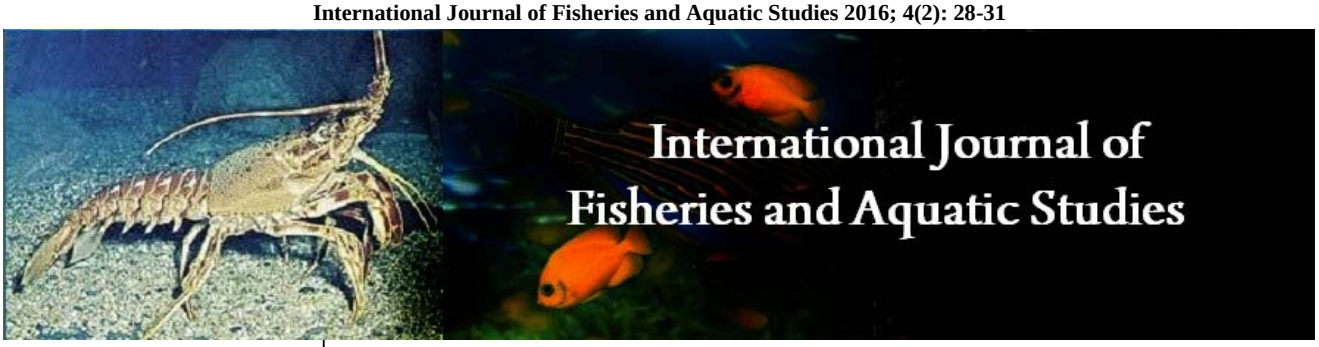

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M Zakariah
Department of Veterinary Anatomy, University of Maiduguri, Nigeria

ML Sonfada
Department of Veterinary Anatomy, Usmanu Danfodio University Sokoto, Nigeria

A William
Department of Veterinary Physiology, Pharmacology and Biochemistry, University of Maiduguri, Nigeria

DA Bwala
Department of Veterinary Anatomy, University of Maiduguri, Nigeria

HD Kwari
Department of Veterinary Anatomy, University of Maiduguri, Nigeria

Correspondence
M Zakariah
Department of Veterinary Anatomy, University of Maiduguri, Nigeria

Histology of seminal vesicles of wild African catfish (*Clarias gariepinus*) during spawning and non-spawning periods in Maiduguri, Nigeria

M Zakariah, ML Sonfada, A William, DA Bwala, HD Kwari

Abstract
The present study investigates histology of seminal vesicles of wild African catfish (*Clarias gariepinus*) during spawning as well as non-spawning periods in Maiduguri Nigeria. Twenty adult males of wild African catfish (*Clarias gariepinus*) were used for the study. Their mean weight was found to 550 g and mean body length was 42 cm. Histology of the seminal vesicles showed simple cuboidal cells in the glandular epithelium in the spawning period and pseudo columnar epithelial cells during the non spawning period. The proximal part of the seminal vesicles that are connected with the milt duct revealed presence of smooth muscle cells. The seminal vesicles were seen divided into compartments by connective tissue fibers, and the compartments were filled with eosinophilic staining colloidal substances. The study described the histological structures of seminal vesicles of wild Clarias species during spawning period as large lobules filled with colloidal substances were seen, while reduced colloidal substances and pseudo columnar epithelial cells were seen during non-spawning period in Maiduguri, Nigeria.

Keywords: Histology, Maiduguri, Seminal vesicles, Wild African catfish

1. Introduction
The business of aquaculture has become a viable and profitable enterprise worldwide. Large quantities of fishery products are consumed. This is so because supply from the wild is unreliable as its limit of exploitation is being reached [1]. World per capita apparent fish consumption has increased from an average of 9.9kg in the 1960s to 19.2kg in 2012 and in 2012, 84% of all people employed in the fisheries and aquaculture sector were in Asia followed by Africa [2].

The proportion of fisheries production used for direct human consumption increased from about 71 percent in the 1980s to more than 86 percent (136 milliontonnes) in 2012, with 21.7 million tonnes destined for non-food uses e.g. fishmeal and fish oil. In 2012, of the fish marketed for edible purposes, 46 percent (63 million tonnes) was in live, fresh or chilled forms. For developing countries as a whole, these forms represented 54 percent of fish destined for human consumption in 2012 [2].

A significant, but declining, proportion of world fisheries production is processed into fishmeal (mainly for high-protein feed) and fish oil (as a feed additive in aquaculture and also for human consumption for health reasons). They can be produced from whole fish, fish remains or other fish by-products and about 35 percent of world fishmeal production was obtained from fish residues in 2012 [2].

In Nigeria the fastest growing arm of agricultural industry is fish farming, because more and more people are picking up interest in fish farming as a source of livelihood or as an investment option [3]. In countries like Nigeria, there is dare need for animal protein to meet its teeming population. Fish production if harnessed properly will contribute significantly to this protein requirement, although despite effort made by Nigerian government to increase fish production, Nigeria is still considered as a protein deficient country [4].

