THINK INDIA JOURNAL

ISSN:0971-1260
Vol-22-Issue-34-December -2019

Process optimization and quality evaluation of developed water chestnut(*Trapabispinosa*), flaxseeds, and Sesame seeds nutritive Chikki (Bar)

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Abstract

*Health is more important aspect nowadays and people are more concern about it, hence they started focusing on nutritional content of their plate.*Nutritive Chikki, *is a ready to eat sweet snack, was elected as a source of enrichment with nutraceuticals by incorporation of water chestnut, flaxseed, sesame seeds and peanuts with jaggery. The rich profile of flaxseeds of omega-3 fatty acids were added at 15% levels in* Chikki *formulation. The nutritional attributes of sesame seeds utilized by adding it at 10% levels in nutritive chikki.Traditional method of preparation of chikki was adopted. No additional fat was added to nutritive chikki as oil seeds were the source of fat content in Nutritive Chikki (Bar). Trapabispinosa(Singhara) has strong nutritional profile and preparing Nutritive chikki by it is a pave way to utilizing its nutritional profile. On the basis of organoleptic evaluation, 5 panelists concluded that J_3WC_3 was best in sensory quality among all its counter parts as J_3WC_3achieved 8±0.353points on Hedonic scale.*

Keywords: **Nutritive Chikki,** ***nutraceuticals, flaxseeds, sesame seeds,Trapabispinosa***

Introduction

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Health is more important aspect nowadays and people are more concern about it, hence they started focusing on nutritional content of their plate. Ready to eat multigrain products with different nutrient content are the center of attraction for everyone. In India all generation people are affectionate by confectionery products as these items provide taste as well as nutrition. Among all confectionery products *Chikki* found an important place in hearts of people. The main objective of this research to develop the Nutritive *Chikki* of water chestnut with value addition by flaxseeds and sesame seeds.

Water Chestnut *(Trapabispinosa)* is a crop frequently grown all over India and traditionally known as Singhara (Singh *et al*., 2011). Singhara *(Trapabispinosa)* comprises pharmacognostic characters such as antioxidants like flavonoids, and flavones. *Trapabispinosa* exposed the presence of flavonoids, glycosides alkaloids, tannins, steroids, saponins, and total phenolic compounds (S. Patel*et al.,* 2010). *Trapabispinosa* has strong nutritional profile as it contains proteins, carbohydrates, minerals, and vitamin B complex such as thiamine, riboflavin, B5, B6, ascorbic acid, retinol, and tocopherol (G. Singh et al., 2011).

Flaxseed is essentially known by its outstanding profile of fatty acid. The polyunsaturated fatty acids are found in flaxseed oil are alpha linolenic acid and linoleic acid and they constitute 59%, and 16% of total fatty acids present. Omega-3 fatty acid found rich in flaxseed and it is the part of 16% of total fatty acid present in flaxseed (Morris, 2001; Ramcharitar et al., 2005; Rubilar et al., 2010).

Sesame seeds contains good amount of oxalic acid (2.5%) and phytic acid (5%). It contains significant amount of sulfur containing amino acids and lysine in low amount (Kapadia et al., 2002). Sesame seed (oil) molecules decrease the level of low density lipoprotein and increases

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the level of high density lipoprotein (Sirato-Yasumoto et al., 2001). Sesame lignans also contribute to antioxidant characteristics and thus improves health of host (Nakai et al., 2003).

Jaggery also known as Gur in India is a traditional sweetener obtained by processing of sugarcane juice (FAO, 2007). The micro minerals of jaggery investigated for their antitoxic as well as anticarcinogenic characteristics (Sahu and Paul, 1998). Gur is used as medicine in Ayurveda treatment and found to be active for purifying the blood. Jaggery is most nutritious sweeteners among all sweeteners (Madan et al. 2004).

