



## Proximate and Some Micronutrients (Zn, Se, Fe and I) Assessed in Goat Milk, and Cattle Milk in Sokoto, Nigeria

Nura Maiakwai Salah<sup>1</sup>, Atiku Yari Dogon Daji<sup>2</sup>, Rilwanu Umar<sup>2</sup>, Al Umar<sup>3\*</sup>, Yusuf Sarkingobir<sup>4</sup>

<sup>1</sup>Department of General Studies, College of Agriculture and Animal Science Wurno, Sokoto State, Nigeria

<sup>2</sup>Department of Animal Health and Production Technology, College of Agriculture and Animal Science Wurno, Sokoto State, Nigeria

<sup>3</sup>Department of Biochemistry, Sokoto State University, Sokoto, Nigeria

<sup>4</sup>Department of Environmental Education, Shehu Shagari University of Education Sokoto, Nigeria

\*Corresponding Author: [superoxidedismutase594@gmail.com](mailto:superoxidedismutase594@gmail.com)

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### ABSTRACT

**Background:** Malnutrition, poverty, and information scarcity are some of the major issues affecting people in West African region. Thus, it is imperative to divulge nutritional information from a cheap and accessible food (the milk) in the region.

**Objective:** This study aimed at performing a proximate and Zn, Se, Fe and I micronutrients determination in goat and cattle milk in Sokoto, Nigeria.

**Method:** The concentrations of zinc, selenium, iron, iodine present in goat and cattle in Sokoto, Nigeria were determined using standard methods and materials of analytical grade.

**Results:** The result reveals ( $< 0.05$ ) Zn, Se, Fe, and I in goat as follows:  $9.10 \pm 0.05$  ppm,  $2.32 \pm 0.004$  ppm,  $10.5 \pm 0.05$  ppm and  $7.8 \pm 0.01$  ppm. In cattle, the concentrations for Zn, Se, and Fe are:  $5.12 \pm 1.05$  ppm,  $1.13 \pm 0.005$  ppm,  $9.5 \pm 0.02$  ppm, and  $5.9 \pm 0.02$  ppm. The proximate values of moisture content, ash content, protein, and fat in milk collected from goat are as follows respectively: 90.21%, 0.56 %, 3.23%, and 2.44%. The proximate values in cattle milk are: 70.11%, 0.50%, 2.11%, 2.11% and 2.21% for water content, ash content, protein content, and fat content respectively.

**Conclusions:** Thus, the goat milk contains higher proximate contents (such as fat, water, carbohydrate, and ash), Zn, Fe, and Se than the cow milk. It is imperative for the public to properly utilize milk for its nutritious benefits.

### Introduction

Dairy products contribute a lot in the meeting up of recommended dietary requirements because of the proximate and micronutrients in milk (Okpani et al., 2016). Milk is a liquid and whitish nutritious food made by the mammary gland of females in the phenomenon called lactation. It is

regarded as a food that contains sufficient nutrients needed by offspring. It provides nutrients for metabolism, development and as well as growth. In milk there are numerous micronutrients, along with macronutrients; thus, milk discharges nutrients that play key roles in human metabolic activities (Okpani et al., 2016).

Micronutrients are elements needed in small amount by the body, but have to be imported into the body through food materials like milk products. Parable, zinc micronutrient helps in several biochemical processes of the body, and functions in DNA synthesis, alcohol and sugar metabolisms. Fe is essential in hemoglobin and other functions of the human body. In this dispensation, iodine is an essential element due its ability to participate in the making of important thyroid hormones. That is why dietary iodine is very important (Umar et al., 2018). Moreover, carbohydrates, and fats are needed for energy metabolism. Ash provides a portend for the presence of mineral elements. Moisture is needed in nutrition and proteins serve as energy source in rare cases. Additionally, proteins are needed for making and repairing of tissues of the human body among other purposes (Ayuba et al., 2020).

However, the milk is produced popularly for human consumption in Sokoto through the cow and goat animals that make the predominant animals in the area. The several factors associated with animals (goat and cow) such as feeding methods, genetics, season, parity, health status, environment, and localities provide an insight that determines the levels of nutrients in milk (Okpani et al., 2016). On the other hand, there is evident fact that,

information about exact nature and levels of nutrients in goat and cow milk in Nigeria and Sokoto is very scarce. Many people pay less attention to the goat milk or other dietary products despite its ability to provide much nutrients even better than other animals like cow (Mazroea et al., 2018). In the same vein, the awareness about the nutritional facts of milk will guide the public and influence their actions in taking milk to circumvent nutrition issues of the populace (Okpani et al., 2016). Thus, the objective of this study was to determine the proximate values and concentrations of Zn, Fe, Se, and I in goat milk and cow milk in Sokoto, Nigeria.

