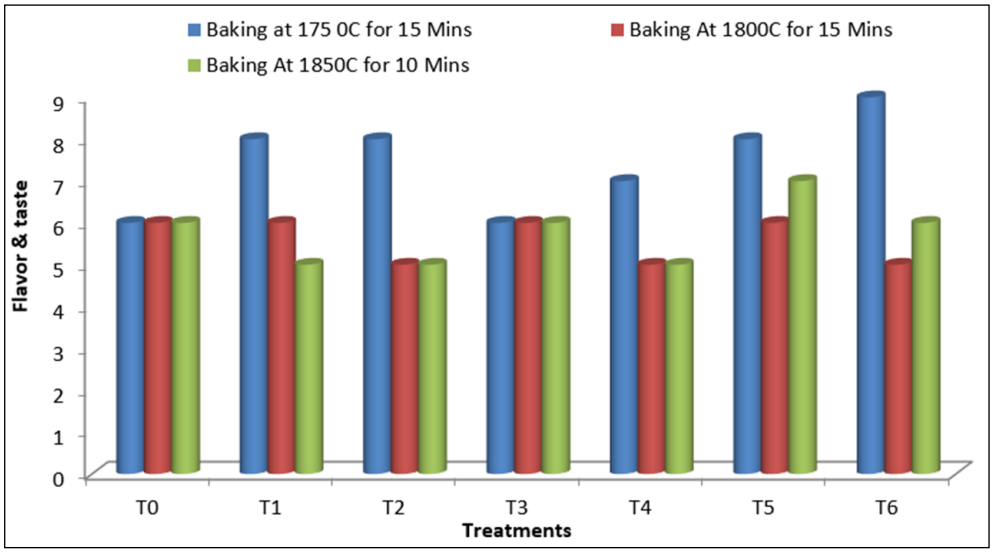

Fig 3: Graphical representation of Flavor & taste level of final prepared Cookies.

Table 12: Table observing the Mouth feel level of final Cookies

Treatments	Mouth feel			
	Baking at 175 ^{0}C for 15 Mins	Baking At 180^{0}C for 15 Mins	Baking At 185^{0}C for 10 Mins	Mean
T_0	7.00	7.00	7.00	7.00
T_1	7.00	7.00	5.00	6.33
T_2	8.00	6.00	6.00	6.66
T_3	7.00	6.00	6.00	6.33
T_4	7.00	5.00	6.00	6.00
T_5	7.00	5.00	6.00	6.00
T_6	8.00	5.00	5.00	6.00
	Result	S. Ed. (±)	C.D. at 5%	
Owing to replicate	NS	0.133	0.282	
Owing to Treatments	S	0.317	0.675	
Owing to Temp	S	0.183	0.390	

The beyond table is display that the cookies that are treated with 175^{0}C, contains high Mouth feel level than 180^{0}C and 185^{0}C heat treatment processes. In case of 180^{0}C and 185^{0}C heat treatment process, the cookies contain lower Mouth feel level. The highest mean value in 175^{0}C, 180^{0}C and 185^{0}C; T_0 has high Mouth feel level.

Table 13: Table display the critical distinction in Mouth feel level of final prepared Cookies

Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6
T_0		0.67	0.33	0.67	1.00	1.00	1.00
T_1			0.33	0.00	0.33	0.33	0.33
T_2				0.33	0.67	0.67	0.67
T_3					0.33	0.33	0.33
T_4						0.00	0.00
T_5							0.00
CD=	0.675						

Table 14: Table observing the ANOVA of Mouth feel level of final Cookies.

ANOVA:						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. tabulated 5%	**Result**
Owing to replicate	4	0.0563	0.0141	0.040	2.47	**NS**
Owing to Treatments	6	13.3333	2.2222	6.314	2.20	**S**
Owing to Temp	2	47.6190	23.8095	67.6471	3.10	**S**
Error	92	32.3810	0.3520	-	-	-
TOTAL	104	93.39	-	-	-	-

The beyond ANOVA table is display that the F. Cal. Value is maximum than the F. tabulated value at 5 % significant level on their respective d.f. owing to treatments and temperature. The beyond table moreover display significant distinction (P<0.05) amoung various approaches.