Material and methods

The present study was carried out in the Department of Food Processing and Technology, School of Vocational Studies and Applied Sciences, Gautam Buddha University, Greater Noida.The ingredients Water chestnut flour, Jaggery, flaxseed, sesame seeds and peanuts used in present study were procured from the local market of Greater Noida, Gautam Buddha Nagar(U.P.).

Procedure

Traditional method of preparation of chikki was adopted. Jaggery syrup was prepared by adding 50 ml of water into predefined amount of jaggery and heated it until end point reached at 148^{o}-158^{o} C temperature. Addition of corn starch when syruping the jaggery reduce the chances of crystallization in syrup. Consistency of syrup affects the texture, appearance of the chikki, thus end point must be kept in mind. After the preparation of jaggery syrup it was added to water chestnut flour, and all ingredients such as peanuts, roasted flaxseeds and sesame seeds were added to it. Then Mixing processdone quickly and chikki mixture poured on the greased plate or tray. For even out the chikki layer we used rolling pin for rolling it. At last step with the help of cutters chikki was cut into round shaped and cooled at room temperature.

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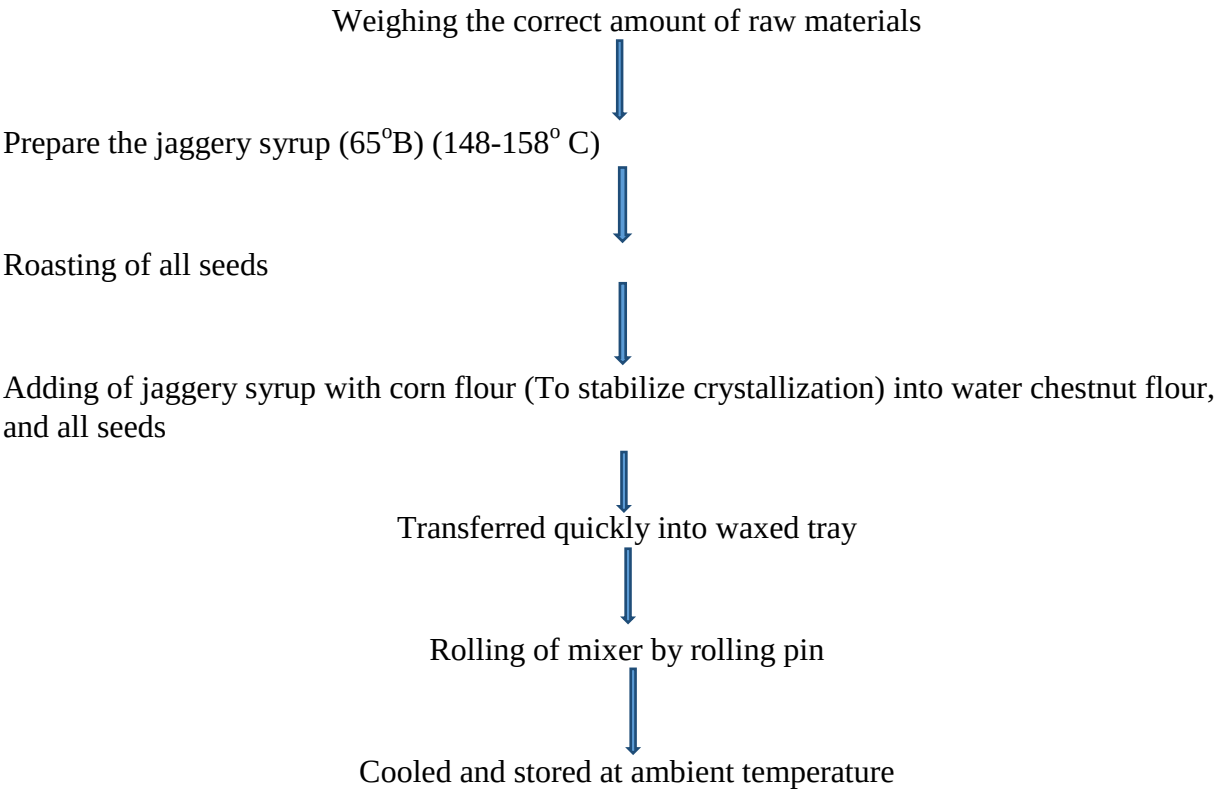

