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Mango kernel oil as a fat replacer in Nankhatai cookies

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Abstract
Nankhatai cookies are a popular round, dome-shaped baked dessert. Nankhatai cookies are most commonly baked until crisp. Nankhatai cookies were developed by replacing the vanaspati with mango kernel oil. Mango kernel oil has high oxidative stability, thus ensuring a long shelf life. Mango kernel oil replaced vanaspati ghee at levels of 25%, 50% and 75%. The shelf life of the Nankhatai cookies was evaluated for three months. There were significant variation observed in Peroxide value, Hardness and FFA yielding a stable, better textured product.

Keywords: Nankhatai, mango kernel oil

Introduction
Mango is a common fruit, which is characterized by its sweet tasty pulp. In mango about 40-50% of total fruit is wasted of which peel is 12-15%, pulper waste is 5-10% and the kernel is 15-20% (Garg *et al.*, 2019) [10]. Mango seed kernel oil is edible oil that can be extracted using both cold press and solvent extraction methods. The total phenolic content of mango seed kernel was 72 mg/100g. Total phenolic contents and induction period of mango kernel oil is greater than many commercial vegetable oils; thus, it can be used as an alternative of synthetic antioxidants for the preservation of fats and oils (Mohamed *et al.*, 2005) [4].

Nankhatai cookies can be defined as a round, dome-shaped baked dessert. A Nankhatai cookie is most commonly baked until crisp. Nankhatai cookies have a long shelf life, and must be acceptable to the consumer for up to six months or more. Oil used in the dough, should have good oxidative stability, so rancidity does not develop in the product during storage. (Pyler *et al.*, 1988) [9].

Materials and Methods
The experiments were undertaken at the Department of Food Process Engineering, SHUATS, Prayagraj. Wheat flour sugar, shortening, baking soda, baking powder and salt were purchased from the local market. Mango kernel oil was extracted by cold press method (T_1), solvent extraction using n-Hexane (T_2) and solvent extraction using petroleum ether (T_3). The vanaspati ghee in the cookies was replaced with mango kernel seed oil at 25%, 50% and 75% levels of replacement as shown in Table 1. Sample T_0 had 100% vanaspati ghee. The nankhatai cookies were prepared using 100 gm wheat flour, 50 gm sugar, 25,50 and 75gm mango kernel oil, 1.5 gm baking soda, 1 gm baking powder and salt were added.

Mango kernel oil/ vanaspati ghee and sugar were kneaded in a pan until a smooth dough was formed. Baking powder was added while blending. Wheat flour; mango kernel oil, baking soda and salt were slowly added to the dough mixture. The dough was flattened using a rolling pin on a smooth surface lightly floured table. The dough was sheeted to a thickness of 1.2 mm and circular cookies were cut, placed on greased baking trays and were baked in an oven at 190 °C for 15 minutes. The cookies were removed from the oven and allowed to cool. Prepared nankhatai were packed in 200 gauge LDPE pouches. The diameter and thickness of the baked cookies was measured and the spread ratio was determined. The packed samples were stored at room temperature up to 3 months for storage study.

The product was drawn at 15 days interval for Physico-chemical analysis. Hardness was determined according to Rangana, (1986). Determinations for Peroxide value, Total phenolic content and free fatty acid contents were carried out according to the method described by AACC (2003). All data were expressed as mean values ± SD. Data were analysed by one-way analysis of variance with Tukey's test. The significance of differences between the mean values was indicated at the 95% confidence level.

Table 1: Experimental Design

Sr. no	Treatments	Mango Kernel oil %
1	T_0	0
2	T_{11}	25
3	T_{12}	50
4	T_{13}	75

Results and Discussion

Replacement of vanaspati ghee with mango kernel oil at different levels did not show any significant differences ($p \leq 0.05$) with the control (100% vanaspati ghee) in the physical properties (diameter, thickness and spread ratio) as shown in table 2. However the hardness decreased significantly with increase in the level of mango kernel oil. Diameter of the nankhatai ranged from 4.10 – 4.14 mm in all samples. Thickness ranged from 1.74-1.77mm and spread ratio was 2.32-2.37. Similar results were obtained by Jain *et al.*, (2017) [8] on Cookies. It was observed that the hardness of the cookies decreased with increase in mango kernel oil content. The decrease in hardness was significant in mango kernel oil levels over 50%. This is similar to the results obtained by the Krystyjan *et al.*, (2018) [12] on biscuits with the highest level of Plantago psyllum. The lower hardness levels could be because of the higher levels of fats in the nankhatai cookie recipe. The fatty acids in the mango kernel oil nankhatai cookie recipe could also be responsible for the decrease in hardness levels.

