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RAD conceptualized the work and participated fully during the laboratory analyses, did the statistical analyses, wrote the first draft of the research and had informed other co-authors of the decision to publish. RSUW had supervised collection of the obtained samples and results of the study as well as its appropriate presentation while SU was instrumental in choosing the right journal to publish.

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Analyses of Proximate Composition of Raw Urine of Some Female Camels (*Camelus dromedarius*) in Sokoto, Nigeria

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Abstract:
This study was conducted to ascertain the nutritional level of camel urine in view of its incessant human oral consumption; albeit with a motive. Raw urine samples (U1-U5) from five domesticated female camels (*Camelus dromedarius*) at Kwakwalawa village of Sokoto; Sokoto State, Nigeria, were collected and analyzed for its proximate composition using standard methods. Samples were obtained overnight in April and May 2022 by skilled camel attendants whom placed open, sterilized plastic containers beneath whenever those camels were urinating. The results of the analyses based on percentage (w/v) showed 5.4 as total dissolved solids (TDS), 96.3 as moisture, 0.3 is ash, 0.1 as crude proteins, and 0.3 as crude carbohydrates, respectively. Conclusively, the analyzed samples of raw camel urine showed a surprising nutrient quality based on proximate composition.

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INTRODUCTION

Going down memory lane there was quite a long history of research interest on urine especially on its medical (Consolo *et al*., 1986), therapeutic, physiological, esoteric, philosophic and alchemic properties (Savica *et al*., 2011). There was reported therapeutic uses of various animal urine as cure for a number of disease conditions that include abdominal enlargements, abdominal tumour, flatulence, dropsy, colic, anaemia, lack of appetite, TB, poison, hemorrhoids, amenorrhoea, leukoderma, leprosy, aggravation of kappa and for treatment of some other mental illnesses (Dogondaji *et al*., 2022).

Although camel urine has been used for medicinal purposes and as an anecdotal proclaimed cure for several diseases for many centuries; the therapeutic action of camel urine was not subjected to complete and rigorous scientific scrutiny (Alhaider *et al*., 2011). In Asian countries raw camel urine was used for diabetic neuropathy treatment (Agrawal *et al*., 2009). As opined and adduced by (Al-Awadi and Al-Judaibi, 2014); camel urine was proven effective as antimicrobial agent (Humaid, 2016), and there may not be any side effects for its use by humans, and it may also be resistant to factors such as high temperatures and other laboratory conditions that include extensive waiting period; which can reduce effectiveness of antibiotics.

Another factor considered to be the most effective reason responsible for therapeutic action assumed for camel urine is the urine's high salinity; which of course is occasioned as a result of their adaptive feeding on their most dominant plants (the xerophytes) for the desert or non-domesticated camels (Ahamad *et al*., 2017). Active ingredients that includes *Suaeda monoica* and *Schrad citrullus colocyntis* were found to be embedded in the desert plants as indicated from laboratory analyses of camels' urine which apparently appears in their urine; which could partially accounts for the therapeutic purposes of urine (Al-Awadi and Al-Judaibi, 2014).

The high salinity of camel urine has earlier been directly related to the glomerular filtration rate and urine concentration (Yagil and Berlyne, 1978). The challenges camels' usually faces in their varied habitat can cause both their urine concentration and its chemical components to vary. Because camels can withstand severe dehydration, it have impact on their renal functions which can affect changes in urea metabolism (Etzion and Yagil, 1986). During time of dehydration, sodium tends to be retained in the extracellular fluid and it is used later to restore the camel fluid volume when potassium became excreted (Siebert and Macfarlane, 1971). Recombinant ontogeny endocrine (rCGH) administration is a practical method for altering the endocrine system and metabolic pathways in animals to promote quicker development, muscle deposition, higher milk yields, and improved feed efficiency (Khan *et al.,* 2016).

This research was conducted to ascertain the chemical or proximate composition present in camel urine because of the surge in its consumption within the study location and elsewhere and to assess its nutrient quality.