One of the major challenges in fish production is inadequate quality and supply fish fingerlings, although several techniques have been developed of inducing gravid females with various hormones and be stripped 9-12 hr latency period [5]. However to obtain milt for fertilizing female eggs, males are generally sacrificed before testes are removed and squeezed

to release the milt [6], such practice compromise attempts for selective breeding and other genetic studies as well as reducing the number of males in circulation [5]. Stripping of catfish males to collect milt has not been successful and therefore it is not recommended, this is due to the anatomical structure of the seminal vesicles which may obstruct the passage of milt through the sperm duct [3]. Generally, many reports regarding the difficulty of milt collection in this species as a result of the seminal vesicles extensions have been documented. However, our literature search revealed that micro anatomy of the proximal part of this organ is rare. Also there is paucity of information on the general micro anatomy of seminal vesicles in the study area especially in the wild species; this necessitated the study.

2. Methodology

2.1 Study area

The study was conducted in the Histology Laboratory of Department of Veterinary Anatomy, University of Maiduguri, Nigeria. Maiduguri is located between latitude 11º and 50º north and longitude 13˚ and 36º east. The annual rainfall average 320mm, rainy season begins in June and last till October and dry season begins in November and last till May. The rainfall is monsoonal, generally been heaviest in August. The annual temperature average 35.4 ºC, the climate of Maiduguri can be divided into six zones: Guinea zone, sunado-Guinea zone, sunado-sahelian zone, sahelo-sudanian, sudano-saharan zone and Saharan zone [7].

2.2 Sources of fish

Twenty adult males of wild African catfish (*Clarias gariepinus*) were used for this study. The mean weight was found to be 550 g and mean length 42 cm. All fish were bought from fish retailers in Gamboru market in Maiduguri, Nigeria whose fish were from Lake Alau. The Lake is located 20 km south east of Maiduguri, Borno State and is ituated at the semi-Arid north Eastern Zone of Nigeria (11˚40N to 11˚45N and 13˚10' E to 13˚20' E). It is believed to be a remnant of former Mega Chad. It receives an annual delivery of water from Ngada and Yedzeram rivers system, but whiles these two rivers and their other tributaries dries up completetly, Lake Alau retains water all year round [8]. The fish were transported alive in a plastic trough to the Histology Laboratory of the Department of Veterinary Anatomy University of Maiduguri, Nigeria.

2.3 Experimental design

Each fish was euthanized using tricaine MSS anaesthetic at the dose of 8 drops/litre of water [9] after which a mid-ventral incision was made and the seminal vesicles was exteriorized using scalpel, scissors and tissue forceps. Samples for histology were taken and fixed in Bouins fluid for 24 hours. The tissues were then dehydrated through graded concentrations of ethanol (70%, 95% and absolute), cleared in Xylene. Tissues were infiltrated in Xylene paraffin in the oven at 62 degree for 3 hrs and embedded in paraffin wax. The embedded tissues were sectioned at 7micrometer thickness and stained with haematoxylin and eosin (H&E) for light microscope examination [10]. The tissues observed under microscope were photographed using canon digital camera power shot (A470).

3. Results

In breeding seasons, the seminal vesicles showed two important histological changes; the proliferation of cuboidal glandular cells that were filled with eosinophilic pinkish colloidal substance (plate 1), numerous glandular cells and presence of smooth muscle cells seen at the junction of the sphincter between the milt (sperm) duct and the proximal part of the seminal vesicles (plate 2). The photomicrograph of seminal vesicles of *C. gariepinus* during non spawning period revealed reduction of colloidal substances (CS), pseudo columnar cells and increased thickness of interstitial connective tissue (plate 3). The transverse section revealed a secretory epithelium of simple cuboidal cells supported by basement membrane in each vesicle or compartment of the gland (plate 4). The inter-vesicular cavity contained loose connective tissue and blood vessel.