Table 2: Physical parameters of nankhatai

Treatment		Physical parameters			
		Diameter (mm)	Thickness (mm)	Spread ratio (mm)	Hardness (N)
Control		4.11±0.14^a	1.77±0.12^a	2.32±0.10^a	7.25±0.12^a
T_1	T_{11}	4.12±0.30^b	1.76±0.41^b	2.34±0.31^b	7.20±0.11^a
	T_{12}	4.14±0.32^a	1.76±0.43^b	2.35±0.38^b	6.90±0.17^b
	T_{13}	4.14±0.35^a	1.75±0.44^a	2.36±0.32^b	6.85±0.10^b
T_2	T_{21}	4.13±0.35^a	1.75±0.45^b	2.36±0.32^a	7.19±0.12^a
	T_{22}	4.12±0.32^a	1.74±0.47^b	2.36±0.34^a	7.01±0.16^b
	T_{23}	4.12±0.34^a	1.75±0.41^a	2.35±0.31^b	6.85±0.14^b
T_3	T_{31}	4.13±0.30^a	1.74±0.41^b	2.37±0.33^b	7.20±0.16^a
	T_{32}	4.10±0.36^a	1.75±0.40^b	2.34±0.30^a	7.00±0.12^b
	T_{33}	4.12±0.34^a	1.74±0.43^a	2.36±0.35^a	6.97±0.18^b

Values are expressed as mean ± standard deviations; values in the same row followed by different letters are significantly different ($p \leq 0.05$)

Replacement of vanaspati ghee with mango kernel oil did not show any significant differences in the moisture content of the cookies as shown in Table 3. The moisture content increased from 1.17 to 1.57% over the storage period. The low moisture content may be on account of the temperature of baking. This is similar to the results obtained by Jain *et al.*, (2017) [8] on cookies.

Table 3: Moisture Content of Nankhatai with different proportion of mango kernel oil

Treatment		Storage period (Days)					
		15	30	45	60	75	90
Control		1.17±0.23^a	1.26±0.36^a	1.31±0.23^a	1.32±0.23^a	1.35±0.25^a	1.37±0.25^a
T_1	T_{11}	1.19±0.25^a	1.22±0.35^a	1.29±0.12^a	1.31±0.21^a	1.33±0.33^a	1.36±0.14^a
	T_{12}	1.25±0.33^a	1.28±0.25^a	1.30±0.24^a	1.32±0.20^a	1.37±0.33^a	1.44±0.11^a
	T_{13}	1.14±0.25^a	1.24±0.16^a	1.28±0.16^a	1.31±0.19^a	1.41±0.28^a	1.43±0.09^a
T_2	T_{21}	1.14±0.21^a	1.24±0.22^a	1.28±0.23^a	1.31±0.18^a	1.34±0.28^a	1.37±0.05^a
	T_{22}	1.25±0.14^a	1.26±0.21^a	1.27±0.25^a	1.30±0.17^a	1.38±0.31^a	1.39±0.13^a
	T_{23}	1.24±0.36^a	1.26±0.23^a	1.29±0.35^a	1.34±0.16^a	1.44±0.29^a	1.47±0.05^a
T_3	T_{31}	1.30±0.35^a	1.27±0.29^a	1.30±0.36^a	1.39±0.32^a	1.41±0.31^a	1.47±0.14^a
	T_{32}	1.28±0.34^a	1.39±0.30^a	1.42±0.24^a	1.46±0.32^a	1.49±0.31^a	1.57±0.11^a
	T_{33}	1.27±0.21^a	1.34±.032^a	1.38±0.25^a	1.42±0.35^a	1.49±0.32^a	1.49±0.03^a

Values are expressed as mean ± standard deviations; values in the same row followed by different letters are significantly different ($p \leq 0.05$)

Peroxide values measures the content of hydro peroxides and are often used as an indicator of primary products of lipid oxidation. Increase in peroxide values indicates an increase in the breakdown of the fats in the product. The changes in the peroxide values of cookies during storage are shown in Table 4. The control sample had the lowest initial peroxide value of 2.44 mg/g which increased to 5.97 mg/g at 90 days of storage. Samples with mango kernel oil had higher initial peroxide values but lower peroxide values compared to control over the storage period, after about 60 days of storage. This suggests that addition of mango kernel oil has an effect on lowering the peroxide values during storage. Samples with 25% and 75% replacement with mango kernel oil showed a significant difference from control samples. Similar results were obtained by Rahman *et al.*, (2018) on biscuits the highest value reached at the temperature of 30 °C, while the one at the temperature of 15 °C and 45 °C only reached minimum value.

