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Research Article

Traditional Processing Method and Nutritional Composition of Kanwa Koko, a Saltpeter-Based Pearl Millet Porridge

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Abstract

Porridges are widely consumed throughout Ghana and beyond and are an important part of most households' daily diet. *Kanwa Koko* is a Ghanaian indigenous porridge made from unfermented pearl millet *(Pennisetum glaucum)* using indigenous traditional processing methods at micro industry levels or in-home-based operations. Saltpeter is usually added as an ingredient during processing, giving it a unique greenish color. This study investigated the traditional processing and proximate characteristics of *Kanwa Koko*. The Association of Analytical Chemists (AOAC) methods were used to determine the proximate composition of the samples. The results generated were analysed with GenStat statistical software Twelfth Edition for descriptive statistics. GenStat (ANOVA) was also used to determine the differences among the proximate values followed by Tukey's post hoc test. The significance level was set at $p < 0.05$. The results revealed that *Kanwa koko* is an alkaline porridge with a pH of 8.33 to 8.00. The proximate composition of *Kanwa koko* are: carbohydrates (1.60±0.91), proteins (8.32±0.08), fats content (0.98±0.05), ash/minerals (6.37±0.04), and high moisture content (82.73±0.99). The high moisture content is good for quenching thirst; however, this predisposes kanwa koko to spoilage. This is because increased moisture content can enhance microbial activities, leading to deterioration. The proximate composition is an essential criterion for determining the nutritional values and quality of food. The traditional processing as well as the proximate composition of *Kanwa koko* has been scientifically documented, and a comprehensive process flow diagram has been developed. This serves as a foundational framework for future research, enabling standardized conditions to ensure the consistent production of *Kanwa koko*.

Keywords

Porridges, Saltpeter, Kanwa Koko, Traditional Processing

1. Introduction

Porridges are an essential part of the Ghanaian daily diet and are made from fermented or unfermented cereals, mainly maize, millet, and sorghum. Porridges are eaten as a staple, weaning, or complementary food for infants, and serve as a source of energy and essential nutrients [1-3]. Thin porridges are called *koko* in Ghana, and are eaten mostly as breakfast and sometimes as lunch. The consumption of porridge in Ghana is largely influenced by convenience, availability, and economic factors.

One common indigenous thin porridge in Ghana is the saltpeter porridge, known as *kanwa koko* (in the Dagbani language in the northern region of Ghana) or *Kunu kanwa* (in

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Hausa). *Kanwa koko/Kunu kanwa* is made from pearl millet *(Pennisetum glaucum)* with saltpeter as a stand-out ingredient giving it a distinctive greenish color and taste differentiating *kanwa koko* from the more popular porridge *Hausa koko.*

Traditional processors produce *Kanwa Koko* at the cottage or micro industry level, mostly in home-based operations using indigenous procedures. The steps in *Kanwa Koko* production include the initial milling of millet with different spices, such as chilli, ginger, and cloves, in a grinding mill. Saltpeter is dissolved in water and added to the resulting flour, a small quantity of the flour is mixed into a very thick paste which is moulded into small balls/ dumplings and the remainder of the millet flour is then mixed into a very thin slurry. Water is boiled for 15-20 mins, then the dumplings are added to the hot water and allowed to boil for 10-15 mins finally the thin slurry is then gently poured into the boiling water and then gently stirred for 5 mins to form an even mixture. The porridge is then served with a small amount of sugar to sweeten it.

According to the traditional processors, *Kanwa koko* is mostly administered to lactating mothers, as it is believed to improve breast milk production, cure stomach aches, and lower excessive blood pressure. They also believe *that Kanwa koko* consumption manages conditions such as anxiety, insomnia, and depression and that the saltpeter in *Kanwa koko* enhances the sensory qualities and shelf life of the product. In addition, the production serves as a source of income for the women who engage in the processing and also provides linkages to local farmers as suppliers of processing raw materials. Despite these advantages, research on Kanwa Koko remains limited compared to other varieties of Koko.

The millet used in *Kanwa koko* is reported to help manage medical disorders, such as diabetes mellitus, obesity, and hyperlipidemia. Millet is also rich in micronutrients, such as vitamin B, minerals, and nutraceuticals. [4, 5].

There is scarcity of research on the physicochemical characteristics of *Kanwa koko*, also *Kanwa koko* processing has been sparsely documented. This study, therefore, seeks to investigate the traditional processing and product characteristics of *Kanwa koko*.

2. Methodology

2.1. Study Area

The study was conducted in the Tamale Metropolitan area in the northern region of Ghana. The areas were surveyed and Traditional Processors of *Kanwa Koko* were visited and interviewed to learn about the traditional processing of *Kanwa koko*.

