



## Macro-anatomical and Morphometric Investigation of the Tongue and Lingual Papillae in the Guinea fowl (*Numida meleagris*)#

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ARTICLE INFO	ABSTRACT
<p><sup>#</sup>This study was presented as an oral presentation at the Ereğli International Science and Academic Congress (Ereğli INSAC 2019).</p> <p>Research Article</p> <p>Received : 17/05/2019 Accepted : 01/07/2019</p> <p>Keywords: Conical papillae <i>Numida meleagris</i> Papillae linguales caudales Tongue Lingual</p>	<p>The aim of this study was to investigate the macroanatomy and morphometric of the tongue of the guinea fowl. Six chicks (6-7 weeks), six layer hens (9-13 weeks) and six studs guinea fowl were used to study and determine the anatomical features of the tongue of the guinea fowl. Papillae of the tongue were examined photos of the general anatomic structures were taken. Morphometry was calculated by statistical analysis. The tongue was triangular shaped, and consisted of apex, corpus, and radix sections. The papillae linguales caudales were on both sides of the corpus and radix linguae. Conical papillae were found to be sequentially V shaped at the radix. Thus, in this study, the anatomy and morphometric of the tongue of the guinea fowl tongue were examined in details and the similarities and differences between the tongue of the guinea fowl and the tongue of other poultry species were investigated.</p>

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### Introduction

*Numida meleagris* is part of the order Galliformes (Monroe and Sibley, 1993; Kristin, 2001; Dyke et al., 2003; Haaroma, 2003). In certain parts of the world, guinea fowl are used as experimental animals in biomedical research (Igwebuikwe, 2013; Poulis, 2014). The avian tongue exists at the beginning of the digestive system and is located inside beak. It is reported that the tongues' anatomical structure varies widely between species and is based upon the animal's eating habits (Getty, 1975; Nickel et al., 1977; Dursun, 2014; Elsheikh and Al-Zahaby, 2014; Erdogan and Iwasaki 2014). The tongues of gallinaceous birds, which are located at the base of the oral cavity, have features that vary according to the shape and function of the bird; for example, the tongue is large and wide in swimming species, shoveled in ducks, folded in birds such

as the woodblock (King and Mclelland, 1984; Karadağ and Nur, 2002). In poultry, the tongue consists of the apex, corpus, and radix linguae sections. The tongue is attached to the base of the cavum oris by the radix linguae with the frenulum linguae.

There have been many studies on the morphological structures, histology, and SEM images of the tongues of different poultry species. Studies of this nature have been completed on domestic chicken (Haaroma, 2003), Onuk et al. (2015) on seagull and common buzzard, Igwebuikwe and Eze (2010) on African pied crow, Erdoğan et al. (2012) on the red-head partridge, and Liman et al. (2001) and Poulis (2014) on the Japanese quail. There have also been studies on the oral cavity and tongue of the guinea fowl (2013).

The aim of this study is to add new information to existing macro-anatomical on the tongue of the guinea fowl, and to provide resources for the scientific research to be done in relation to other morphological structures of the guinea fowl.

## Materials and Methods

Protocols used in this research are approved by SUVEK, with the decision of the ethics committee dated 30/12/2014, and numbered 2014/81. Six guinea fowl chicks (6-7 weeks), six layer hens (9-13 weeks) and six studs from an Aksaray guinea fowl breeder were weighed. Anaesthetic was injected intramuscularly, at dose rate of 5 mg/kg xylazine for premedication and 30 mg/kg for anaesthesia, into guinea fowl held in special cages. Tongue length and width of examined materials were measured with digital calipers. Macroanatomical findings were photographed with light microscope (40X) and a camera (Figure 2). Nomina Anatomica Avium (NAV) (1993) was used in the writing of terminological expressions.

## Results

### Macroscopic Measurements and Findings

The research material showed that the average weight of the first group of animals was  $331.83 \pm 53.98$  g for 6-7 week-old chicks,  $1127.66 \pm 77.37$  g for 9-13 week-old layer hens, and  $1.592 \pm 87.93$  g for studs. This weight gain was statistically significant at  $P < 0.01$ . In general, it is seen that the shape of the tongue of domestic poultry takes shape according to the feeding type. In guinea fowl, the anatomical structure of the tongue was flattened, pointed, flat, and triangular at the edges in accordance with the diet.

While the apex sections of the tongues of the 6-7 week-old guinea fowl were thin, the apex sections of the studs were thicker. The tongue was extending rostrally to caudally. The average tongue length (apex-radix distance) was between  $11.27 \pm 0.87$  mm for the 6-7 week-old chicks,  $15.20 \pm 1.24$  mm for the 9-13 week-old layer hens, and  $18.21 \pm 0.68$  mm for the stud group. This change in length was statistically significant at  $P < 0.01$  (Table 1). The tongue of the guinea fowl was divided into the apex, corpus, and radix sections (Figure 1, 2). Light microscope images showed that the dorsum lingua was flat, but sulci and tori linguae formations could not be detected (Figure 2).

The longest cross-sectional area of the tongue was between  $3.5 \pm 0.39$  mm for the 6-7 week-old chicks,  $6.03 \pm 0.69$  mm for 9-13 week-old layer hens, and  $8.64 \pm 0.56$  mm for the stud group. It was observed that this cross-sectional area change was statistically significant at  $P < 0.01$ . Thin, weak papillae were observed in the 6-7 week-old chicks weak and 9-13 week-old layer hens, and were observed to be harder and thicker in the studs. In the dorsal area, there were thorn-like papilla linguales caudales between the corpus and radix sections (Figure 2). It was determined that the section near to the radix was longer. In this sequence, the length of the papilla increased from the medial to the lateral position.