MATERIAL AND METHODS

Equipment and chemicals

Kjeldahl glass wares, photometer and spectrophotometer, test tubes and all the chemicals and reagents used in this research were of analytical grade and the purest quality available.

Raw CU samples collection

Urine samples (CU) used in this study were collected from five (5) healthy domesticated lactating female camels (*Camelus dromedarius*) that were of 5-10 years old from Kwakwalawa village along the main road to the permanent site of Usmanu Danfodiyo University, Sokoto, Sokoto state, Nigeria between April to May, 2022. Gallon-full (5litres) of each of those female camels urine samples' labeled (U1-U5) was collected separately overnight using an aseptic

technique with help of an experienced and skilled camel attendant.

The urine was collected by directly placing and trapping open bowl sterilized (plastic) containers beneath; whenever any of those female camels is urinating. The properly labeled (A-E) collected samples were transported immediately via the ice-cold medium in vaccine carriers to the Postgraduate research laboratory of Usmanu Danfodiyo University, Sokoto within 2 hrs of collection and refrigerated immediately at -20°C until required for subsequent use.

Proximate composition analyses

Obtained samples were subjected to proximate analyses for moisture, crude fat, and ash in accordance to the methods described by the Association of Official Analytical Chemists; AOAC (2005) procedures and petroleum ether was used as solvent for crude fat determination. Crude protein and total dissolved solids were determined by Pearson, 1976 methods. The samples' nitrogen content was determined by micro-Kjeldahl 1838 method. Obtained nitrogen value from the previous step was multiplied by 6.25 as factor to convert it to crude protein. Carbohydrate was determined by calculating the Weight difference from other components; while mineral contents were determined by atomic absorption spectrometry, flame photometry, and spectrophotometry as specified in AOAC (2003) methods.

Statistical analysis

Results obtained were expressed as Mean ± standard error of the mean (SEM). SPSS version 2012 software was used for statistical analyses. Multiple comparisons of means to examine the effect of the period of sampling were employed using ANOVA and Tukey's tests. Differences were considered statistically significant at $p < 0.05$ and or when the chi-square approximation value is less than 0.0001 (<0.0001) respectively (Dogondaji *et al.,* 2023).

RESULTS

The results obtained from the proximate analyses of five raw camel urine samples are presented as mean values of the determined components expressed as Mean±SEM in some drawn tables. Table 1 present summary of the proximate composition analyses of the major food macromolecules, while Table 2 contained mean values (also expressed as Mean±SEM) for the micronutrients and some determined minerals. Table 3 presents comparison made from some known urine proximate values.

Table 1. Proximate analyses of raw urine of five female camels.

Parameter (w/v) %	TDS	MC	CP	Ash	CC (by wd)	CF	N
Determined value	5.4±2.6	96.3±0.2	0.1±0.04	0.3±0.16	0.3±0.005	0.0±0	0.01±0.005

Key:-TDS:-Total Dissolved Solids; MC:-Moisture content; CP:-Crude protein; CC (by wd):- Crude carbohydrate by weight difference; CF:-Crude fat; N:-Nitrogen. Values are mean±SEM (n=5). Values with statistically significant difference, p<0.05 are asterisked *

Table 2. Mineral compositions determined in five samples of raw camel urine.

Mineral (mg/L)	Na^+	K^+	Ca^{2+}	Mg^{2+}	P
Value	45.6±6.1	602.8±114.8	0.5±0.01	0.2±0.1	1.6±0.1

Key:- Na+-Sodium ion; K+:- Potassium ion; Ca2+:-Calcium ion; Mg2+:-Magnesium ion; P:-Phosphorous
Values are mean±SEM (n=5). Values with statistically significant difference, p<0.05 are asterisked *

Table 2. Proximate values of some domestic animals' urine compared.

