Kokum Butter: Traditional Fat of Western Ghats for New Vegan Era

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ABSTRACT

Kokum (*Garcinia indica*) is an indigenous fruit of the Konkan region whose seed kernel yields kokum butter, a valuable yet underutilised plant fat. Its unique fatty-acid profile and desirable melting and structuring properties make it a promising ingredient for vegan butter and other plant-based foods. This article highlights its nutritional and functional properties, traditional and modern extraction techniques, reasons for its underutilisation, and emerging opportunities in sustainable vegan food formulations.

INTRODUCTION:

From an indigenous Konkan resource to a promising plant-based alternative to dairy butter

The global food landscape is changing rapidly. Consumers are increasingly looking for foods that are plant-based, sustainable, minimally processed and locally sourced. The rise of veganism and flexitarian diets has stimulated interest in alternatives to conventional dairy products particularly milk, cheese and butter. While the market is crowded with products based on coconut, shea, palm and other vegetable fats India possesses an indigenous resource that has remained surprisingly overlooked.

Kokum butter is a pale cream to yellowish, semi-solid to hard fat traditionally produced in the Konkan region of India derived from kernels of fruits *Garcinia indica* (Fig.1). Kokum tree is associated with Western Ghats and coastal regions of Maharashtra, Goa and Karnataka. The fruit is better known for its sour rind widely used as a culinary acidulant, while its seeds have historically received much less attention. Fat hidden inside these seeds have remarkable technological properties. Kokum kernel contains approximately 40–50% fat and kokum butter is particularly rich in stearic and oleic acids (Kalse et al.,20124). It has relatively high melting point and being solid at room temperature give it the ability to provide body and stability to fat-based foods. These characteristics have already attracted interest in confectionery, shortenings and specialty fats. The question is can this traditional fat be transformed into a modern plant-based butter suitable for the emerging vegan food market?

Kokum: A fruit with more than one story

Kokum is traditionally valued for its dark purple-red fruit rind. Dried kokum rind locally used as *aamsul* is an important souring ingredient in regional cuisines (Rane et al.,2025). Kokum is also used to prepare beverages, syrups and other traditional products. After processing edible portion of the fruit seeds remain as a relatively underutilised fraction. Their kernels contain a substantial amount of fat which solidifies at room temperature and is traditionally known as kokum butter. The butter is known locally and has been used in traditional practices as well as in cosmetic and medicinal preparations.

Fig 1. Kokum Fruit processing

Interestingly, the indigenous knowledge surrounding kokum butter predates the modern language of "plant-based fats." Local communities have traditionally prepared the butter by processing kernels, heating them with water and recovering fat that separates from the aqueous phase. Thus, what appears today as a new opportunity for vegan food technology has roots in traditional Konkan processing knowledge.

What makes kokum butter different?

The most interesting characteristic of kokum butter is its fatty-acid and triacylglycerol composition. Kokum fat has been reported to contain approximately 50–60% stearic acid and 36–40% oleic acid, although composition varies with variety, origin and processing conditions. Its major triacylglycerol is 2-oleodistearin, a structure that contributing to its relatively firm nature and melting behaviour. Kokum fat generally melts around 39–42°C.This combination is particularly valuable from food-processing perspective. Unlike highly liquid vegetable oils, kokum butter can provide structure without hydrogenation and its melting behaviour allows it to soften and melt relatively readily during consumption. These characteristics explain why kokum butter has attracted considerable attention as a cocoa-butter equivalent and as a specialty fat. Recent studies have also highlighted potential of garcinia seed fats in trans-free shortenings, dressings, cooking fats and oleogels.

From seed to butter

Kokum butter can be obtained through several extraction approaches ranging from traditional household methods to modern food-engineering technologies.

1. Traditional wet extraction

The traditional process is remarkably simple.

Mature kokum fruit - Seed separation- Sun drying - Removal of seed shell Kokum kernels - Crushing / grinding - Mixing with water- Prolonged heating- Fat rises to the surface - Skimming / separation- Clarification- Cooling and solidification- kokum butter

The advantage of this approach is that it is inexpensive and requires relatively simple equipment. Its major disadvantage is low extraction efficiency, high labour requirement and long processing time. Conventional cottage-level extraction has been reported to recover only about 25–31% of the available fat.