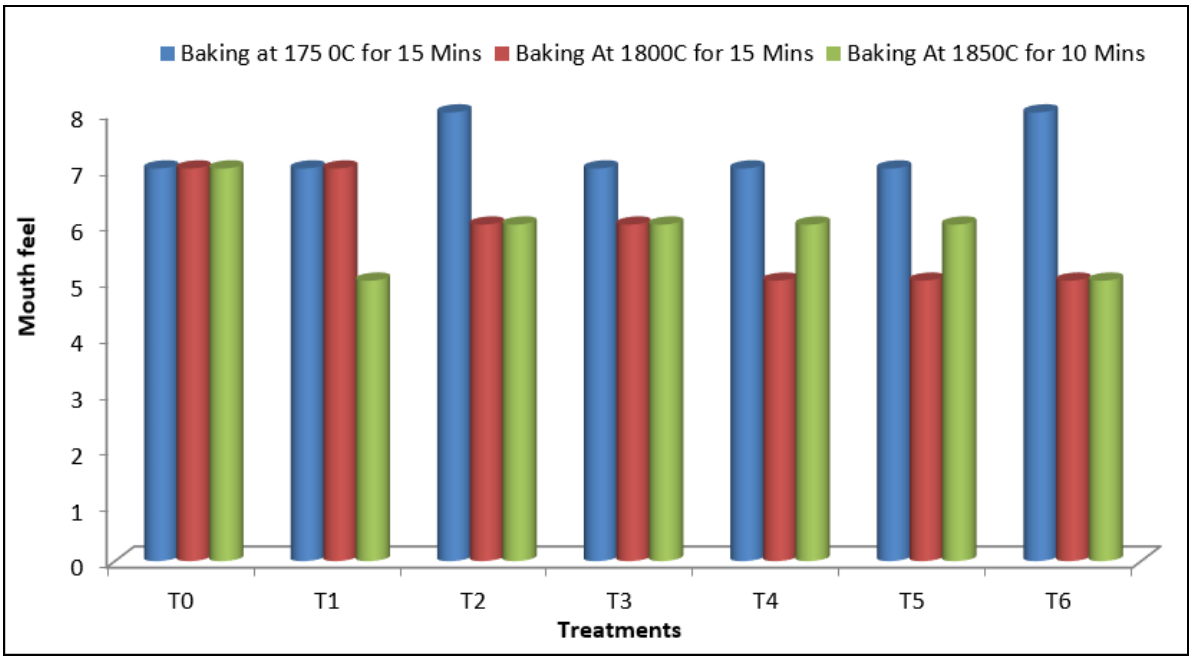

Fig 4: Graphical representation of Mouth feel level of final prepared Cookies.

Table 15: Table observing the Overall acceptability level of final Cookies

Treatments	**Over all acceptability**			
	Baking at 175 ^{0}C for 15 Mins	**Baking At 180^{0}C for 15 Mins**	**Baking At 185^{0}C for 10 Mins**	**Mean**
T_0	6.50	6.50	6.50	6.50
T_1	7.25	6.25	5.25	6.25
T_2	7.75	5.50	5.50	6.25
T_3	6.50	5.75	5.50	5.91
T_4	7.25	5.25	5.25	5.91
T_5	7.50	5.50	6.25	6.41
T_6	8.50	5.25	5.50	6.41
	Result	S. Ed. (±)	C.D. at 5%	
Owing to replicate	NS	0.115	0.244	
Owing to Treatments	S	0.274	0.583	
Owing to Temp	S	0.158	0.337	

The beyond table is display that the cookies that are treated with 175^{0}C, contains high Over all acceptability level than 180^{0}C and 185^{0}C heat treatment processes. In case of 180^{0}C and 185^{0}C heat treatment process, the cookies contain lower

Overall acceptability level. The highest mean value in 175^0C, 180^0C and 185^0C; T_0 has high Over all acceptability level.

Table 16: Table display the critical distinction in Overall acceptability level of final prepared Cookies

Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6
T_0		0.25	0.25	0.58	0.58	0.08	0.08
T_1			0.00	0.33	0.33	0.17	0.17
T_2				0.33	0.33	0.17	0.17
T_3					0.00	0.50	0.50
T_4						0.50	0.50
T_5							0.00
CD=	0.583						

Table 18: Table observing the ANOVA of Overall acceptability level of final Cookies.

