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Short Communication

Chemical Composition of *thua nao*-a Fermented Soybean Food of Northern Thailand

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ABSTRACT

This study was undertaken to evaluate the nutritional potential of *thua nao*, a traditionally fermented soybean food of Northern Thailand. Based on the proximate analysis results, some differences in chemical compositions between fresh *thua nao* and *thua nao kab* are observed. In general, fresh *thua nao* contained 64.91% moisture, 1.65% ash, 7.69% crude fibre, 14.33% crude protein and 1.83% fat whereas those features of *thua nao kab* were 11.88%, 4.94%, 13.46%, 36.43% and 17.96%, respectively.

Keywords: chemical analysis, food composition, nutritional value, *thua nao.*

1. INTRODUCTION

thua nao is a traditional Thai fermented soybean product which has been produced and consumed for several decades. This product is popular especially for people in the Northern part of Thailand. Its use is versatile; for example, *thua nao* product derived from fermentation can be readily eaten (by steaming or roasting) or can be used as a major ingredient in many local dishes. Conventional *thua nao* production is as follows: whole soybeans are cleaned, washed and soaked in tap water overnight. After that, soaked beans can be cooked by steaming for 3 – 4h in order to soften the beans further. Cooked soybeans are then air-dried and cooled down before wrapping with banana leaves. The fermentation of soybeans is allowed to proceed naturally at ambient temperature for 2 – 3 days. Prior to consuming, the fermented soybeans must be steamed and are ready to eat 'freshly'. In some community, the fresh *thua nao* will be seasoned with spices (i.e., chillies, pepper and salt). Alternatively, the fermented soybeans are exposed to sunlight, resulting in a 'dried' form, the so-called "*thua nao kab*" that can be stored for several months.

Fermented soybeans are well known as a protein-rich dietary supplement. Several studies have confirmed this fact with an emphasis on amino acid profiles to indicate their nutritive quality [1, 2]. However, it is not only protein (and amino acid content) that affects the nutrition issue, other components such as fat, carbohydrate and mineral are also considered to be important [3, 4]. In fact, food composition data has long been regarded as a key indicator to show the relationship between food and nutritional status. Besides, it can also be used as a reference for regulatory standard, food labeling and formulation [5].

thua nao—a local food of Northern Thailand—has no detailed information on this matter. In this study, nineteen *thua nao* samples (10 of *thua nao kab* and 9 of fresh *thua nao*) were collected from different places in Chiang Rai to analyse their physical and chemical properties. These data of food composition are needed

for reference and can be used to elucidate the nutritional value of this local condiment.

2. MATERIALS AND METHODS

2.1 Collection of *thua nao* Samples

thua nao samples were purchased from different local markets in Chiang Rai (i.e., Chiang Khong, Chiang Saen, Mae Fah Luang, Mae Sai and Mae Suai). Of these, ten samples were in dried form (*thua nao kab*); three were seasoning fresh *thua nao* and six were non-seasoning fresh *thua nao*.

2.2 Proximate Analysis

In general, proximate analysis was carried out in accordance with the AOAC procedure [6]: the pH value by using the digital pH meter (Sartorius); moisture content by drying 1.0000g test sample at 105°C in a hot air oven (UM500, Memmert); ash content by igniting 2.0000g sample in an electric furnace (Eurotherm 2416CG, Lento) at 600°C; and crude fibre by acid treatment and subsequent heating 2.0000g at 600°C in the Fibertec System M1020 Extractor (Foss Tecator); ammonia concentration by titration 1.000g sample with 0.1M HCl after steam distillation with the Kjeltec 2100 Distillation Unit (Foss Tecator). The Kjeldahl method was performed to analyse nitrogen-free extract in which the protein content was estimated by multiplying with a conversion factor of 5.71 [7]. Fat content was determined by the Soxtec2055 Extraction Unit (Foss Tecator) with petroleum ether. Reducing sugar was characterised using the DNS method [8].

