

Traditional preparation of Na.kam su.a - an ethnic fermented fish product of Garo tribes of Meghalaya in Northeast India

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Traditionally, food fermentation has been practised as one of the food preservation methods and is still in vogue predominantly in Southeast Asian Countries. The methods of preparation and utilisation of different fermented fish products vary among the communities or regions of Northeast India. The Garo tribe of Meghalaya has a unique form of a fermented fish product known as “Na.kam su.a” prepared from Gangetic hairfin anchovy, *Setipinna phasa*. The proximate composition analysis of na.kam su.a, contained 32.54% crude protein followed by 36.82% moisture, 16.26% ash, and 13.44% lipid. The energy value of na.kam su.a was estimated as 419.6 kcal/100 g. The paper highlights the method of preparing and utilizing this traditional fish product of the Garo tribal community of Meghalaya in Northeast India.

Keywords: Ethnic, Fermentation, Garo tribe, Proximate composition

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Fermented fish products are among the highly preferred traditional fish products consumed for their taste and nutritive value around the globe. These products are popular for enhancing the taste and possess multiple beneficial nutrients such as amino acids, nitrogen and various other trace elements comprising sodium chloride, phosphorous, calcium and fluoride. Moreover, these fermented fish products are reported to be far more acceptable than other preserved fish products such as salting or drying in Southeast Asian Countries¹. The Northeast region of India which greatly resembles the Southeast Asian countries in terms of food and traditions is also popular for several traditionally prepared fish, meat, vegetable and fruit products. The methods of preparing such products are often standardized within the region and village, and variation occurs depending upon the traditional knowledge². Thus, fermented fish products has a high consumer demand and fetch reasonable market prices in the local market.

The Northeastern region of India has its unique status for its ethnic, traditional and cultural diversity in the country. This region is characterised by hilly terrain and crisscrossed by several rivers and streams along with many natural lakes and wetlands. This region is

naturally rich with many fish species and almost 95% of the local population are fish eaters. Both tribal and non-tribal communities of the region have been preserving fish by various traditional methods for ages to increase the shelf life of the prepared product. Several such value-added fermented fish products designated by different names across the region are traditionally prepared and consumed locally. Some of these products are commonly known as *ngari* and *hentak* in Manipur; *shidal* in Assam and Tripura; *namsing* in Assam; *mio* and *sepaa* in Arunachal Pradesh; *tungtap* in Meghalaya³. These fermented products are mostly prepared utilizing small fish species of the genus *Puntius* and *Setipinna*. According to Nayeem⁴, the fermented fish product is also popular in the neighbouring country, Bangladesh where it is known as *Chepa Shutki*.

Considering the delicacy of the fermented fish products along the Southeast Asian belt, many studies have been reported on the traditional fish-based food of this region but the literature on “Na.kam su.a” (a common name of the fermented fish product in Garo language) was found to be scanty. Na.kam su.a also known as *Kutung* in Khasi language is a fermented fish product having low rancid odour usually prepared by the Garo community of Meghalaya. Garo tribes are the people who call themselves A’chik or Mande and the

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tribes immigrated to Garo Hills from Tibet around 400 BC. The majority of the Garo tribes are settled in Garo Hills followed by Khasi Hills and Ri-Bhoi Districts of Meghalaya state. Over the years, the Garo tribes have settled in different states of the Northeastern region of India such as Assam, Nagaland and West Bengal and even in country like Bangladesh.

Na.kam su.a is prepared from dried small to medium-sized anchovies mainly *Setipinna phasa*. The process of na.kam su.a preparation consists of 8 steps and the processed food is consumed as a side dish in the form of soup, chutney, fermented fish fried along with vegetables and as a curry with the locally available vegetables in the region. The product is very common in every household of the Garo community but the scientific information regarding their composition; flavour compounds, nutritive value and storage are very scanty. The common method of preparation of na.kam su.a together with the traditional knowledge system associated with the product will be described in the present communication. Moreover, the product was not explored scientifically in the past, hence this study was undertaken to provide a comprehensive knowledge of this indigenous fermented fish product and to pave the way for future research agenda.