Figure 1. Flow-chart of development of technology of Water chestnut Chikki (Bar)

Table1. Different combination and standardization of nutritive chikki

Treatments	Composition	Ratio
J_1WC_1	Jaggery + Water chestnut flour	70:30
J_2WC_2	Jaggery + Water chestnut flour	50:50
J_3WC_3	Jaggery + Water chestnut flour	40:60

In all three trials the quantity of flaxseed, sesame seed, and peanut was constant and it was 15%, 10%, 20% respectively. No additional fat was added to nutritive chikki as oil seeds were the source of fat content.

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Result and discussion

Proximate Analysis

Chemical analysis was carried out by adopting standard methods of analysis. Fat estimation by soxhlet method (Cohen, 1917), protein estimation by kjeldhal method (AOAC 2000), carbohydrate by difference method (AOAC 2000), ash by muffle furnace (AOAC, 1995), moisture by hot air oven method (AOAC, 1995).

Table 2. Chemical analysis of treatments of nutritive chikki

Treatments	Fat%	Protein%	Moisture %	Ash %	Carbohydrate%
$\mathbf{J_1WC_1}$	16.24 ±0.63	5.725 ±0.48	6.032 ±0.45	2.88 ±0.29	69.11±0.82
$\mathbf{J_2WC_2}$	13.25±0.27	6.215 ±0.44	9.086 ±0.72	2.85 ±0.54	68.71±1.57
$\mathbf{J_3WC_3}$	13.41±0.56	4.7616 ±0.57	8.696 ±0.37	2.6 ±0.23	70.24±1.13

*Values are mean ± S.D. (standard deviation) of triplicates.

Results of chemical analysis showed that fat percentage and ash were found highest in $J_1WC_1$16.24±0.63, and 2.88 ±0.29 respectively, protein % and moisture % were highest in $J_2WC_2$6.215 ±0.44, and 9.086 ±0.72 respectively, carbohydrate % was highest in J_3WC_3(70.24±1.13).

Physical Analysis

For physical analysis, color was estimated by Hunter Lab Colorimeter. Results obtained by HLC were interpret among the all trials and trial J_3WC_3found superior in comparison with J_1WC_1 and J_2WC_2. Hue for $J_3WC_3$was 92.09 which was higher among all trials. The negative value of a* (-0.43) shows that trial J_3WC_3giving the perception of green color. Analysis result for Hunter Lab Colorimeter given in table 2.

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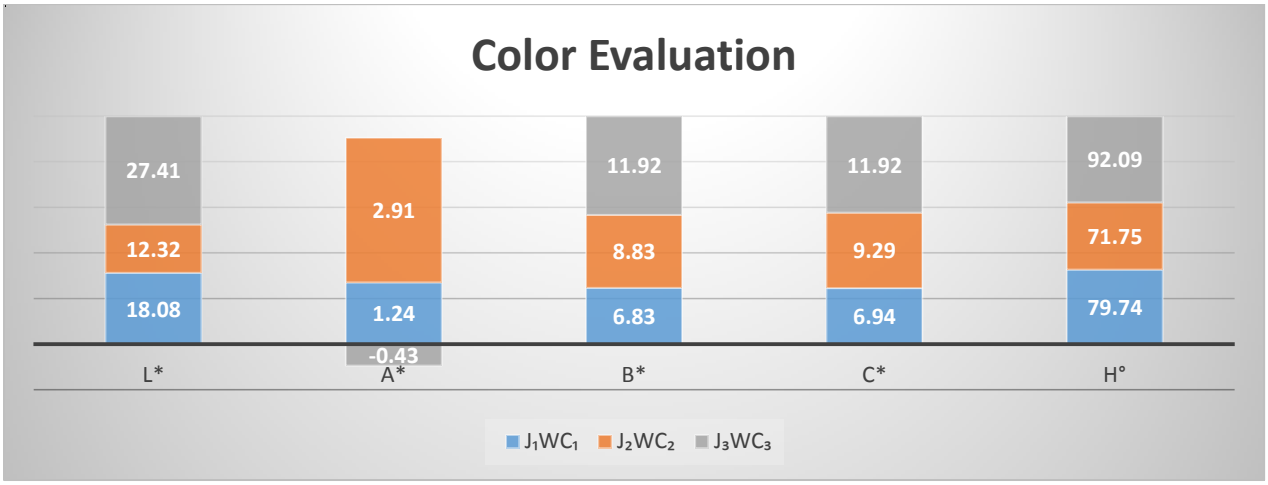