## **Methods**

### **Study area**

Nigeria is a country located in the West Coast of Africa; lying 5<sup>0</sup> North Equator and between 3<sup>0</sup> and 4<sup>0</sup> East of the Greenwich Meridian. It has 36 states and the Abuja Capital. One of the zones where Sokoto lies is the Northwest zone. Sokoto state is a state that lies in the northwestern part of the country bordering Kebbi, Zamfara, states, and Niger Republic. The research was conducted in Sokoto, Sokoto state, government Areas or Council (LGAs).

### **Micronutrients Zn, Fe, I, and Se determination**

Through random sampling method approach, fresh milk was collected from the two different animals (goat and cattle) within Sokoto state, Nigeria. Each sample was collected thrice, and each element was determined thrice and mean was computed. The micronutrients Zn, Fe, and Se were determined in milks of goat and cow collected from Sokoto town using atomic absorption spectroscopy (AAS).

### Proximate content study

Proximate content of milks collected in Sokoto, Nigeria was determined using methods and procedures related in Nweze & Nwagwe (2019). The moisture, ash, crude fats, proteins and carbohydrates of all the samples were carried out using standard AOAC method (1990). The moisture and ash were determined using weight difference method. Crude fat was extracted by means of the Soxhlet apparatus with petroleum ether (40 to 60°C) for 6 hours. The nitrogen value, which is the precursor for protein of a substance, were determined by micro Kjeldahl method, involving digestions, distillation and finally titration of the sample. The nitrogen value was converted to protein by multiplying a factor of 6.25. Carbohydrate was determined by difference method. The carbohydrate was calculated by difference method and as the nitrogen free extract (NFE), calculated as % NFE = 100 - % (a + b + c + d + e) where a

= protein, b = fat, c = fibre, d = ash, e = moisture. All the proximate values were reported in %. The proximate analyses were done in triplicates as in Nweze & Nwagwe (2019).

### Statistical analysis

The descriptive statistics and one-way analysis of variance (ANOVA) were carried out at (p<0.05) significance level using Microsoft excel version 7.

### Results and Discussion

The results for determination of some micronutrients and proximate content of goat milk and cow milk in Sokoto were shown in Tables 1 and 2.

**Table 1. Some elemental contents of goat and cattle milk collected from Gwadabawa, Sokoto, Nigeria**

Elements	Goat (ppm)	Cattle (ppm)
Zinc	9.10 ± 0.05	5.12 ± 1.05
Selenium	2.32 ± 0.004	1.13 ± 0.005
Iron	10.5 ± 0.05	9.5 ± 0.02
Iodine	7.8 ± 0.01	5.9 ± 0.02

Key: Values are expressed as mean ± standard deviation

Table 1 shows the concentrations of zinc, selenium, and iron present in goat and cattle in Sokoto, Nigeria. In goat Zn, Se, Fe and I are: 9.10 ± 0.05 ppm, 2.32 ± 0.004 ppm, 10.5 ± 0.05 ppm, 7.8 ± 0.01 ppm. In cattle, the values for Zn, Se, Fe, and I are: 5.12 ± 1.05 ppm, 1.13 ± 0.005 ppm, 9.5 ± 0.02 ppm, 5.9 ± 0.02 ppm. And The result indicates that the goat contains more Zn, Fe,

and Se than the cattle. This is in tandem with the previous studies that show more nutrients in goat milk than in cow milk. In another similar study, a similar trend (to the concentrations in Table 1) was shown with selenium, and zinc concentrations in goat milk higher than in cattle milk; therewith, only cow milk iron was higher than that of goat (Almazroea et al., 2018). In a dissimilar case, a study from Abakaliki, Southern Nigeria displayed more Fe and Zn in cow milk than in goat milk observed (Okpani et al., 2016). Moreover, another Southern Nigeria study unveiled that zinc and iron present in cow milk is more elevated than that of cow Nweze & Nwagwe (2019).

Certainly, there are varied concentrations of Zn, Fe, and Se in goat milk and cow milk collected in Sokoto, Nigeria (Table 1). The milk from these two animals is very paramount in the state as it is being sold and served along with grains (such as corn and millet) preparations in a popular food called *Fura* and the milk is served raw as a result of its cheapness, sweetness, energy-yielding and other uses by most of the population in the state. However, the Sokoto state is being faced by malnutrition, hunger, and other nutrition issues in rampant cases especially in rural dwellings (Sarkingobir et al., 2023). Thus, the milk would be a better source of nutrients at affordable rate to the teeming

population in the state. Indeed, the determination of micronutrients will inform the public on some useful contents of the popularly consumed milk in the state. And in turn instigate more consumption. Therein, the presence of zinc, iron, and selenium provides many benefits to consumers. Parable, selenium ( $2.32 \pm 0.004$  and  $1.13 \pm 0.005$  ppm as in Table 1) is a trace/micronutrient that acts in selenoproteins (such as Thioredoxin reductase, deiodinases, glutathione peroxidase) playing significant functions in many instances such as antioxidant defense, DNA synthesis, fertility, synthesis of thyroid hormones, reproduction, and cancer prevention (Soetan et al., 2010; Mehdi et al., 2013; Sen et al., 2019). The level of determined selenium will invariably contribute to the Recommended selenium intake of 40 ug daily (Sen et al., 2019).