Methodology

A semi-structured interview schedule was prepared and used during April 2019 to survey four notable Garo villages namely Tura in West Garo Hills District, Williamnagar in East Garo Hills District, Baghmara in South Garo Hills District and Resubelpara in North Garo Hills District, as these selected villages represented the major proportion of Garo population in the state. PRA (Participatory Rural Appraisal) tool was used for collecting information on the preparation methods and other indigenous knowledge. Information for documentation was collected from each selected village from the person who was practically engaged in Na.kam su.a preparation by issuing PIC (Prior Informed Consent) (Fig. 1).

Materials and Methods

Biochemical analysis

Fresh Na.kam su.a samples prepared by different local producers who were more experienced and practically engaged in Na.kam su.a preparation were procured from the local markets of the study region (Fig. 1). Following this, the procured materials were packed in sterile pouches and aseptically brought to

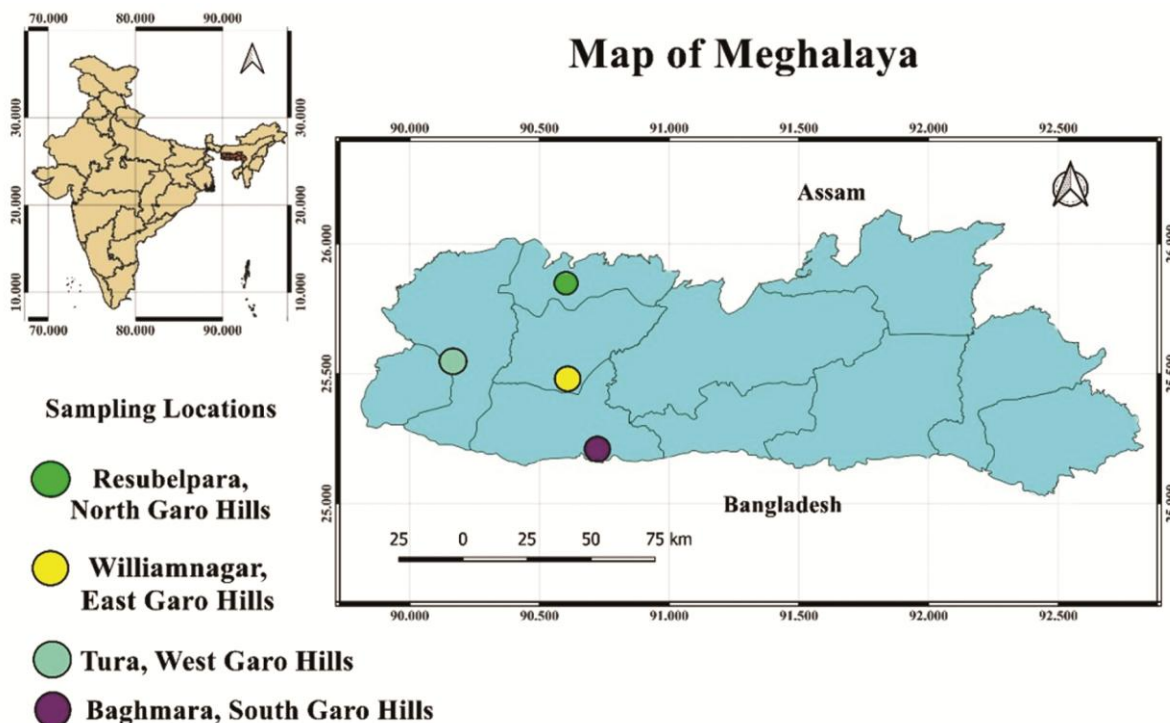


Fig. 1 — Map showing different study areas in Meghalaya (Prepared by S. Gojendro Singh, using QGIS 3.34.15-Prizren Version and shape files downloaded from DIVA-GIS)

the laboratory for biochemical analysis. Proximate analysis *viz.*, moisture, ash, crude protein and crude fat contents of samples were calculated following Farhad. The energy contents of the fermented fish products were determined by employing a Bomb calorimeter⁵.