Animal	Parameter	Value	Reference
Cow	Cl^-	1556 (mg/L^{-1})	Miah *et al*., 2017
	P	7.49 (mg/L^{-1})	Miah *et al*., 2017
	P	1.49 (mg/dl)	Pandey *et al*., 2018
	N	6.8 - 21.6 g N $litre^{-1}$	Bristow *et al*., 1992
Goat	P	3.64±0.28 (mg/dl)	Pandey *et al*., 2018
	Total protein	14.90±0.85 (mg/dl)	Pandey *et al*., 2018
Sheep	N	3.0 -13.7 g $litre^{-1}$	Bristow *et al*., 1992

DISCUSSION

This study was conducted to ascertain proximate composition of some samples of raw female camels' urine and results of the study have revealed not only availability of food composite macromolecules especially water or moisture content in the samples analyzed but there is also presence of some mineral elements that were determined; with astonishingly K^+ worthy of noting having the highest amount of all the determined components (602.8±114.8 in mg/L). In terms of this noteworthy K^+ content findings from this research results totally agreed with Salwa *et al*., 2004 research report that their analyzed camel urine has highly pronounced value for potassium. Thus, this finding have deviated from almost a half century initial assumption that camel urine composition analyses was thought to be little different from that of other herbivorous animals as earlier documented (Kalra and Arya, 1959). It was due to some of the performed latter studies which have affirmed presence of additional composite compounds in it (Amer and Al- Hendi, 1996; Faye *et a*l., 1999 and Salwa *et al*., 2004). Result of this study thus, have further lend credence to the just mentioned assertion beyond doubts that raw urine of camels do indeed contained composite (proximate) compounds in it. The performed research showed samples investigated contained adequate amount of water (96% w/v) and it is the highest component therein which conforms to literature assertion and definition of urine composition.

Urine was defined as liquid waste products of multiple metabolic activities which comprised of major nitrogenous waste predominantly urea and other nitrogenous compounds, which are filtered from the blood by pair of kidneys (Atif, 2011). Urine is stored in the urinary bladder and is excreted from the body through the urethra.

A hypertonic urine produced by the camels is related to the anatomic morphometric shape or specialty of their kidneys (Abdallah and Abdalla, 1979). Urea as a bye product of major nitrogenous-based metabolic activities is the predominant biochemical waste present in camel urine; which can explicitly account for the miraculous use of camel urine (Read, 1925).

The normal chemical composition of urine is mainly water content, but it also includes nitrogenous molecules, such as urea, as well as creatinine and other metabolic waste components just as have mentioned in the penultimate paragraph. Other substances may be excreted in urine due to injury or infection of the glomeruli of the kidneys, which can alter the ability of the nephron to reabsorb or filter the different components of blood plasma.

Nitrogenous compounds that are present in any animal urine notably urea and ammonia are in form of liquid solutions due to high amounts of water. And in this study, the determined water composition component in the urine sample analyzed is the highest amount present followed by the total dissolved solid particles (TDS) in % (w/v). In addition, the obtained result also showed appreciable crude carbohydrate and ash content in the same proportion, with some relative amount of crude protein and percentage nitrogen respectively.

And as can be deduced from presented values in Table 3; the amount of phosphorous in the present study (1.6 (mg/L) is lower than cow's similar parameter value, thus on that regard our result was in disagreement with Miah *et al*., 2017 that reported 7.49 mg/L^{-1} for cow's Phosphorous value.

Results of this research findings partially agreed with Salwa *et al*., 2004 research reports on terms of high K^+ and somewhat low Na^+ values contents. Salwa et al. (2004) research had analyzed camel urine for its chemical, physical, microscopic and biochemical attributes and their obtained results showed that camel urine was superior followed by goat, cattle and human urines; and it has highly pronounced values for

potassium, urea and total protein while its sodium, uric acid and creatine were very low compared to other species that includes cattle, goat and human urine samples.

The analysis of mineral elements in the raw urine of camels in this study revealed that dissolved potassium and sodium ions were followed by calcium, magnesium, and phosphorus trailing behind them in that order.

CONCLUSION

Camels' raw urine, although it is collection of metabolic waste products processed by specially shaped camel kidneys and excreted through their urinary system it does contained important proximate composition that appears relatively adequate; probably because of nature of their inclination as xerophytic herbivorous animals.

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CONFLICT OF INTEREST

Authors hereby declare that they have no conflict of interest.

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