2. *Improved mechanical extraction*

Mechanical extraction offers a more scalable alternative.

In an improved processing route, dried kokum seeds are decorticated, the kernels are conditioned or steamed and subjected to mechanical pressing such as screw pressing. The expressed fat is subsequently heated and clarified to remove suspended particles and other impurities. After cooling, fat solidifies and may be churned or moulded into blocks. A reported standardised process includes seed drying, decortication, steaming, screw pressing, heating of oil/butter mixture, separation of scum and clarification followed by cooling and churning. This approach produced a higher recovery than the traditional expelling process. Mechanical extraction is attractive as it avoids organic solvents and can potentially be adapted to village- or small-scale processing units.

3. Solvent extraction

This method recovers a larger proportion of available lipid. Dried and powdered kokum kernels are contacted with a suitable solvent, allowing the lipid fraction to dissolve. In laboratory studies, Soxhlet extraction using solvents such as petroleum ether, acetone or ethanol has been investigated. After extraction, the solvent is removed, generally by evaporation or distillation, leaving the extracted fat.

The principal advantage is high extraction efficiency. However, solvent recovery, solvent residues, flammability, environmental considerations and capital requirements become important when the product is intended for food applications. Hexane-based extraction, for example, is widely used industrially for edible oils but presents environmental and safety concerns. Therefore, solvent extraction is technically effective but is not necessarily the most attractive route for a clean-label, traditional and environmentally conscious vegan food ingredient.

4. Three-phase partitioning (TPP):

It is interesting and a high-efficiency approach. In this process, powdered kokum kernel is dispersed in water and treated with ammonium sulphate and a water-miscible organic solvent such as *t*-butanol. Under optimised conditions, the system separates into three phases. Lipids preferentially move into the upper solvent-rich phase, while other components are partitioned into different phases. Approximately 95% recovery of the available fat under an optimised TPP system within about two hours. This is considerably higher than traditional extraction. This technology demonstrates an important possibility that traditional resource need not remain trapped in traditional processing. Appropriate food-engineering interventions could convert it into a high-value specialty fat (Patil et al.,2026).

5. Supercritical CO_2 extraction

Supercritical carbon dioxide extraction is another advanced technique. Carbon dioxide is brought above its critical temperature and pressure, where it exhibits properties between those of a gas and a liquid. In this state, CO_2

can penetrate the plant matrix and dissolve lipids. After extraction, reducing the pressure allows CO_2 to separate from the extracted fat. Supercritical CO_2 reduce dependence on conventional organic solvents and allows relatively clean recovery of lipid fractions. Research has specifically investigated supercritical CO_2 extraction of kokum fat and its use as a gelator for forming oleogels. The major limitation is the cost and complexity of high-pressure equipment. Consequently, this approach is currently more suitable for high-value specialty ingredients than for conventional village-scale butter production.

Can kokum butter really replace dairy butter?

Pure kokum butter should not simply be treated as a direct replacement for dairy butter in every food product.

Dairy butter is a complex water-in-fat emulsion containing approximately 80% milk fat along with water, milk solids and minor components. Kokum butter is essentially a plant-derived fat which is considerably harder at room temperature and hence, most promising approach would be formulation rather than one-to-one substitution.

Kokum butter can act as hardstock or structural component of a vegan butter. It can be blended with softer plant oils such as sunflower, rice bran, canola, soybean or other suitable edible oils. Water, salt and a plant-derived emulsifier can then be incorporated to create a stable water-in-oil emulsion resembling dairy butter. A useful formulation strategy is to combine the firmness of kokum butter with the fluidity of a vegetable oil. The exact ratio would need optimisation based on hardness, spreadability, melting profile, emulsion stability, sensory quality and storage behaviour. This is an exciting research opportunity because the objective would not simply to “replace butter”, but to engineer a new Indian plant-based butter with desirable functionality.