Figure 2. Color evaluation of nutritive chikki by Hunter Lab Colorimeter

Table3. Color analysis of nutritive chikki

Treatments	L*	a*	b*	c*	h°
J_1WC_1	18.08	1.24	6.83	6.94	79.74
J_2WC_2	12.32	2.91	8.83	9.29	71.75
J_3WC_3	27.41	-0.43	11.92	11.92	92.09

Organoleptic analysis

Nutritive chikki'sall treatments were subjected to organoleptic evaluation by hedonic scale (Watts *et al.* 1989) for five different attributes such as color & appearance, texture, taste & flavor, mouth feel, and overall acceptance and judged by 5 penal members with the help of 9 points.J_3WC_3got 8±0.353 points in overall acceptance thusit was concluded that treatment J_3WC_3 was best in sensory quality among all counter parts.

Treatments	Color& Appearance	Texture	Taste & Flavour	Mouth feel	Overall Acceptability
J_1WC_1	7.1±0.418	7±0.790	7.7±0.570	7.2±0.570	7.5±0.353
J_2WC_2	6.8±0.570	6.8±0.570	6.6±0.418	6.54±0.353	7.4±0.418
J_3WC_3	7.6±0.418	8.1±0.418	8.1±0.418	8±0.476	8±0.353

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Table 4.Organoleptic analysis of nutritive chikki

*Values are mean ± S.D. (standard deviation) of triplicates.