Method of preparation

The detailed process and steps followed for the preparation of 'Na.kam su.a' are presented in flowchart 1. Generally, this product is prepared from January to March each year when the climate in the Northeast India region has less rainfall and more sunny days. The final fermented fish product is obtained after 3 months of the fermentation process usually during April to June.

1. Collection of raw material: Good quality dry fish (*Setipinna phasa*) is collected from the nearest dry fish market (Fig. 2). The dry fish are usually imported from other coastal states of India.
2. Locally available matured bamboo is collected, washed properly and sundried for preparation of the product. In some cases, the bamboo is wrapped with mustard oil on its inner surface.
3. Washing: The dry fish is washed thoroughly with 2-4 tablespoons of edible soda and common salt in a big tub of 25 L water capacity to remove the dust, sand and other unwanted items. Then, they are kept for sun drying on a plastic sheet for around 2 h till the excess water is completely removed (Fig. 3). The perfect moisture content is achieved when the dry fish is squeezed between the palm and no extra moisture is observed in the palm. Complete or excessive drying is not required.



Fig. 2 — Collection of fish raw material

4. Bamboo tube preparation: A long bamboo with a big hole is selected for preparation of na.kam su.a. The bamboo is cut into appropriate lengths (40 cm) and washed thoroughly with soda water before drying.
5. Seasoning of bamboo: The dried bamboo is slightly burnt on the outer side for seasoning.
6. Stuffing: After the bamboo and the fish have been dried adequately then they are ready for stuffing. Now the dry fish are stuffed inside the bamboo tubes very tightly with the help of a bamboo-made long pestle in such a way that no air pockets are formed inside the bamboo tube or else it will spoil the product. Dry fish is filled to the neck of the bamboo and is sealed airtight (Fig. 4 & Fig. 5).
7. Sealing: Sealing is done with the help of several materials layer by layer as follows. After the fish is filled to the neck, initially a layer of salt is placed followed by lemon leaves. The tip is sealed with a mixture of ash and mud to prevent the passage of



Fig. 3 — Drying of fish after washing



Fig. 4 — Stuffing of dry fish inside the bamboo tube

any type of air or gasses. Finally, banana leaves are used to cover the sealed part of the bamboo.

8. Maturation/fermentation and Storage: After sealing the bamboo, they are kept for maturation or fermentation for 3 months (Fig. 6). Usually in most cases, fermentation is allowed for 3 months (Fig. 7).

Raw material collection from the nearest dry fish market (*Setipinna phasa*) (Fig. 2)

↓
Matured long bamboo with big holes is collected, washed properly, sundry and wrapped with mustard oil on the inner surface

↓
Washing thoroughly the fish with 2-4 tablespoons of edible soda and common salt to remove the dust, sand and other unwanted items

↓
Sun drying the fish on a sheet of plastic for around 2 h till the excess water is completely removed (Fig. 3)

↓
Bamboo tube preparation followed by seasoning of the bamboo tube

↓
Stuffed the dry fish inside the bamboo tubes tightly with the help of a bamboo long pestle in such a way that no air pockets are formed inside the bamboo tube (Fig. 4 & Fig. 5)

↓
Dry fish is filled till the neck of the bamboo, placed with a layer of salt and lemon leaves and sealed air tightly with the help of a mixture of ash and mud

↓
After sealing the bamboo, they are kept for maturation (fermentation) for 3 months (Fig. 6 & Fig. 7)

Flow chart 1 - Method of preparation of Na.kam su.a.