Table 4: Peroxide value of Nankhatai with different proportion of mango kernel oil

Treatment		Storage period (Days)					
		15	30	45	60	75	90
Control		2.44±0.32^{a}	2.56±0.23^{a}	3.99±0.17^{a}	4.93±0.32^{a}	5.20±0.81^{a}	5.97±0.71^{a}
T_1	T_{11}	2.61±0.69^{b}	2.56±0.31^{b}	3.91±0.22^{b}	4.15±0.18^{b}	4.86±0.32^{b}	5.38±0.86^{a}
	T12	2.56±0.72^{a}	2.79±0.3^{a}	4.21±0.20^{a}	4.36±0.19^{a}	4.70±0.30^{a}	5.75±0.83^{b}
	T13	2.50±0.71^{b}	2.50±0.30^{b}	3.94±0.20^{a}	4.86±0.16^{b}	4.92±0.31^{b}	5.68±0.81^{a}
T_2	T_{21}	2.45±0.80^{b}	2.56±0.31^{b}	3.90±0.30^{b}	4.36±0.93^{b}	4.45±0.16^{b}	5.40±0.76^{a}
	T22	2.49±0.83^{a}	2.57±0.30^{a}	4.34±0.30^{a}	4.30±0.95^{a}	4.61±0.16^{a}	5.70±0.70^{b}
	T23	2.44±0.81^{b}	2.69±0.33^{b}	3.96±0.31^{b}	4.45±0.93^{b}	4.88±0.15^{b}	5.55±0.73^{b}
T_{3a}	T_{31}	2.48±0.59^{b}	2.73±0.35^{b}	4.12±0.29^{b}	4.13±0.89^{b}	4.84±0.80^{b}	5.66±0.85^{a}
	T32	2.81±0.62^{a}	2.84±0.32^{a}	4.13±0.28^{a}	4.38±0.90^{a}	4.76±0.80^{a}	5.78±0.84^{b}
	T33	2.74±0.61^{b}	2.84±0.18^{b}	4.17±0.26^{b}	4.39±0.31^{b}	5.08±0.32^{b}	5.67±0.38^{b}

Values are expressed as mean ± standard deviations; values in the same row followed by different letters are significantly different ($p \leq 0.05$)

The Free fatty acid content of the nankhatai cookies are shown in Table 5. Replacement with mango kernel oil showed a decrease in free fatty acid content for samples compared to control with 25% replacement and an increase for replacement with mango kernel oil greater than 25%. The that addition of mango kernel oil T_1 to T_3 samples have comparable observation in terms of free fatty acid of nankhatai compared to the control. The T_1 had the lowest initial free fatty acid of 0.60 which increased to 0.92% at 90 days of storage of the Nankhatai. However sample T_2 the range of free fatty acids was 0.60-1.02% and T_3 varied from 0.71-1.03%. It was found that T_{11} there was less volume of Mango kernel oil used (25%) so these are good for storage up to 90 days. the similar results obtained by the Jayalaxmi *et al.*, (2018) [5] on Biscuits the increase was considerably higher in control biscuits compared to TPP biscuits indicating the potency of antioxidant inhibiting the formation of free fatty acids.

Table 5: Free fatty acids of Nankhatai with different proportion of mango kernel oil

Treatment		Storage period (Days)					
		15	30	45	60	75	90
Control		0.74±0.15^{a}	0.73±0.19^{a}	0.73±0.23^{a}	0.72±0.25^{a}	0.78±0.41^{a}	0.85±0.45^{a}
T_1	T_{11}	0.60±0.51^{b}	0.61±0.63^{a}	0.71±0.98^{a}	0.75±0.34^{a}	0.86±0.71^{b}	0.92±0.19^{b}
	T12	0.88±0.42^{b}	0.82±0.85^{a}	0.81±0.98^{a}	0.92±0.34^{b}	0.91±0.68^{b}	0.95±0.19^{b}
	T13	0.91±0.39^{a}	0.91±0.33^{b}	0.92±0.98^{a}	0.92±0.71^{b}	0.91±0.71^{a}	1.01±0.19^{a}
T_2	T_{21}	0.60±0.50^{b}	0.61±0.30^{a}	0.71±0.82^{b}	0.77±0.31^{a}	0.87±0.63^{b}	0.97±0.64^{b}
	T22	0.88±0.54^{c}	0.76±0.80^{a}	0.80±0.82^{b}	0.80±0.31^{a}	0.87±0.62^{b}	0.95±0.65^{b}
	T23	0.84±0.56^{b}	0.80±0.29^{b}	0.80±0.82^{a}	0.81±0.62^{a}	0.89±0.62^{a}	1.02±0.65^{a}
T_3	T_{31}	0.71±0.56^{b}	0.70±0.15^{a}	0.73±0.99^{a}	0.81±0.16^{a}	0.91±0.62^{b}	1.02±0.66^{b}
	T32	0.88±0.55^{c}	0.80±0.15^{a}	0.89±0.99^{a}	0.89±0.16^{b}	0.89±0.64^{b}	1.02±0.66^{b}
	T33	0.88±0.55^{a}	0.89±0.14^{b}	0.89±0.99^{b}	0.92±0.63^{a}	0.95±0.63^{a}	1.03±0.66^{a}