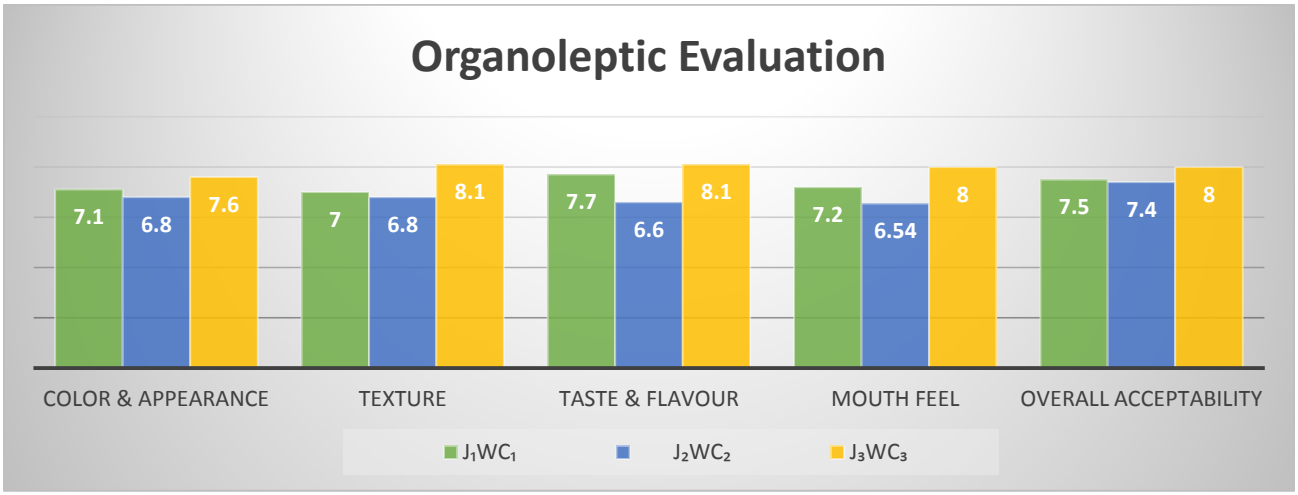

Figure 3. Graphical projection for organoleptic evaluation of nutritive chikki

Figure 4: Pictures of Nutritive Chikki.

Storage study of *nutritive chikki*(Bar)

Prepared nutritive chikki (Bar) subjected to storage study of 45 days in two different types of packaging, one was aluminum packaging and second was transparent LDPE. Results shows that aluminum packaging was more appropriate to maintain the good shelf life of chikki in comparison to transparent LDPE.

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Table 5. Storage study of prepared nutritive chikki (Bar) using Aluminum packaging

Treatments	0th Day		15th Day		30th Day		45th Day	
	PV	Moisture(%)	PV	Moisture(%)	PV	Moisture(%)	PV	Moisture(%)
J_1WC_1	1.2	6.03	2.2	6.79	3.2	8.05	4.0	10.01
J_2WC_2	1.5	9.08	2.0	9.30	4.0	9.60	4.2	10.05
J_3WC_3	1.1	8.69	2.1	8.91	3.6	9.02	3.9	9.10

*PV= Peroxide value in terms of meq O_2/kg

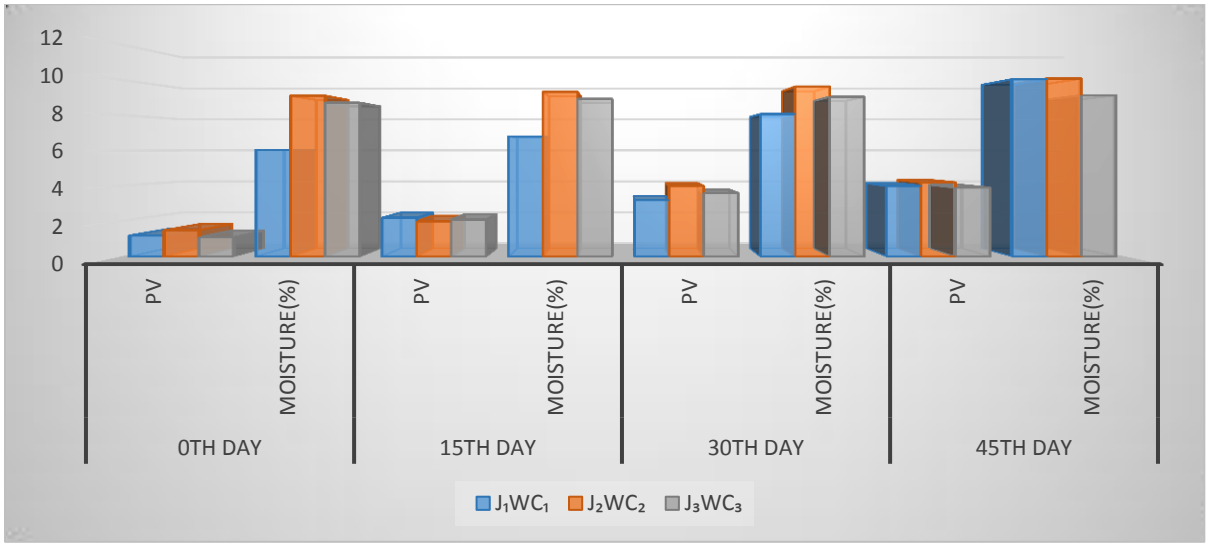

Figure 5: Graphical projection ofstorage study of prepared nutritive chikki (Bar) using Aluminum packaging