3. RESULTS AND DISCUSSION

thua nao is widely used as condiment of local food in Northern part of Thailand. Although, like other fermented soybean foods, *thua nao* is believed to be a good source of protein, there is little information regarding the nutritional value. To elucidate further information on this, nineteen samples of *thua nao* were collected form different local markets in Chiang Rai. Of these, ten samples were in dried form (*thua nao kab*); three were seasoning fresh *thua nao* and six were non-seasoning fresh *thua nao*. Based on the AOAC procedure [6], proximate compositions of *thua nao* samples were determined and illustrated in Table 1.

In general, the chemical composition of fresh *thua nao* (non-seasoning) does not differ greatly from that of boiled soybeans except for ammonia (Table 1). It should be noted, however that the content of protein, fat, and reducing sugar of the fresh *thua nao* was slightly higher possibly due to biochemical activities from fermenting microbes. Several extracellular enzymes (i.e., proteases, lipases, and amylases) were produced and detected during the fermentation; these enzymatic activities gradually increased and reached their peaks at the end of the fermentation period [9]. The presence of protease enzymes in particular causes the proteolysis and thus

Table 1. Proximate compositional analysis[a] of *thua nao*.

	Raw soybean	Boiled soybean	Seasoning FTN[b]	Non-seasoning FTN[b]	TNK[b]
pH	6.4	6.9	7.1	6.7	5.9
Moisture (%)	10.49 ± 0.00	68.43 ± 0.01	63.27 ± 4.22	64.91 ± 2.77	11.88 ± 1.67
Ash (%)	4.22 ± 0.62	1.07 ± 0.04	4.99 ± 2.70	1.65 ± 0.25	4.94 ± 1.04
Crude fibre (%)	14.22 ± 0.71	8.08 ± 0.04	7.30 ± 2.03	7.69 ± 2.91	13.46 ± 2.99
Protein (%)	32.93 ± 0.52	12.15 ± 0.09	12.17 ± 0.95	14.33 ± 1.80	36.43 ± 1.16
Fat (%)	8.19 ± 0.00	1.01 ± 0.21	1.41 ± 0.82	1.83 ± 0.72	17.96 ± 2.99
Reducing sugar (g/l)	0.29 ± 0.02	0.22 ± 0.09	0.40 ± 0.12	0.38 ± 0.25	0.77 ± 0.35
Ammonia (g/100ml)	0	0	0.02 ± 0.01	0.02 ± 0.02	0.03 ± 0.01

[a]Results are mean values ± standard deviation of at least triplicate determinations.
[b]Abbreviations: FTN = fresh *thua nao*; TNK = *thua nao kab*.

helps generate the ammonia release during the fermentation [10, 11]. Seasoning fresh *thua nao* also has similar chemical profiles except for ash content. This is mainly because of the presence of additional spices. In some households, the spices such as chillies, pepper, and salt are added to make *thua nao* more favourable taste and addition of these spices therefore affects the chemical analysis results. In contrast, *thua nao kab*—a dried form of *thua nao* which is further processed by exposure to sunlight—had the lowest moisture (11.88%). In terms of energy values, *thua nao kab* showed the highest protein (36.43%), fat (17.96%), and reducing sugar (0.77g/l).

thua nao has long been produced in a conventional manner. The production is still practised locally with little information of fermentation mechanism. Besides, a systematic procedure has not been established including the use of a mixture of naturally occurring microbes to initiate the fermentation. The manufacturing process without systemic and quality control often yields the product's loss and will definitely affect the product quality. This study is an attempt to determine the chemical proximate analysis of *thua nao* in expectation that the data generated can be used as the nutritional reference and as the food regulatory standard.

thua nao containing high protein has a potential to develop for wider use and application. Several aspects involving its production are waiting for further research and development. For example, use of the potential microbial strain(s) as starter culture will be a good alternative means to control the product's yield. The quality control and management during the fermentation process must also be taken into an account. With this adaptation, *thua nao* is likely to be an appropriate choice for protein supplement and could be scaled up for commercialisation.

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