Values are expressed as mean ± standard deviations; values in the same row followed by different letters are significantly different ($p \leq 0.05$)

Replacement of vanaspati ghee with mango kernel oil did not show any significant differences in the total phenolic content of the cookies as shown in Table 6. The total phenolic content increased from 10.17 to 11.24 mg over the storage period. This is similar to the results obtained by Puravankara *et al.*, (2000) [3] on oxidative stability of buffalo ghee.

Table 6: Total phenolic content of Nankhatai with different proportion of mango kernel oil

Treatment		Storage period (Days)					
		15	30	45	60	75	90
Control		10.17±0.23^{a}	10.19±0.25^{a}	10.20±0.26^{a}	10.21±0.12^{a}	10.23±0.12^{a}	10.23±0.23^{a}
T_1	T_{11}	10.20±0.11^{a}	10.21±0.24a^{a}	10.21±0.25^{a}	10.22±0.23^{a}	10.23±0.16^{a}	10.23±0.25^{a}
	T12	10.20±0.12^{a}	10.21±0.28^{a}	10.22±0.23^{a}	10.23±0.15^{a}	10.24±0.14^{a}	10.25±0.21^{a}
	T13	10.21±0.16^{a}	10.22±0.17^{a}	10.23±0.24^{a}	10.24±0.24^{a}	10.22±0.16^{a}	10.23±0.20^{a}
T_2	T_{21}	10.29±0.15^{a}	10.36±0.26^{a}	10.55±0.27^{a}	10.74±0.26^{a}	10.95±0.19^{a}	10.94±0.23^{a}
	T22	10.35±0.25^{a}	10.48±0.22^{a}	10.66±0.28^{a}	10.85±0.27	11.08±0.17^{a}	11.10±0.28^{a}
	T23	10.40±0.30^{a}	10.54±0.31^{a}	10.72±0.29^{a}	10.95±0.26	11.20±0.17^{a}	11.24±0.29^{a}
T_3	T_{31}	10.24±0.23^{a}	10.33±0.26^{a}	10.52±0.30^{a}	10.63±0.29	10.85±0.21	10.88±0.25^{a}
	T32	10.31±0.28^{a}	10.44±0.24^{a}	10.61±0.36^{a}	10.81±0.28	10.98±0.19^{a}	10.99±0.26^{a}
	T33	10.36±0.29^{a}	10.51±0.21^{a}	10.70±0.35^{a}	10.91±0.25^{a}	11.15±0.18^{a}	11.16±0.24^{a}

Values are expressed as mean ± standard deviations; values in the same row followed by different letters are significantly different ($p \leq 0.05$)

Sensory properties of food products play an important role in consumer acceptance. Therefore, our goal is not only to improve the functionality of cookies, but also to produce acceptable cookies from sensory evaluations in nankhatai cookies. Sensory evaluation of fat substitution using mango kernel oil in nankhatai cookies were shown in Table 7. The T_1 using 25% mango kernel oil cookies were rated higher in appearance, texture, taste, after taste and overall acceptance. When the mango kernel oil level increases from 30% to 50%, the cookies become lower sensory score. Similar results were obtained by Patil *et al.*, (2020) [11] on Nankhatai.

