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Enrichment of kanji for sound health

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ABSTRACT

Kanji is a fermented naturally processed beverage. Kanji is value added drink derived from black carrot. Research trail was conducted with carrot, radish and beet root. Because their equivalent textural and chemical properties similar to black carrot. Every ingredient serves it's unique test, flavour and medicinal property. For preparation of kanji 100gm of carrot, radish and beet roots were selected along with red chilli powder (0.58g), mustard powder (0.46g), black paper powder (1.2g), pink salt (2g), white salt (1g), ginger (0.23g), asafoetida (0.87g) per litter. And blend uniformly within lukewarm water (39.50C). Kept for fermentation for 3 days. Process of lactobacillus fermentation was occurred in kanji samples. According to response of sensory test. kanji sample were mixed in various proportions. From all possible combinations 60% beet root + 30% carrot + 10% radish mixed combination emerge as best mixture. Among all samples mixed kanji combination shown more beneficial bacterial growth. Although it contains crude protein (2-3%), crude fiber (0-3%), calories (0.4-0.6%), CHO (0-1%). Which proven that instead of consuming caffeinated, sugar added and carbonated water added beverages. Consumption of healthy, medicinal elements rich and test refreshing fermented beverage along with tangy flavour which is beneficial for health. Hence experiment were entitled by "Enrichment of Kanji for Sound Health"

Keywords: Fermentation, Kanji, Healthy, Medicinal

Introduction

Kanji is probiotic, tangy flavoured enriched, fermented, naturally fermented beverage. Generally kanji is made up of black carrot (*Daucus carota ssp. Sativus var. atropurpureus*) Black carrot predominantly cultivated in northern states of India. but rarely found in regions of western and central India in a states such as Gujarat, Maharashtra, Chhattisgarh, Odisha (Bali *et al.*, 2024) [1]. Hence experiment was conducted with rooted vegetables such as carrot (*Dacus carota*), beet root (*Beta vulgaris*), radish (*Raphanus sativus*). Because their textural and chemical properties were equivalent to black carrot.

Youth is backbone of modern India but today's modern generation tends their interest towards consumption of fast food, junk food and unhealthy food. Which deteriorates their health in a drastic way. Peoples of society are unable to complete their daily task, targets, goals (Baganto *et al.*, 2023) [2] Due to consumption of caffeinated, carbonated water added and artificial essence added food products lowers immunity levels of human body. Recently covid-19 pandemic were occurred and majority of population of India got affected by these viral outbreak. Simple small change in climate becomes problem for health of our society. And main issue of society is "unconsciousness of people's about healthy diet" (Bakaloudi *et al.*, 2022) [3]

Hence experiment were carried out to introduce people's to test buds refreshing, tangy flavoured, probiotic riched natural and medicinal ingredient containing fermented beverage "Kanji" which is having numerous health benefits, medicinal properties and far better than caffeinated, carbonated water added, artificial chemical added, health damaging cold drink (Sharma *et al.*, 2022) Kanji will contributes for upliftment of immunity, energy and replacement of junk foods (Bustami *et al.*, 2025) [4]

Materials and methodology

Materials were used for preparation of kanji are glass jars, plastic jars, carrot, beet root, radish, red chilli powder, asafoetida, ginger, mustard powder, black pepper powder, pink salt, white salt, water.

Water were boiled up to 118°C and allow to cool down up to 39.5°C i.e. lukewarm state. To maintain aseptic conditions during preparation of kanji mixture. Beverage was made In three glass jars up to volume of 1 liter. Every ingredient diffuses its typical textural and chemical properties to mixture at lukewarm state of water.

Solution preparation and fermentation processes were carried out under glass jars because glass jars, earthen pots and clay utensils maintains natural texture and chemical composition of the solution during process of fermentation.

Mustard (*Brassica nigra*) seed powder were mixed @ 0.5g/1L in 3 jars. As mustard powder contains variety of phytochemicals such as flavonols, phenolic acid, palmitic acid, olic acid. Delivers numerous health benefits such as anticancer potential by reducing colonogenic survival of cancer cells by resting their growth at G0/S phase. (Anand *et.al.*, 2007) [5]

Red chilli powder were added @ 0.6g/1L in 3 jars of lukewarm water. Red chilli contains vit.C, antioxidant properties, bioactive chemicals such as capsaicinoids and carotenoid pigments shows anti litho genic activities. The protective effect of capsaicin helps to reduce the risk of cancer cells through the inhibition of the NF-B pathway. Chilli peppers can promote catabolic activity in lipids of various tissue and organs. Chilli powder can regulate to coronary blood flow and also founds effectful in reducing to the concentration of enezymes associated with alzheimer's disease. (Matsufuji *et.al.*, 1998) [6]

