International Journal of Applied Home Science
Volume 10 (5 & 6), May & June (2023) : 137-142
Received : 08.04.2023; Revised : 23.04.2023; Accepted : 08.05.2023

RESEARCH PAPER
ISSN : 2394-1413 (Print)
DOI: 10.36537/IJAHS/10.5&6/137-142

Development and process standardization of Sweet corn (*Zea maize)* based spread (Toppings and Dips)

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ABSTRACT

Food emulsions are important in the food industry. There are many types of butter, soft margarine, and combinations, like those that include butter and vegetable fats, that can be used as bread spreads. Of these, butter and butter-vegetable fat blends are the most popular. A product's physicochemical makeup and functional qualities, including its texture, frequently affect a consumer's choice to buy it. The cereal crop known as maize, or corn, is a significant one worldwide (*Zea mays* L.). Nutrients as well as phytochemicals are present in it. Phytochemicals are essential for preventing chronic diseases. Most people frequently consume fats and spreads, providing a great foundation for healthy additions. Olive oil is different from long-chain triglyceride saturated oil in the way it is digested, and as a result, it offers several nutritional benefits and health-promoting properties. Olive oil may be beneficial for your health in a number of ways. Also, it's a great option for salad dressing, cooking, and as a source of healthful fat. To fight the obesity epidemic, the goal of this study was to develop sweet corn spread with far less oil. This study found that the parameters ash content, moisture, crude protein, crude fat, crude fibre, carbs, and energy value were (2.8%), (64.8%), (6.40%), (3.20%), (0.2%), (87.4%), and 165.52 kcal/100g, respectively. The results of the analysis showed that the contents of the minerals calcium, magnesium, iron, and zinc were 11.60, 36.25, 0.23, and 2.13 mg/100g, respectively. It was discovered during 7-days storage tests that maintaining a product at refrigeration temperature was superior to ambient temperature. The storage survey of sweet corn-based spread revealed that at ambient temperature, the dramatic rise in moisture content ranged from 64.8 to 66.0 per cent, while the overall drop in protein, ash, and fat ranged from 6.40 to 6.34 per cent, 2.8 to 2.1 per cent, and 3.20 to 3.30 per cent, respectively. The sample's peak in the absorbance wave number component, which had a wave number of 3367.91 cm^{-1}, indicates that the bound OH group will be implicated. Carbonyl (C=O) stretching is what causes the prominent peak in N2M5NPBA at 1639.89 cm1. At 1029.19 cm^{1} assigned to CN stretch, absorption was visible.

Key Words : Sweet Corn, FT-IR analysis, Obesity, Chemical analysis

INTRODUCTION

There are many types of butter, soft margarine, and combinations, like those that include butter and vegetable fats, that can be used as bread spreads. Of these, butter and butter-vegetable fat blends are the most popular (Ziarno *et al.,* 2023). A product's physicochemical makeup and functional attributes, such as its texture, create public awareness a consumer's choice to buy it. The spread is classified as a functional spread since it has the capacity to provide several health advantages to people, particularly youths who have acquired a habit of eating spreads/butter/dips accompanying breakfast or snack foods. This product's core market is the obese population and young people, who are encouraged to switch their snacking habits to healthy options.

One of the health problems that receives the least attention is obesity, which can cause diabetes and heart disease. Almost 1.9 billion people worldwide are overweight or obese, with 650 million of them classified

How to cite this Article: Rohilla, Bhuneshwari and Singh, Sury Pratap (2023). Development and process standardization of Sweet corn (*Zea maize)* based spread (Toppings and Dips). *Internat. J. Appl. Home Sci.,* **10** (5 & 6) : 137-142.

as obese. According to estimates, 2.8 million fatalities occur each year as a result of obesity or overweight. Both developing and developed countries now face serious public health problems related to obesity and overweight. Due to increased industrialization and urbanization, India is a developing nation that is moving from under nutrition to obesity. Almost 135 million individuals in India suffer from obesity (Ahirwar and Mondal, 2019). A tremendous financial and public health burden is created by obesity in less developed nations, which can be considered as the initial manifestation of the "New World Syndrome," a categorised cluster of noncommunicable diseases. Obesity is one of the most prevalent but under appreciated public health issues today, according to the World Health Organization, and it affects every continent (Pednekar *et al*., 2008).