Why was kokum butter underutilised for so long?

Kokum has been consumed and processed by communities of Konkan region for generations, yet kokum butter has not achieved the level of mainstream food utilisation that might be expected from such a technically interesting fat.

Firstly, kokum production is geographically concentrated and has traditionally been associated with forest and homestead-based production rather than large organised plantations. Kokum has historically been an underexploited indigenous tree rather than a major commercial oilseed crop. Secondly, the traditional extraction process is laborious. Seeds must be dried, decorticated, crushed and heated for long periods before the fat can be recovered. Traditional methods also give relatively low recovery. Research from ICAR-Central Coastal Agricultural Research Institute has specifically highlighted the difficulty of local butter preparation and the need for improved hygienic extraction technologies. Third, the economic value of kokum has historically been associated more strongly with its rind than its kernel. The rind is directly visible to consumers as a culinary ingredient, whereas the valuable lipid is hidden inside the seed. Fourth, kokum butter has often been directed towards cosmetic, medicinal and confectionery applications, rather than being developed as a mainstream edible spread.

Thus, kokum butter is not necessarily ignored because it lacked value. Rather, processing limitations, fragmented supply chains, limited consumer awareness and insufficient product development prevented its transition from indigenous knowledge to mainstream food technology.

From Konkan tradition to vegan innovation

The current vegan movement provides an opportunity to rewrite story of kokum seeds. A successful kokum-based vegan butter could potentially offer several advantages:

- **Indigenous raw material:** It would utilise a resource native to India's Western Ghats and Konkan region.
- **Plant-based:** Properly formulated kokum butter products can provide a dairy-free fat option suitable for vegan formulations.
- **Value addition:** Instead of treating kokum seeds as a low-value or discarded fraction, they can become the raw material for a high-value food ingredient.
- **Rural livelihood potential:** Decortication, drying, extraction and formulation could create opportunities for local processing enterprises.
- **Technological functionality:** The high stearic-acid content and characteristic triacylglycerol structure provide useful firmness and thermal behaviour.
- **Potential for clean-label formulations:** Mechanical extraction and emerging solvent-minimised technologies could support more consumer-friendly processing routes.

Future ahead

The future of kokum butter lies not simply in selling blocks of traditional fat but in food formulation and process innovation. Researchers could investigate the optimum proportion of kokum butter and liquid vegetable oils to achieve the hardness and spread ability of dairy butter. Emulsion stability, crystal morphology, melting behaviour, oxidative stability, sensory characteristics and shelf life would need to be evaluated systematically. More advanced approaches could include fractionation, blending, interesterification and oleogelation to tailor kokum fat for specific food applications. Garcinia seed fats are already being investigated for oleogels and specialty fats, demonstrating that the chemistry of these fats can be exploited far beyond their traditional applications. The opportunity is particularly attractive in India, where the vegan and flexitarian market can be linked with a growing interest in indigenous ingredients. Instead of importing exotic plant-based ingredients, food innovators can look towards resources already embedded in local food culture.

Conclusion: A traditional butter for a modern generation

Kokum butter represents a fascinating meeting point between traditional knowledge and modern food engineering. For generations, communities in the Konkan region recognised the value hidden inside kokum seeds. Today, science is beginning to explain why that traditional fat behaves so differently from ordinary vegetable oils. Its firm structure, high stearic-acid content and distinctive melting characteristics make it a promising ingredient for specialty fats and plant-based foods. However, the real potential of kokum butter may emerge when traditional extraction is combined with modern formulation technology. Rather than attempting to imitate dairy butter molecule-for-molecule, researchers can use kokum butter as a structural foundation and combine it with softer plant oils, water and suitable emulsifiers to create a new generation of vegan spreads. Journey of kokum is more than a story about replacing dairy. It is a story about rediscovering an indigenous resource, improving its processing, creating rural value and translating traditional food wisdom into modern sustainable foods. Next time a consumer reaches for a plant-based butter,

perhaps the answer will not come from a distant crop or an imported ingredient. It may come from the small purple fruit that has been growing quietly along the Konkan coast for generations.

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