Black pepper (*Piper nigrum*) powder have been induce @ 0.75g/1L lukewarm water in every jar respectively. As it contains active compound piperine offers several health benefits such as boosting nutrient absorbtion, antioxidant properties and contributes for blood sugar level control. Black pepper is major source of manganese which is essential for bone health and metabolism. (Pop *et.al.*, 2024) [7]

Pink salt have added @ 3g/L in each glass jar respectively. As it contains several minarals such as iron (0.0369 mg), calcium (1.6 mg), potassium (2.8 mg), magnesium (1.06 mg), sodium (368 mg). Which helps in digestion, maintenance of electrolytic balance of body which plays key role in muscle contraction and nerve function. Pink salt also supports to cardio vascular health, respiratory health, hair health, pH regulation of body, lowers blood pressure effectively. (Jayaraman, 2022) [8]

White salt mixed @ 2gm/L. Because white salt maintains aseptic conditions during the process of lactobacillus acid fermentation process. Salt is beneficial for osmoregulations of body, ion balance of body, white salt helps to maintain water levels of body and plays key role in detoxification of blood, stomach, skin etc. (Elias *et al.*, 2024)

Ginger was added to each jar of kanji with a concentration of 0.5g/L. Zingiberene is an medicinal characters enriched chemical content of ginger serves several health benefits such as. Relief from menstrual cramps, nausea of motion sickness, bloating. Singletary (2010) [9]. Asafoetida were added @ 0.96g/L in each lukewarm water containing Rooted vegetables beet root, carrot, radish was pilled, grated and added to jar 1, jar2, jar3 having lukewarm water along with ingredients @100gm/L respectively. Beet root contains folic acid, iron, potassium, fiber, vit A, B and C (Babarykin *et al.*, 2019) [10]. Carrot contains beta- carotene, ascorbic acid, tocopherol. (Prasad *et al.*, 2017) [11]. Radish contains isothiocyanates, glucosinolates. (Khan *et.al.*, 2022) [12] As each vegetable generally consumed as a salad in diet as beet root, carrot and radish serves health benefits.

Result and discussion

Pre fermented, post fermented samples were submitted for food nutrition analysis. Three kanji samples labelled as beet root kanji, carrot kanji and radish kanji respectively. And nutrients identified in pre fermented samples are crude protein and crude fiber. Carrot kanji contains (0.82 gm) crude protein, (0.5 gm) crude fiber. Beet root kanji contain (2.08 gm) crude protein and (0.3 gm) crude fiber. Radish kanji contains (0.40 gm) crude protein, (0.1 gm) crude fiber.

Sample Parameters	PRE FERMENTED		POST FERMENTED			OVER FERMENTED		
	Crude Protein	Crude Fiber	Crude Protein	Crude Fiber	Calories	Crude Protein	Carbo hydrates	Crude Fat
CARROT	0.82	0.2	2.18	0.5	0.42	2.50	0.9	0.6
RADISH	2.08	0.3	3.21	0.6	0.5	2.33	0.9	1.0
BEET ROOT	0.40	0.1	0.89	0.3	0.5	2.37	0.83	1.12
MIXED	-	-	2.56	0.5	0.59	2.40	0.92	

As fermentation process were completed in warm area and mustard powder starts to float on kanji beverage. Which is a sign that product is ready to consume. When Lab results claims that product is safe to consume then 25 sensory tests were conducted. According to response of sensory test a fourth combination were made by composing three kanji solution by various trials among from all possible combinations 60% beet root kanji, 30% radish kanji

and 10% radish kanji mixture were emerge as a best combination which have shown satisfactory results. Taste of mixed kanji combination were unique and different than carrot kanji, beet root kanji, radish kanji and black carrot kanji. Also nutrition values of mixed kanji is far better than individual kanji. Four fermented samples labelled as carrot kanji, beet root kanji, radish kanji, mixed kanji respectively were submitted to Food Nutrition Analysis. Lab results displayed nutrients crude protein and crude fiber during lab testing's. According to lab

tests beet root kanji contains (2.18 mg) crude protein, (0.2 gm) crude fiber. Carrot kanji contains (3.21 mg) crude protein, (0.6 mg) crude fiber. Radish kanji contains (0.89 mg) crude protein, (0.3 mg) crude fiber. And mixed kanji contains (2.56 mg) crude protein, (0.5 mg) crude fiber.