Sweet corn:

Corn, also known as Indian corn or maize, is a cereal plant that is a member of the Poaceae grass family. Maize, a domesticated plant initially cultivated in the Americas, is the food crop that is planted the most widespread in the globe. In addition to being a human food, corn is used as a biofuel and a raw material in industry (Haque *et al.,* 2022). *Zea mays* (L.) var. saccharata, a cultivar intended for human use, is used by the food industry as a raw or processed food source everywhere in the globe. It has gained popularity among consumers thanks to its distinctive flavour, pleasing flavour, and sweetness. 75 to 90 days after planting, sweet corn, also known as sugar corn, begins to produce green ears. A hybridized variety of maize called "sweet corn" was created expressly to increase the sugar levels (*Zea mays* L.) (Haque *et al.,* 2022). The newest superfood for consumers who are health-conscious is sweet corn. Sweet corn, additionally low in cholesterol and high in fibre, offers nutritional value comparable to some premium vegetables like cauliflower, cabbage, and French beans. The percentages of water (72.7%) and total solids (27.3%) in sweet corn kernels are connected to their nutritional value. Hydrocarbons make up the majority of solid components (81%), with proteins, lipids, and other materials making up the next 13%, 3.5%, and 3.5%, respectively. Starch makes up most of the hydrocarbons (Szymanek, 2012). Corn is a good supply of phytonutrients since it contains dietary fibre, vitamins, antioxidants, and a minimal quantity of minerals. Sweet corn is rich in lutein, zeaxanthin, and certain other carotenoids (Junpatiw *et al*., 2013). Despite a (25%) reduction in vitamin C, thermal processing sweet corn at 1150°C for 25 minutes greatly boosted its overall antioxidant activity by (44%) and (54%) (Dewanto *et al*., 2002). The spread is categorized as a functional spread since it can offer numerous health benefits to consumers, especially young people who have developed a habit of eating spreads, butter, and dips with their breakfast or snack items.

METHODOLOGY

The present investigation entitled "Development and process standardization of Sweet corn (*Zea maize*) based spread (Toppings and Dips)" was conducted under different experiments in the Department of Food Technology, Parul Institute of Applied Sciences, Parul University, Vadodara, Gujarat, India during the years 2023.

Procurement of raw materials:

Sweet corn, ginger-garlic paste and other material such as salt, olive oil and chili flakes were procured from the local market of Vadodara, Gujarat and bought to product development laboratory of Department of food technology, Parul University, Vadodara (GJ).

Optimization of methodology for the preparation of sweet corn based spread:

The Sweet corn were sorted, peeled and washed thoroughly with running water. Kernels were separated and were grinded in electrical grinder (Havells, Model MX-1155) for the preparation of spread. The slurry paste of sweet corn was then filtered out by muslin cloth and heated at low flame for 20-30 mins along with addition of salt and olive oil. Ginger-garlic paste was to enhance flavour. The product was stored at ambient temperature as well as refrigeration temperature for 7 days observation.

Packaging and storage:

Sweet corn based spread was packed in Polyethylene terephthalate (PET) plastic containers and were stored for 7 days at refrigerated (4^0C) and ambient (18-38 ^{0}C) temperature (Fig. 1).

Standardization of treatments:

Standardization of various flour blends was done after performing various treatments as mentioned below. The best treatment was selected on the basis of sensory