### Statistical Analyses and Findings

SPSS 20.0 was used for the statistical analysis of data (Büyüköztürk,2011). It was determined whether there was a significant relationship between the three sample groups given the quantitative scale observations in the study. A non-parametric Kruskal-Wallis test was used. Data were shown with mean and standard error (Büyüköztürk,2011), (Table 1).

Table 1 The average measurements of structures in the guinea fowl. (mm) (n:6)

	Guinea fowl									P
	6-7 weeks			9-13 weeks			Studs			
	Min	Max	Mean $\pm$ SE	Min	Max	Mean $\pm$ SE	Min	Max	Mean $\pm$ SE	
Va	269	425	$331.83 \pm 53.98$	1025	1250	$1127.66 \pm 77.37$	1500	1750	$1592 \pm 87.93$	$P < 0.01$
Du	10.02	12.36	$11.27 \pm 0.87$	13.23	16.63	$15.20 \pm 1.24$	17.23	19.01	$18.21 \pm 0.68$	$P < 0.01$
Dek	3.12	4.17	$3.5 \pm 0.39$	5.22	6.91	$6.03 \pm 0.69$	8.05	9.58	$8.64 \pm 0.56$	$P < 0.01$

Ort $\pm$ SH: Mean  $\pm$  SE, (range;  $P < 0.01$ ); Va: Total weight of the body (g). Du: Length of the tongue (apex-radix distance) (mm), Dek: Cross-sectional length of the tongue (mm).



Figure 1 (A) Dorsal views of the tongue of guinea fowl, (1) 6-7 weeks, (2) 9-10 weeks, (3) studs, (B) Dorsolateral view of the tongue of guinea fowl, (1) Apex, (2) Lingual body (Corpus), (3) Radix.

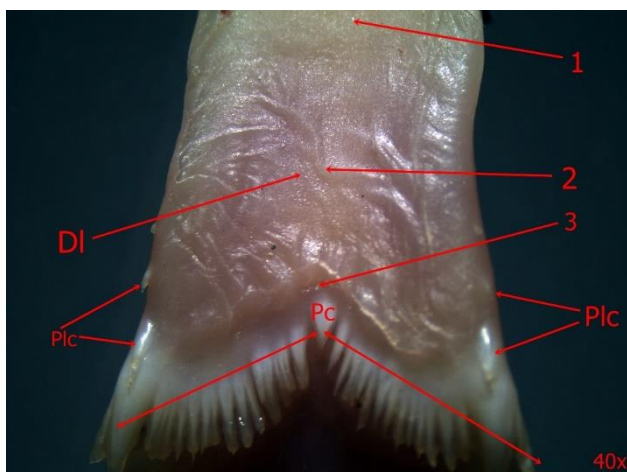


Figure 2 Light microscopic view of the dorsal surface of the tongue (40X), (DI) Dorsum linguae, (Plc): Papilla linguales caudales, (Pc) Papilla conicae, (1) Apex, (2) Corpus, (3) Radix

## Discussion

Dursun (2014) on poultry and Mentis et al. (1975) on Guinea fowls are reported that tongues can be various colours and shapes depending on the animal's feeding habits. In adapting to its dietary preferences, the guinea fowl was determined to have a light light-red, pointed, flat, long, and triangular tongue.

Through Emura and Chen (2008) on fowl, and Crole and Soley (2010) on ostriches, as well as other literature (Getty, 1975; Nickel, 1977; Baumel et al., 1993; Dursun, 2014) it can be determined that the avian tongue consists of apex, corpus and radix sections and attaches to the frenulum linguae and the surface of the oral cavity. In the present study, the tongue structure of the guinea fowl was found to possess these characteristics, in accordance with the literature.

Rossi et al. (2005), reported that in partridges, the dorsum lingua is flat state, and sulci and torus linguae did not form. We observed similar results in guinea fowl.

In the literature (Getty, 1975; Baumel et al., 1993; Crole and Soley, 2009; El Bakary, 2011; Dursun, 2014; Aytekin, 2016), papillae are named papillae linguales caudales in the papillae of the dorsolateral tongue, which are flatter and fewer in number poultry species. Papilla linguales caudales are therefore named as such in the present report, to be in agreement with the literature. Papilla linguales caudales were found in two pairs of right and left horns in the dorsal apex, while those in the corpus and radix sections were found to be pointed spikes, with the radix examples being longer and more pointed.

In the literature (Igwebuike and Eze, 2010), papilla conica was the given name for the papillae on the tip of the lingual radix, showing a cone-shaped, pointed, longitudinal sequence. The present study has therefore named the papilla conicae similarly in guinea fowl.

It is reported that in the literature (Crole and Soley, 2009; Jackowiak et al., 2010; Erdoğan and Iwasaki, 2014), the papilla conicae, which is arranged caudally in the majority of the radix in the poultry species, is involved in the transmission and regurgitation of food transported to the oesophagus. Erdoğan et al. (2012) reports that the

number of conical papillae in partridges changes between 12-14 weeks old. The papilla conicae were found in all of the poultry chickens examined, and the numbers ranged from 16-18 week.

As with reports by Erdoğan et al. (2012) and Rossi et al. (2005) on partridges, Parchami et al. (2010) on quails, and Hassan et al. (2010) on geese, Igwebuike and Anagor (2013) reported that Nigerian guinea fowl's papilla conicae are arranged in a V-shaped sequence on the radix linguae. In the guinea fowl that examined in this study, a similar pattern was displayed in the same section.

As a result, the anatomy, and morphometric findings of the tongue and lingual papillae of the guinea fowl were examined, and their similarities and differences with other poultry species were determined.

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