In a similar vein, significant amount of iron ( $10.5 \pm 0.05$  and  $9.5 \pm 0.02$  ppm) was determined in goat milk and cow milk respectively as shown in Table 1. Iron possesses several functions in the human body, such as serving as oxygen carrier in the blood, participating in many enzymes, acting in ferritin, myoglobin, etc. (Abbaspour et al., 2014; Gupta, 2014; Iqbal et al., 2014 Umar et al., 2022). Likewise, the concentrations ( $9.10 \pm 0.05$  and  $5.12 \pm 1.05$  ppm) of determined zinc in goat milk and cow milk are important because they make

the milk to serve as zinc source to consumers. The recommended dietary zinc intake daily is around 8-11 mg/day depending on the age of the consumer (Devi et al., 2014). Zinc is a micronutrient participating in growth, immune function, and cell differentiation events (Ebisintei, 2018). More than 200 metalloproteins utilized zinc, it is also involved in blood glucose regulation, regulation of thyroid function, regulation of gonads, requires in acid base balance, and plays role in adrenal and prolactin synthesis. Structural roles of zinc include: component of membrane, component of cell receptors, required by taste buds, and act as antioxidant for stabilization of membranes. In cell growth, replication, and maturation, zinc plays vital functions by influencing enzymes such as DNA polymerase, thymidine kinase, RNA synthetase. Therefore, zinc is versatile in normal growth and development and has to be imported through foods such as the common and cheap milk from goat or cow (Soetan et al., 2010; Narwal et al., 2017; Maywald & Rink, 2022). Likewise, iodine was determined in the observed milk as shown in Table 1. Iodine acts to regulate basal metabolic rate through thyroid hormones biosynthesis. Therefore, 100-200 ug/day amount of iodine is needed in this regard. Insufficient amount of iodine in the body called iodine deficiency triggers disorders such as goiter, central nervous

system disorders (for instance cretinism, mental retardation, and relations). Indeed, iodine is essential in the synthesis of thyroid hormones in thyroid glands by iodination (formation of oxidized iodine species), iodization of iodine derivatives. Therein, the hormones T<sub>3</sub> and T<sub>4</sub> formed a conformation of twist-skewed fashion. The iodine is the most effective lipophilic substituent required to fix the twist-skewed conformation of T<sub>3</sub> and T<sub>4</sub> hormones (Umar et al., 2023).

**Table 2. Proximate contents of goat and cattle milk collected from Gwadabawa, Sokoto, Nigeria**

Proximate	Goat (%)	Cattle (%)
Water	90.21	70.11
Ash	0.56	0.50
Protein	3.23	2.11
Fat	2.44	2.21
Carbohydrate	6.23	5.67

Table 2 shows the proximate content of milk collected from goat and cattle in Sokoto, Nigeria. The proximate values of moisture content, ash content, protein, and fat in milk collected from goat are as follows respectively: 90.21%, 0.56 %, 3.23%, and 2.44%. The proximate values in cattle milk are: 70.11%, 0.50%, 2.11%, 2.11% and 2.21% for water content, ash content, protein content, and fat content respectively. Therein, the goat milk contains more proximate parameters than the cattle milk. This is in consonant with the study that reveals more water, protein, and

fat in goat milk than the cow and buffalo milks (Yuherman et al., 2018). In a contrast case, a study from Southern part of Nigeria shows that proximate values in cow are more elevated than in goat milk Nweze & Nwagwe (2019).

Additionally, proximate contents (as revealed in Table 2) are essential in nutrition. The proteins give out aminoacids essential for making of new tissues and repairing of wounded tissues. Proteins are utilized in formation of enzymes, hormones, and other factors such as blood clotting factors and immunoglobulins. Carbohydrates are needed for energy provision for the routine activities of the body system. Fats too is a source of energy twice the carbohydrates and are needed to form important components of the body such as hormones, membranes, and relations. Therefore, presence of these proximate values indicates that the milk is nutritious and a cheap source for the dwellers of the state for curbing nutrition issues (Muhammad et al., 2015; Hassan et al., 2018). Therefore, people are enjoined to appropriately utilized milk for provision of Zn, Fe, Se, I and proximate parameters as well.

### Conclusion

Milk is versatile in nutrition of many populations including that of Sokoto, Nigeria. However, few studies have been

conducted in the country to reveal nutrients in milk fold. Therefore, this work assesses the proximate and Zn, Fe, and Se nutrients in goat and cow milk in Sokoto, Nigeria. Thus, the goat milk contains higher proximate contents (such as fat, water, carbohydrate, and ash), Zn, Fe, Se, and I than the cow milk. It is imperative for the public to properly utilize milk for its nutritious benefits.

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