2.2. Samples and Sample Collection

Samples of raw millet flour with kanwa (RMFK) and *Kanwa koko* (KK) were taken from the processors for pH determination and proximate analysis. The analysis was conducted at the Spanish Laboratory Complex of the University for Development Studies, Nyakpala Campus, Tamale, Ghana.

2.3. Determination of Samples pH

Ten grams of the samples were homogenized with 20 ml of distilled water in a stomacher bag mixer (Selecta, Buch, and Holm A/S) for 30 seconds, and the pH of the homogenate was determined using the digital pH meter (Crison Basic 20 model) calibrated with standard buffer solutions (Crison).

2.4. Determination of Proximate Compositions

The methods described in the Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC, 2005) International were used to determine the proximate compositions of the samples with slight modification in the determination of moisture (the samples were dried at 105°C overnight for approximately 12 hours instead of 24 hours) (AOAC 925.10), crude protein (AOAC 960.52), Ash (923.03), and crude fat (AOAC 922.06). The total carbohydrate was computed by difference.

2.5. Data Analysis

The results generated were analysed with GenStat statistical software Twelfth Edition for descriptive statistics thus finding means, standard deviation, developing graphs, and tables. GenStat (ANOVA) was also used to determine the differences among the proximate values followed by Tukey's post hoc test. The significance level was set at $p < 0.05$.

3. Results and Discussion

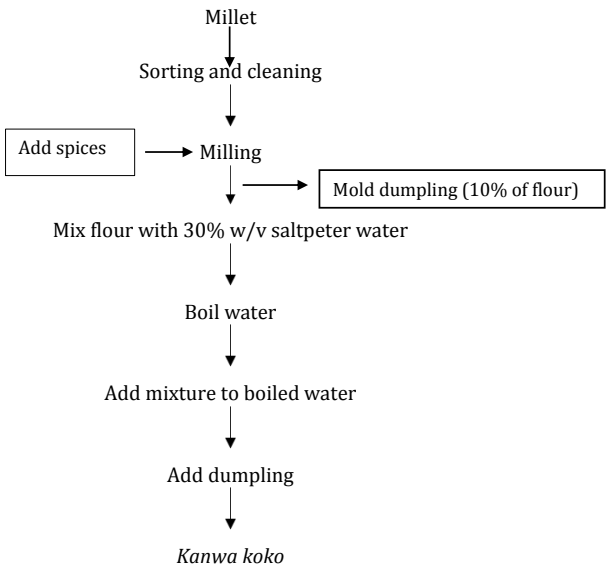

Figure 1. *Traditional Processing of Kanwa koko.*

The main ingredients for *Kanwa Koko* processing in Ghana are pearl millet (*Pennisetum* spp.) and spices such as pepper, cloves, and ginger and saltpeter. Figure 1 summarizes the traditional *Kanwa Koko* process. As the first step, the millet is milled with spices, in a grinding mill. Saltpeter is dissolved in water and added to the resulting flour, a small quantity of the flour is mixed into a very thick paste which is moulded into small balls/ dumplings and the remainder of the millet flour is then mixed into a very thin slurry. Water is boiled for 15-20 mins, then the dumplings are added to the hot water and allowed to boil for 10-15 mins finally the thin slurry is then gently poured into the boiling water and then gently stirred for 5 mins to form an even mixture. The porridge is then served with a small amount of sugar to sweeten it.

The pH of raw millet flour mixed with Kanwa (RMKF) and *Kanwa koko* (KK) samples taken are presented in Figure 2. The pH was 8.33 for the RMKF and 8.00 for the KK samples. The high pH values in the samples rightly suggest that *Kanwa koko* is an alkaline product. Although the pH of solutions of traditional salts is not reported in many studies, their alkaline characteristics are an important factor in the degradation of cell walls, leading to a reduction in cooking time, this is due to the speed-up in the degradation of pectocellulosic components in cell walls during cooking [6-8].

The alkaline characteristics of traditional salts have raised interest in their nutritional effects, particularly their effects on proteins, since thermal treatment at alkaline pH promotes cross-linking reactions [7].