ANOVA:						
Source	d. f.	S.S.	M.S.S.	F. Cal.	F. tabulated 5%	Result
Owing to replicate	4	0.0563	0.0141	0.053	2.47	NS
Owing to Treatments	6	5.0893	0.8482	3.225	2.20	S
Owing to Temp	2	61.6369	30.8185	117.1784	3.10	S
Error	92	24.1964	0.2630	-	-	-
TOTAL	104	90.98	-	-	-	-

The beyond ANOVA table is display that the F. Cal. Value is maximum than the F. tabulated value at 5 % significant level on their respective d.f. owing to treatments and temperature. The beyond table moreover display significant distinction ($P<0.05$) among various approaches.

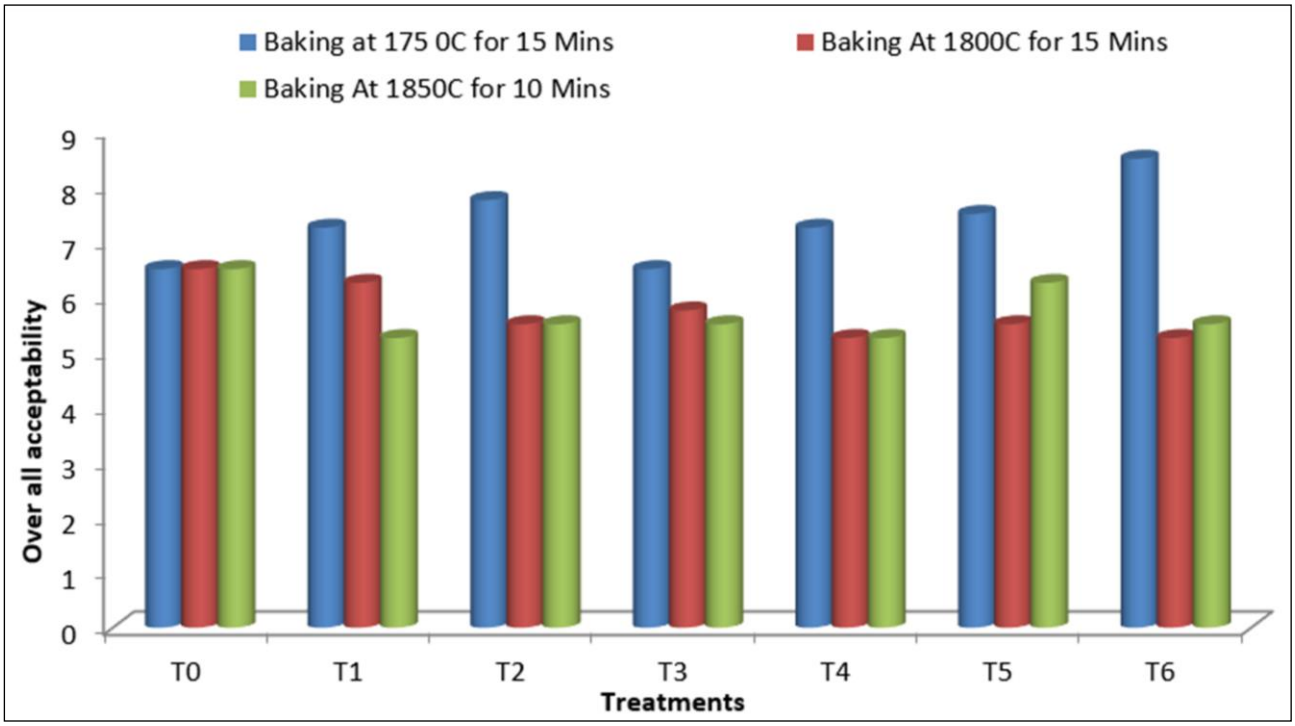

Fig 5: Graphical representation of Overall acceptability level of final prepared Cookies.