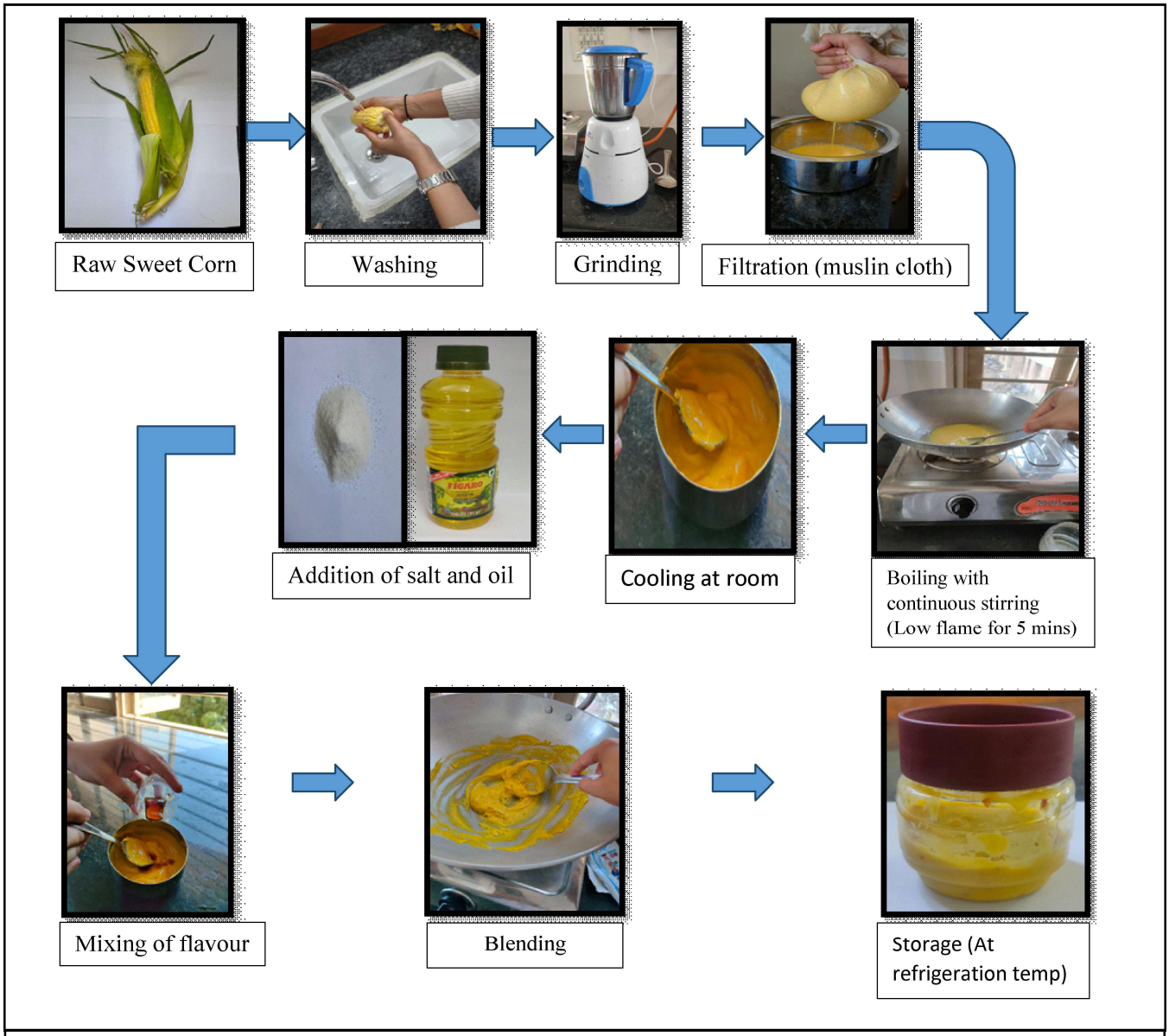

Fig. 1 : Preparation of sweet corn spread

evaluation by our experts, including Dean Sir, Institutional faculty and mentor, Parul University, Vadodara (Table 1).

Chemical and functional analysis:

The present research was focused on the development of sweet corn (*Zea maize*) based spread. According to Ranganna's methodology, moisture, ash, fibre, and carbohydrate were quantified (1986). Protein and fat levels were analysed using the AOAC-recommended methodology (2012). Bomb calorimeters are used to estimate energy value Rajsekaran *et al.* calculated the mineral content (2005). The Stuart technique was used to establish Fourier Transform-Infrared Spectroscopy (2005).