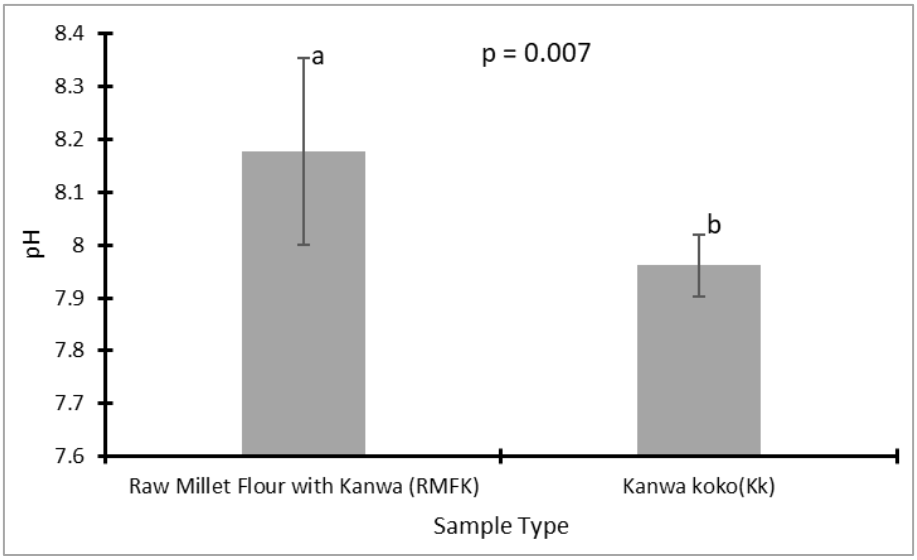

Figure 2. *pH of Raw Millet Flour Mixed with Kanwa and Kanwa koko.*

The proximate composition of raw millet flour mixed with kanwa and final *Kanwa koko* is presented in Table 1. The proximate composition is an essential criterion for determining the nutritional values and quality of food [9] In this regard, the proximate composition of Kanwa koko was compared with raw millet flour mixed with kanwa.

Kanwa koko has a high moisture content of 82.73±0.99 which is good for quenching thirst, this is similar to other cereal porridges like *Hausa koko* [10]. However, this high moisture content predisposes kanwa koko to spoilage. This is because increased moisture content can enhance microbial activities, leading to deterioration [11].

The crude protein content was high in the raw millet flour mixed with kanwa (9.45±0.03) as compared to the final *kanwa koko* (8.32±0.08). Many studies [12-14] have revealed the effects of traditional salts on nutrient compositions. In general, the processing of foods with traditional salts decreased the protein contents as observed in this study. This might be due to either the alkalinity of the salts, which favors proteins solubility and/ or the pre/post-treatment practices at the household level, which favor the leaching of proteins and other nutrients [12, 14-17]. Yet, it should be noted that, while blanching and squeeze-washing reduced soluble nutrient contents, traditional salts increased the mineral contents of foods [7, 15, 16, 18].

The final *Kanwa koko* had a reduced fat content of 0.98±0.05 as compared to 2.72±0.11 for the raw millet flour mixed with kanwa, an observation that could be attributed to elevated temperatures during cooking and metallic ions (Ca^{2+}) contributed by Kanwa (saltpetre) solution, facilitating fats oxidation and degradation [19, 20]. Other researchers have reported no significant effects of traditional salts on lipid and carbohydrate contents [7, 12, 17].

Total carbohydrate content was reduced in the final *kanwa koko* (1.60±0.91) as compared to 14.46±0.11 for the raw millet flour mixed with kanwa. Since carbohydrate content was determined by difference, the variations in the other proximate compositions would affect the total carbohydrate content [20].

Crude ash content was higher in the final *kanwa koko* than

the raw millet flour mixed with kanwa as shown in the table (Table 1). [20], reported that the increased ash content in nixtamalized millet samples is perhaps a result of Ca^{2+} ions absorbed into the grains during lime cooking and steeping. This could be also for *kanwa koko* since the traditional salt used might contain Ca^{2+} ions.

Table 1. *Proximate composition of raw millet flour mixed with Kanwa and final Kanwa koko.*

Product	Moisture%	Ash%	Fat%	Protein%	CHO%
RMFK	68.39^{d}±0.05	4.97^{b}±0.03	2.72^{b}±0.11	9.45^{bc}±0.03	14.46^{a}±0.11
KK	82.73^{b}±0.99	6.37^{a}±0.04	0.98^{c}±0.05	8.32^{e}±0.08	1.60^{c}±0.91
P-value	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

4. Conclusion

The traditional processing of *Kanwa koko* has been scientifically documented, and a comprehensive process flow diagram has been developed. This serves as a foundational framework for future research, enabling standardized conditions to ensure the consistent production of *Kanwa koko*.

The findings of this study indicate that *Kanwa koko* is an alkaline product, which may have both beneficial and adverse effects on consumers. Furthermore, the proximate analysis suggests that *Kanwa koko* possesses significant nutritional value, making it a potential source of essential nutrients.

Abbreviations

KK	Kanwa Koko
RMFK	Raw Millet Flour with Kanwa
AOAC	The Association of Analytical Chemists

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Author Contributions

Fortune Akabanda: Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing

Richard Atinpore Atuna: Data curation, Formal Analysis, Investigation, Writing – original draft

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Conflicts of Interest

The authors declare no conflicts of interest.

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