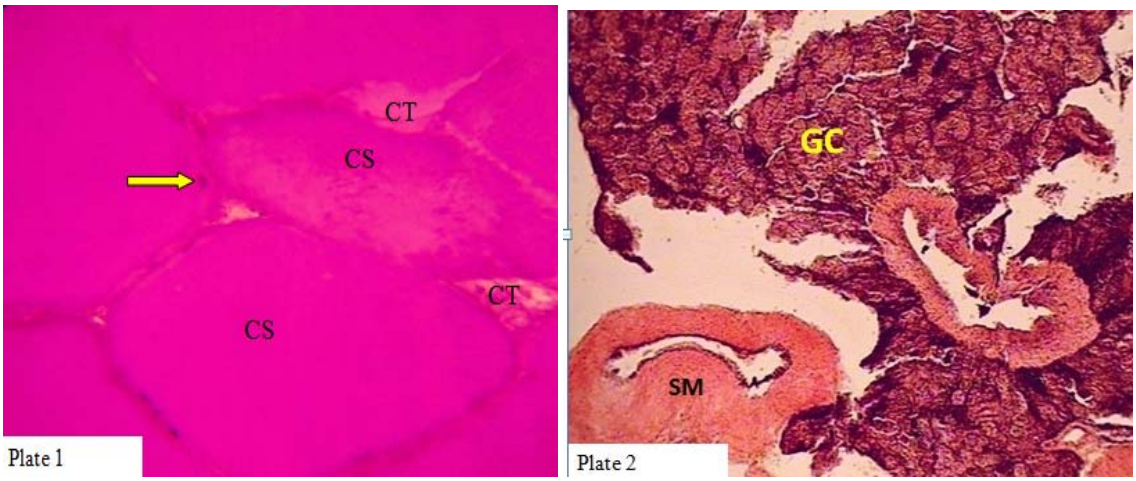

Fig 1: Photomicropgraphs of seminal vesicles *C. gariepinus* during spawning season showing lobules filled with colloidal substance (CS), nuclei of epithelial cells (arrow) and interstitial connective tissue (CT) (plate 1), and the proximal part showing presence of numerous glandular cells (GC) and smooth muscle cells (SM) (plate 2).

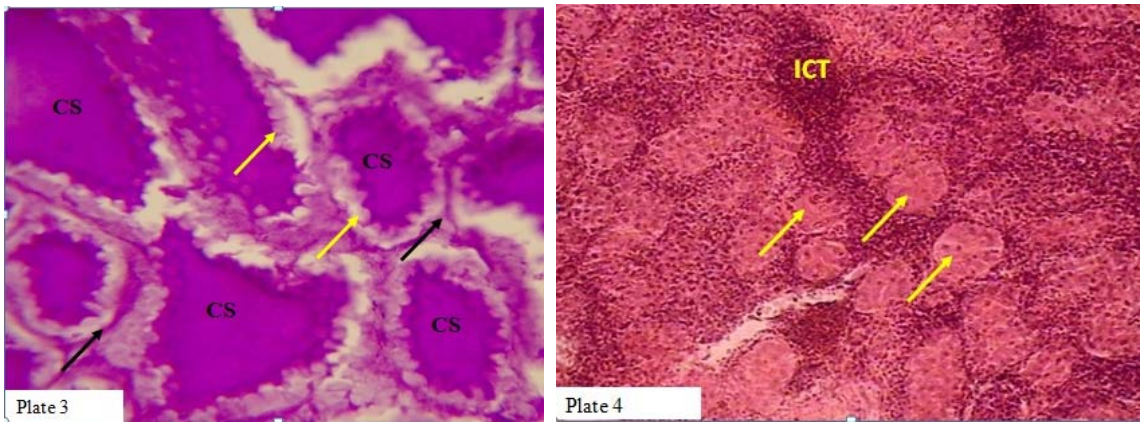

Fig 2: Photomicrographs showing seminal vesicles during non-spawning period, revealing reduction of colloidal substance (CS), pseudo columnar cells (yellow arrows) and connective tissue (black arrows) (plate 3) and presence of secretory epithelial cells (arrows) and intravesicular connective tissue (ICT) (plate 4).

4. Discussion

The seminal vesicles in the present study showed some important histological changes; the proliferations of cuboidal glandular cells that are filled with pinkish colloidal substances which agrees with the work documented by [11, 12]. However the presence of smooth muscle cells seen at the middle of the sphincter between the milt (sperm) duct and the proximal part of the seminal vesicles seen in the present study have not been reported. This finding could possibly be one of the reasons why milt cannot stripped in this species. Since actions of smooth muscles are involuntary; when male fish are excited the smooth muscles may constrict thereby leading to the occlusion of the milt duct. The proliferations of glandular cells of the seminal vesicle as seen in this study also agrees with the findings of [12] who reported an extensive proliferation of the lobules, and secretory activity of seminal vesicles which accounted for the significant increases in the sizes of glandular cells of seminal vesicles. This could also be another reason why milt stripping have not been successful as the glandular cells and their secretion may exert pressure on the milt duct and occlude it. The secretions were stored in the lumen resulting in gradual distension of the lobules to the maximum extent [13], which agrees with the findings in this study as eosinophilic colloidal substances were seen both in the breeding and non breeding seasons. However, in the present study there were marked reductions of glandular cuboidal cells in non-breeding season which has not been reported in the study area. During breeding season, the epithelial cells, which were originally tall and columnar, became progressively reduced in size to assume cuboidal, squamous and pseudo columnar forms [12]. However in this study, only the cuboidal and pseudo columnar glandular cells were seen in spawning and non spawning periods respectively. It is not clear whether the change in the morphology of the glandular cells was due to progressive shedding of the apical part of the cells into the lumen as secretory material (apocrine activity), or due to intraluminal pressure of the stored secretory material on the cells to become flat [14]. The disparity of sizes of cuboidal cells of the seminal vesicles during breeding and non-breeding seasons obtained during the present study agrees with Fishelson *et al.* [15] that seminal vesicles showed extensive degenerative and regenerative changes after the discharge of secretions during breeding season which could lead to its collapse of the lobule in the non breeding season.

In conclusion, this study has provided the histology of seminal vesicles in the wild Clariid species during spawning and non-spawning periods. The presence of smooth muscle cells and the proliferation of the glandular cells may possibly be one of the reasons why milt cannot be stripped in this species.

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