Kanji samples allow to ferment more and microbial population allowed to grown and over fermented samples submitted to microbiology laboratory for microbial population detection and nutritional

analysis. Calories, crude protein, carbohydrate, total ash and crude fiber was identified in over fermented samples labbled as over fermented carrot kanji, beet root kanji, radish kanji and mixed combination respectively. Beet root kanji contains 0.5 Kcl calories, (2.37 gm) crude protein, (0.83%) carbohydrates, (1.5 gm) total ash. Carrot kanji contains (0.42 Kcl) calories, (2.50 gm) crude protein, (0.9 %) carbohydrates, (0.6 gm) crude fiber. Radish kanji contains (0.5 Kcl) calories, (2.33 gm) crude protein, (0.9 %) carbohydrate, (1.0 gm) crude fiber. And mixed kanji combination contains (0.59 Kcl) calories, (2.40 gm) crude protein, (0.92 %) carbohydrate, (1.12 gm) crude fiber.

B: Carrot kanji sample have results in minor growth of microbes in kanji sample as it have more red chilli powder in solution which retards to the growth of fermentating beneficial bacteria.

C: Beet root kanji sample results better growth of beneficial bacteria. Due to presence of folic acid and natural sugar which provides media for bacterial growth.

D: Mixed kanji sample which have unique test, and being prepared on the basis of response of sensory test not only become good in test, texture and flavour but also shown maximum growth of beneficial bacteria when this sample have been submitted to microbiology laboratory along with other three samples. mixed kanji becomes best combination for this experiment as it serves as favourable media for beneficial bacterial growth during the process of fermentation.

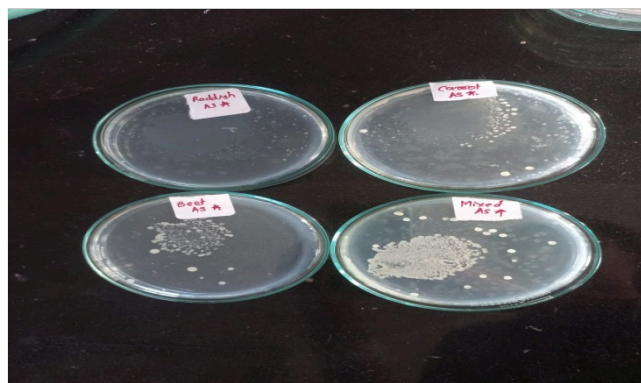


Figure 4.1. Growth of beneficial microbes have been analysed in microbiology lab screening of A: Radish kanji sample results in lesser population of microbes due to presence of isothiocyanate chemical in radish which is responsible for pungency of radish.



Figure 2. Fermentation of kanji samples in warm area

Fermentation process were carried out in glass jars to retain chemical, textural and physical properties of sample. Lactobacillus fermentation process were occurred (Swanson *et al.*, 2020) [13] And tangy flavour enriches during the process of fermentation. Three days are required for fermentation at the end of third day mustard powder starts to float on sample which is a sign that beverage is ready to consume. As this kanji contain healthy ingredients along with nutrition rich rooted vegetables. At the end of fermentation no any alcohol, toxic compound, harmful chemicals and microbes were detected in lab testing's.

Conclusion

Kanji is sugar free, caffeine free and carbonated water free naturally fermented beverage. Black carrots are rarely available in central western parts of India hence same combination were tried with carrot, radish and beet root which serves their typical test to beverage along with ingredients which are having resemblance in medicinal studies, preservation technologies and balance diet analysis. Every kanji sample including mixed sample imposes convincing microbiology lab reports, sensory responses and food nutrition analysis.

Tangy flavour diffuses, every ingredient disperse its typical test and property in the sample during the lactobacillus fermentation process. This had conducted in glass jar to avoid any chemical and textural change in the samples. Cold drinks also delivers tangy flavour but they are manufactured by using heavy amount of caffeine, carbonated water and sugars which are not recommended for pregnant women, children's below 12 years, diabetic patient. Cold drinks also unfit for consumption beyond 400 ml. (Seifert *et al.*, 2011) [14] But kanji can be consumed by any age group as this beverage is made to improve health, skin, metabolism, nutrient uptake etc.. (Lamba *et al.*, 2019) [15] Kanji is easy to formulate and propagate at commercial scale. It could be act as a life savour during the disease or viral outbreak such as Covid-19, also health conscious people's and youth will also try to shift towards test bud refreshing healthy alternative. Rather than consuming to health hazard fast food.

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