RESULTS AND DISCUSSION

The current study, titled "Development and process standardization of Sweet corn (Zea maize) based spread. (Toppings and Dips)," was carried out in Vadodara, Gujarat, India during the years 2023 at the Department of Food Technology, Parul Institute of Applied Sciences, Parul University. Under many headings and subheadings, the study's findings are presented and discussed:

Table 1 : Standardization of treatments

Trials	Sweet Corn (gm)	Flavoring Agent (gm)	Chili Flakes (gm)	Fat (olive oil) (ml)	Salt (gm)
Control	100	0	5	3	1
T_1	95	5	5	3	1
T_2	90	10	5	3	1
T_3	85	15	5	3	1
T_4	80	20	5	3	1
T_5	75	25	5	3	1
T_6	70	30	5	3	1
T_7	65	35	5	3	1
T_8	60	40	5	3	1
T_9	55	45	5	3	1
T_{10}	50	50	5	3	1
T_{11}	45	55	5	3	1
T_{12}	40	60	5	3	1
T_{13}	35	65	5	3	1
T_{14}	30	70	5	3	1
T_{15}	25	75	5	3	1
T_{16}	20	80	5	3	1
T_{17}	15	85	5	3	1
T_{18}	10	90	5	3	1
T_{19}	5	95	5	3	1
T_{20}	0	100	5	3	1

Chemical composition of sweet corn spread:

Table 2 depicts the ash, moisture, crude protein, crude fat, crude fiber, carbohydrates and energy value content as (2.8%), (64.8%), (6.40%), (3.20%), (0.2%), (87.4%) and 165.52, respectively.

Table 2 : Illustrates the chemical composition of sweet corn spread

Parameters	Amount (%)
Physical parameters	
Ash	2.8
Moisture	64.8
Crude protein	6.40
Crude fat	3.20
Crude fiber	0.2
Carbohydrates	87.4
Energy value	165.52 kcal/ 100gm

Table 3 depicts the calcium, magnesium, iron and zinc content as 11.60, 36.25, 0.23 and 2.13, respectively mg/100mg.

Table 3 : Minerals content in sweet corn spread

Minerals	Sweet corn spread (mg/100g)
Calcium	11.60
Magnesium	36.52
Iron	0.23
Zinc	2.13

FT-IR Analysis :

The data presented in Fig. 2 shows some peak in the absorbance wave number component present in the spread in graph showed the wavenumber 3367.91cm $^{-1}$ sample shows that the bound OH group will be involved in the adsorption, there was a clear band shift and a decrease in the band intensity to 3367.91cm $^{-1}$ due to high temperature in the activation process which has broken some intermolecular bonds, indicating that malachite green bind mainly in the OH position (Al-Degs *et.al*., 2008). The strong peak observed at 1639.89 cm^{-1} in N2M5NPBA is due to carbonyl (C=O) stretching (Prabukanthan *et al*., 2021). Absorption appeared

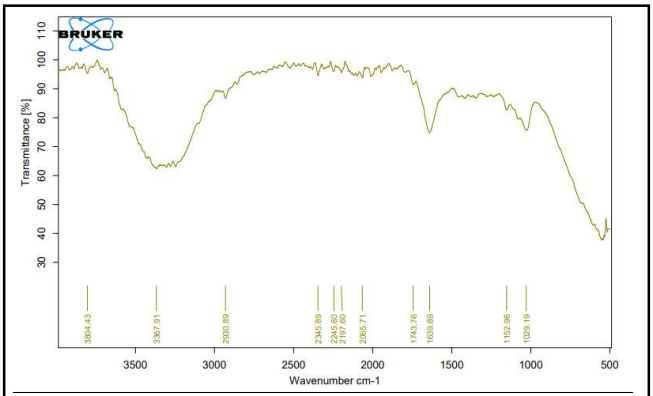

Fig. 2 : FT-IR analysis peaks of sweet corn spread

at 1029.19 cm^{-1} assigned to CN stretch (Li *et al*., 2018).

Quality evaluation of sweet corn based spread during storage:

Storage study of sweet corn based spreadat ambient temperature and refrigeration temperature:

Sweet corn spread were packed in Polyethylene terephthalate (PET) plastic containers and were stored for 7 days at refrigerated (4^0C) and ambient (25-27 ^{0}C) condition.