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Table 6. Storage study of prepared nutritive chikki (Bar) using transparent LDPE packaging

Treatments	0th Day		15th Day		30th Day		45th Day	
	PV	Moisture(%)	PV	Moisture(%)	PV	Moisture(%)	PV	Moisture(%)
J_1WC_1	1.2	6.03	2.5	6.81	4.8	8.55	8.6	11.05
J_2WC_2	1.5	9.08	2.8	9.63	5.2	10.07	9.6	11.12
J_3WC_3	1.1	8.69	3.0	8.99	4.4	9.73	8.5	10.03

*PV= Peroxide value in terms of meq O_2/kg

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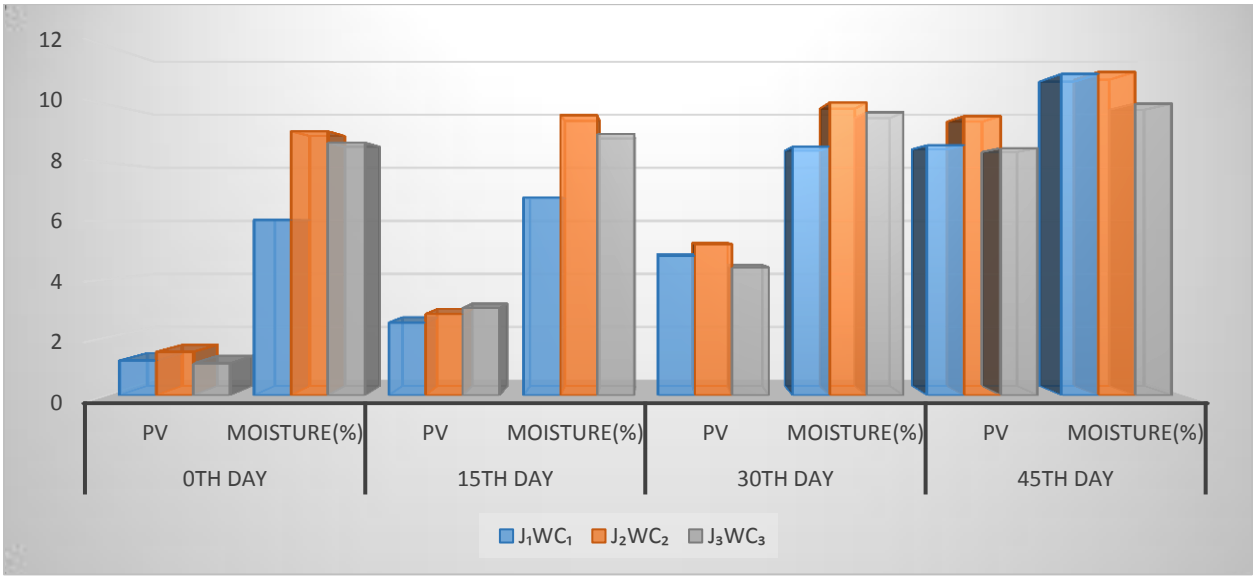

Figure 6. Graphical projection ofstorage study of prepared nutritive chikki (Bar) using Transparent LDPE packaging

Conclusions

Nutritive Chikki, is a ready to eat sweet snack, was elected as a source of enrichment with nutraceuticals by incorporation of water chestnut, flaxseed, sesame seeds and peanuts with jaggery. The rich profile of flaxseeds of omega-3 fatty acids were added at 15% levels in *Chikki* formulation. The nutritional attributes of sesame seeds utilized by adding it at 10% levels in nutritive chikki. Shelf life study done by storing nutritive chikki for 45 days and found that the peroxide values increases on storage at ambient temperature. PUFA profile of chikki enhanced with the addition of flax seed and sesame seeds. Flaxseeds and sesame seeds reported a slight dark color to the product and the products compared with each other.

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