Table 7: Sensory evaluation of Nankhatai with different proportion of mango kernel oil

Treatment		Sensory Evaluation				
		Appearance	**Texture**	**Colour**	**Taste**	**Overall acceptability**
Control		7.5±0.14^{a}	8.0±0.12^{a}	6.5±0.10^{a}	8.0±0.12^{a}	7.5±0.12^{a}
T_1	T_{11}	7.5±0.30^{b}	7.5±0.41^{b}	7.0±0.31^{b}	7.5±0.11^{a}	7.0±0.11^{b}
	T12	7.0±0.32^{b}	6.5±0.43^{b}	7.0±0.38^{b}	7.0±0.17^{b}	7.5±0.17^{b}
	T13	7.0±0.35^{c}	6.5±0.44^{a}	7.0±0.32^{b}	6.5±0.10^{b}	7.0±0.10^{a}
T_2	T_{21}	7.5±0.35^{b}	8.0±0.45^{b}	7.5±0.32^{a}	7.0±0.12^{a}	7.5±0.12^{b}
	T22	7.0±0.32^{a}	7.0±0.47^{b}	7.5±0.34^{a}	7.0±0.16^{b}	7.0±0.16^{a}
	T3	6.5±0.34^{a}	6.5±0.41^{a}	7.0±0.31^{b}	6.5±0.14^{b}	7.0±0.14^{a}
T_3	T_{31}	7.0±0.30^{b}	7.0±0.41^{b}	7.0±0.33^{b}	6.5±0.16^{a}	7.0±0.16^{a}
	T32	6.5±0.36^{a}	7.0±0.40^{b}	7.0±0.30^{a}	6.0±0.12^{b}	6.5±0.12^{a}
	T33	6.5±0.34^{c}	6.5±0.43^{a}	7.0±0.35^{a}	6.0±0.18^{b}	6.5±0.18^{a}

Conclusion

Nankhatai Cookies prepared with Mango kernel oil as a fat replacer were found to be comparable to the control in the physical parameters such as thickness, spread ratio and diameter. Use of mango kernel oil decreased the hardness of the cookies rendering them more acceptable to the panellists. The peroxide value was 2.44-5.97mg/g and total phenolic content was 10.17-11.16mg during 90 days storage. T_{11} Cookies (25% Mango kernel oil) had a better acceptance than T_2 Cookies (50% Mango kernel oil) and T_3 (75% Mango kernel oil).

References

1. American Association of Cereal Chemists. Approved methods of the AACC 10th Ed. The Association, St. Paul, MN, 2000.
2. Rangana S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata McGraw Hill, New Delhi, 2018.
3. Puravankara D, Boghra V, Sharma RS. Effect of antioxidant principles isolated from mango (Mangifera indica L) seed kernels on oxidative stability of buffalo ghee (butter-fat), Journal of Science Food Agriculture. 2000;80(4):522-526.
4. Mohamed EM, Girgis AY. Utilization of mango seed kernels for improving stability of some oils and biscuit production. Journal of Agriculture and Science, Mansoura University. 2005;30:4625-4636.
5. Baddi Jayalaxmi, Vijayalakshm D. Retention and Evaluation of Antioxidant Activity of Polyphenol Extract from Mango Peel Powder as a Source of Natural Phyto-Nutrients in Biscuits and Its Shelf Life Study, International Journal of Current Microbiology and Applied Sciences. 2018;7(5):1214-1226.
6. Constance Chiremba, John Taylor RN, Kwaku Duodu G. Phenolic Content, Antioxidant Activity, and Consumer Acceptability of Sorghum Cookies, Cereal Chemistry. 2009;86(5):590-594.
7. Rahman T, Sulaiman NF, Turmala E, Andriansyah RCE, Luthfiyanti R, Triyono A. Shelf life prediction of biscuits prepared from modified suweg (*Amorphophallus campanulatus* B) flour using Arrhenius model, Earth and Environmental Science. 2019;251:1-10.
8. Dr. Simmi Jain, Pooja Sree KM. Physicochemical and Organoleptic Properties of Cookies Made Using Tender Coconut Pulp as a Fat Replacer, Asian Journal of Science and Technology. 2017;08(12):7089-7091
9. Pyler EJ. Baking science and technology, Volume I. Third edition, Sosland Publishing Company, Kansas, 1988.
10. Neelima Garg. An Integrated approach for Mango solid waste utilization, Central Institute for Subtropical Horticulture, Lucknow, 2019.
11. Sunitkumar Patil. Development and Quality Evaluation of Ragi Powder Incorporated Nankhatai. Paridnya –The MIBM Research Journal. 2020;7(1):69-75.
12. Magdalena Krystyjan, Dorota Gumul, Anna Korus, Jarosław Korus, Marek Sikora. Physicochemical properties and sensory acceptance of biscuits fortified with Plantago psyllium flour. Emirates Journal of Food and Agriculture. 2018;30(9):758-763.