Table 4 : Storage study at ambient temperature (%)

Parameters (%)	0th day	2nd day	5th day	7th day
Moisture	64.8	65.1	65.7	66.0
Ash	2.8	2.6	2.4	2.1
Fat	3.20	3.18	3.15	3.12
Protein	6.40	6.39	6.36	6.34

The moisture content on the first day was (64.8%). As seen over the course of the following 7 days, the moisture content gradually rose due to humid. Whereas, ash, protein, and fat levels all decreased in quantity at ambient temperature.

Table 5 : Storage study at refrigeration temperature (%)

Parameters (%)	0th day	2nd day	5th day	7th day
Moisture	64.8	64.9	65	65.1
Ash	2.8	2.8	2.7	2.6
Fat	3.20	3.20	3.19	3.18
Protein	6.40	6.40	6.39	6.38

Due to its freezing temperature, the moisture level of sweet corn spread under refrigeration temperature (4ºC) increases extremely slow. Whereas, at refrigeration temperature, the amount of ash, protein, and fat gradually declines. So, it is advisable to store sweet corn-based spread at a refrigerated temperature for shelf-life.

Moisture (%):

The information in Tables 4 and 5 showed that there was a general upward trend in the moisture content of the sweet corn spread during the course of their 7-days storage at ambient temperature and under refrigeration, respectively. Overall storage time effects show that spread's moisture contents rose from 64.8 to 66.0 at room temperature and from 64.8 to 65.1 at refrigeration temperature. When evaluating the overall impact of storage condition on moisture content of spread, the lowest moisture content was found in spread stored at refrigerated condition and the greatest in spread stored at ambient condition. As a result of the spread's hydroscopic character, the moisture content of the spread dramatically rose during storage, which may have been caused by the absorption of moisture from its surroundings.

Ash (%):

The impact of ash content during storage is shown in Tables 4 and 5, which show that there was a general decreasing trend in ash content of sweet corn spread during the full storage duration of 7-days at ambient temperature and refrigerator temperature, respectively. When stored for a longer length of time, sweet corn spread's ash content fell from 2.8 to 2.1 at ambient temperature and from 2.8 to 2.6 at refrigeration temperature, according to the overall impact of storage time.

Protein (%) :

By reviewing the data in Tables 4 and 5, it can be seen that the protein content of sweet corn spread generally decreased throughout the course of the 7-days storage period, falling from 6.40 to 6.34 and from 6.40 to 6.38 for ambient and refrigerator temperatures, respectively. According to the findings, protein loss is greater at room temperature than it is under refrigeration. Protein loss might be brought on by thermally unstable protein denaturing during storage. Similar observations were found by (Nazni *et al.,* 2010).

Fat (%):

The information in Tables 4 and 5 shows that for the full 7-days period of storage at ambient and refrigeration temperatures, respectively, there was a general decrease in the fat content of sweet corn spread. In terms of the overall impact of storage time, sweet corn spread's fat content reduced from 3.20 to 3.12 at ambient temperature and from 3.20 to 3.18 at refrigerator temperature.

Conclusion:

The spread is classified as a functional spread since it has the capacity to provide several health advantages to people, particularly youths who have acquired a habit of eating spreads/butter/dips accompanying breakfast or snack foods. It is far superior to market spreads made from high fat animal sources, which are responsible for

raising cholesterol levels in people. It is considered healthful since it contains helpful nutrients. Olive oil, salt/ spices, and sweet corn are the elements used in the production. Vitamins A, B, and C, soluble fiber, plant protein, potassium, and magnesium are all abundant in sweet corn. The associated components provide a nourishing addition to the typical diet and may have advantages over commercial spreads produced from animal sources, making them an appealing dietary option. Tropical nations have a long tradition of using coconut oil. Olive oil-rich native diets indicate that this community is generally in excellent wellness. Additional human research are required to confirm the beneficial physiological and pharmacological effects of olive oil. Overall, include olive oil in your diet may have several health advantages. It's also a terrific option for cooking, salad dressing, and as a healthy fat source. Parameters including moisture content, ash, crude protein, crude fat, crude fibre, carbohydrates, and energy value were determined as (2.8 %), (64.8%), (6.40%), (3.20%), (0.2%), (87.4%) and 165.52 kcal/100g, respectively. Determination of minerals like calcium, magnesium, iron and zinc content as 11.60, 36.25, 0.23 and 2.13, respectively mg/100mg were obtained.

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