Results and Discussion

The results of the biochemical analysis of the fermented fish product “Na.kam su.a” are presented in Table 1. The product is found to contain a moderate amount of moisture content (36.82%). Our result corroborates with the earlier study conducted by Kakati and Goswami⁶ where a fermented fish product ‘*Shidol*’ prepared from *S. phasa* contained a moisture amount of about $37.52 \pm 0.36\%$. Similarly, other fermented fish products of Manipur *viz.*, *Ngari* and *Hentak* also contained moisture quantity of 36.3% and



Fig. 5 — Stuffing of dry fish inside the bamboo with a bamboo pestle



Fig. 6 — Na.kam.su.a after fermentation



Fig. 7 — Na.kam.su.a after fermentation

Table 1 — Bio-chemical analysis of Na.kam su.a

Bio-chemical parameters	Value
Moisture	36.82 (%)
Ash content	16.26 (%)
Crude protein	32.54 (%)
Total Lipid	13.44 (%)
Energy content	419.6 (Kcal/100 g)

36.03%, respectively⁷. The amount of moisture content in fermented products is mainly affected by the quality of raw material (level of sun drying) used for the preparation of products. Furthermore, the level of moisture content in the final product kept either for sale or consumption is also affected by the surrounding conditions where they are stored. On this contention, Majumdar⁸ suggested that drying under sunny days with windy ambient situations provides favourable conditions for the production of superior quality of *S. phasa*. The ash content in the collected samples of Na.kam su.a was estimated to be 16.26% and a similar range of ash content was observed in *Lona ilish* fermented fish product of Tripura⁹. However, our finding is higher than that of Kakati and Goswami⁶ and lower than the ash content of Hout-Kasef a salted fermented fish product¹⁰.

The crude protein content of Na.kam su.a was found to be 32.54%. Interestingly, several workers had reported different values of crude protein of fermented fish products prepared from *S. phasa*. For instance, Sarojnalini and Suchitra (2009)¹¹ had reported crude protein (36.25%) contained in fermented *Setipinna* spp; 27.2% in *Phayssa Shidol*⁶, 36.75% in *Phasa Shidal*¹². The total lipid content of na.kam su.a in the present study was 13.44%.

However, our result is lower than those of *Phasa Shidal*¹² and fermented *Setipinna* spp¹¹ but in conformity with the fermented fish products of *Hentak* (13.6%) and *Ngari* (13.36%) as reported by Sarojnalini and Vishwanath (1995)⁷. Thus, the variation in different biochemical parameters in different fish fermented products might be due to differences in species used, method of preparation and their prevailing environmental conditions, etc.¹⁰. The energy content of the fermented product “na.kam su.a” was found to be 419.6 (Kcal/100 g) and our result is higher than that of Tungtap (384.4 kcal/100 g), a traditional fermented fish product of the Khasi tribe, Meghalaya and also from ngari (381.6 kcal/g) a fermented fish product of Manipur made from *Puntius* sp.³. Moreover, *Satipinna phasa* has a good source of Omega-6 fatty acids which will help in enhancing the nutritive value of the fermented fish product¹². Overall, with the advance in technology and increase in the demand for eco-friendly and sustainable value-added products, this ethnic food ‘na.kam su.a’ of Garo tribes is increasing its popularity as the food contains no harmful preservatives, no colouring agents, negligible amount of potentially harmful Low-Density Lipoprotein (LDL). It will also be a good source of antioxidants and essential fatty acids like palmitic, oleic and linoleic acid as reported in ngari¹³.