Conclusion

The cookies that are heated to 175ºC have a higher level of colour and appearance than those that are heated to 180ºC or 1850C. Cookies using a heat treatment technique at 180°C and 1850°C have less energy. T2, which has the greatest mean value in 175ºC, has a high level of colour and appearance. The 175ºC heat treatment procedure gives cookies a higher body and texture level than the 180ºC and 185ºC processes. Cookies with a heat treatment temperature of 180ºC and 185ºC have a lower body and texture level. T0 has a high Body & texture level with the highest mean value at 175ºC, 180ºC, and 185ºC. The cookies that are heated to 175ºC have higher levels of flavour and taste than those that are heated to 180ºC and 185ºC. The degree of flavour and taste in cookies produced by the 180ºC and 185ºC heat treatment processes is lower. The T5 has a high level of flavour and taste and has the highest mean value at 175ºC, 180ºC, and 185ºC. Cookies that have been heated to 175ºC

have a higher mouth feel than cookies that have been heated to 180ºC or 185ºC. Cookies with a heat treatment temperature of 180ºC and 185ºC have a lower Mouth feel level. T0 has a high Mouth feel level with the highest mean value in 175ºC, 180ºC, and 185ºC. The 175ºC heat treatment procedure produces cookies with a higher overall acceptance level than the 180ºC and 185ºC processes. Cookies with a heat treatment temperature of 180ºC and 185ºC have a lower overall acceptance rating. T0 has a high overall acceptability level with the greatest mean value in 175ºC, 180ºC, and 185ºC.

References

1. Awasthi R, Yadav KK. Buck Wheat (Fagopyrum esculentum): A Gluten Free Product. Indian journal of Nutrition,2015:2(1):110.
2. Caperuto LC, Amaya-Farfan J, Camargo CRO. Performance of quinoa (Chenopodium quinoa Willd) flour in the manufacture of gluten-free spaghetti. Journal of the Science of Food and Agriculture,2001:81(1):95-101.
3. Comai S, Bertazzo A, Bailoni L, Zancato M, Costa CV, Allegri G. The content of proteic and nonproteic (free and protein-bound) tryptophan in quinoa and cereal flours. Food Chemistry,2007:100(4):1350-1355.
4. Demir MK. Use of quinoa flour in the production of gluten-free tarhana. Food Science and Technology Research,2014:20(5):1087-1092.
5. Demir MK, Kılınç M. Utilization of quinoa flour in cookie production. International Food Research Journal,2017:24(6):2394-2401.
6. Dini I, Tenore GC, Dini A. Antioxidant compound contents and antioxidant activity before and after cooking in sweet and bitter Chenopodium quinoa seeds. *LWT-Food Science and Technology*,2010:*43*(3):447-451.
7. FAOSTAT.2008. http://faostat.fao.org/DesktopDefault.aspx?PageID=291&lang=en
8. Farinazzi-Machado FMV, Barbalho SM, Oshiiwa M, Goulart R, Pessan Junior O. Use of cereal bars with quinoa (Chenopodium quinoa W.) to reduce risk factors related to cardiovascular diseases. Food Science and Technology,2012:32:239-244.
9. Gely MC, Santalla EM. Moisture diffusivity in quinoa (Chenopodium quinoa Willd.) seeds: Effect of air temperature and initial moisture content of seeds. Journal of Food Engineering,2007:78:1029-1033.
10. Miranda M, Delatorre-Herrera J, Vega-Gálvez, A, Jorquera E, Quispe-Fuentes I, Martínez EA. Antimicrobial potential and phytochemical content of six diverse sources of quinoa seeds (Chenopodium quinoa Willd.). Agricultural Sciences,2014:5(11):1015.
11. Ruiz KB, Biondi S, Oses R, Acuña-Rodríguez IS, Antognoni, F, Martinez-Mosqueira EA *et al*. Quinoa biodiversity and sustainability for food security under climate change. A review. Agronomy for sustainable development,2014:34(2):349-359.
12. Shukla V, Choudhary S. Deep Learning in Neural Networks: An Overview. Deep Learning in Visual Computing and Signal Processing, 2022, 29-53.
13. Tang Y, Li X, Chen PX, Zhang B, Hernandez M, Zhang H *et al*. Characterisation of fatty acid, carotenoid, tocopherol/tocotrienol compositions and antioxidant activities in seeds of three Chenopodium quinoa Willd. genotypes. Food chemistry,2015:174:502-508.
14. Tewari S. Therapeutic diet to control diseases, AkiNik publication, 2019, 1-79.
15. Valencia-Chamorro SA. Quinoa. Encyclopedia of Food Science and Nutrition, 2003.
16. Vega-Gálvez A, Miranda M, Vergara J, Uribe E, Puente L, Martínez EA. Nutrition facts and functional potential of quinoa (Chenopodium quinoa willd.), an ancient Andean grain: a review. Journal of the Science of Food and Agriculture,2010:90(15):2541-2547.