Fish and fish derivative products are known for their nutritional quality, especially as rich sources of animal protein and highly unsaturated fatty acids¹⁴. Nonetheless, due to its highly perishable nature, fish needs to be preserved or stored under favourable conditions which would not change or alter the quality with time. Preservation of fish helps in extending the shelf life of the products; otherwise, they will be lost easily due to their perishable nature¹⁵. Moreover, it also helps in making fish or its products available throughout the year, especially during the lean season period¹¹. The Garo tribe of Meghalaya has been practising a traditional way of fish preservation through fermentation for the past several years. The unique fish product known as “na.kam su.a” is prepared mostly during the winter and pre-monsoon season when good quality dry fish *Setipinna phasa* is abundantly available in the market. *S. phasa* is an anchovy found in rivers and estuaries with little tolerance to salinity. The use of slightly burnt seasoned bamboo with the addition of lemon leaves makes “na.kam su.a” a unique fish product providing a distinct raw bamboo aroma and lemon flavour. The

lemon leaves with their characteristic smell act as an insect repellent and also absorbs the unpleasant smell produced during the process of fish fermentation.

Cooking process: The Garo people in an ethnic way consume 'na.kam su.a' in the form of vegetable soup curry with locally available seasonal vegetables and a small quantity of baking soda. For medicinal purposes, a simple soup is prepared comprising of Na.kam su.a, soda, chilli, black pepper, ginger, garlic and fern to treat fever and malaria traditionally. Na.kam su.a chutney is also one of the favourite cuisines of the Garo tribe where the na.kam su.a wrapped in a banana leaf is steam-cooked along with the rice. The steam-cooked material is then ground into a paste along with the banana stem, onion and chilli to prepare the chutney. There is also another form of chutney made from the mixture of steamed kabuli channa, onion, na.kam su.a and chilli which is also relished by the Garo tribe. Na.kam su.a is also fried in oil with locally available seasonal vegetables and herbs such as *Eryngium foetidum*¹⁶. Some also prefer eating dal curry mixed with na.kam su.a.

With its unique taste and flavour, 'na.kam su.a' has also become a favourite food item among many other tribes of the Northeastern states. During the lean period seasons when fish are scarcely available, people largely depend on na.kam su.a for their daily nutritional protein requirement. Interestingly, the final fermented product could fetch around Rs. 500/kg at the local market and the price of the product increases with the increased length of the fermentation period of more than 3 months. Thus, the production of na.kam su.a not only helps in meeting the nutritional requirement of the people but also improves the socio-economic status of the local people as there is tremendous scope for entrepreneurship development in the field of fish by-product due to huge demand of fish by-product in Northeastern region.

Conclusions

Na.kam su.a is prepared by utilising the locally available resources which is an environment-friendly preservation method of value addition. The product is very common in every household of the Garo community but the scientific information regarding their composition, flavour compounds, nutritive value and storage life are found to be very limited. Moreover, the product was not explored scientifically in India hence this study will provide a comprehensive scenario of the indigenous fermented

fishery products and suggest future research aspects. The study on scientific refinement and to scale up the popularity of this product among the fish-eating population of the country has a lot of scope for future research. However, further studies are required for quality enhancement, packaging and storage etc.

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Conflict of Interest

The authors declare no conflicts of interest.

Author Contribution

NPD, SKD and SGS: Conceptualization of the research idea; NPD: Performed the laboratory analysis, drafted the original manuscript and processed the data; SKD: Review and edited the manuscript, supervised the work; SGS: Survey, sample collection and editing the manuscript; AD and PM: Performed the laboratory analytical work.

Prior Informed Consent

The photographs and information for documentation included in this manuscript were taken with the full knowledge and prior informed consent of the relevant stakeholders. Permission was explicitly obtained from the individuals and community members involved before capturing the images. The purpose of the photographs and their intended use in academic publication was clearly communicated and agreed upon by the stakeholders at the time of documentation.

Data Availability

The data supporting the findings of this study are primarily based on fieldwork and consist of original, primary data collected from the Garo tribe/community in the Garo Hills of Meghalaya. These data include ethnographic observations, interviews, and photographic documentation, gathered with prior informed consent from the stakeholders. Due to the culturally sensitive nature of the information and

in respect of community privacy and ethical considerations, the raw data are not publicly available but may be shared by the corresponding author upon reasonable request and with appropriate permissions.

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