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RESEARCH ARTICLE

Analysis of Kidney Amino Acids in Iraqi Pin-Tailed Sandgrouse Pterocles Alchata Bird

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ABSTRACT

The amine group (NH2) and the carboxyl group (COOH-) are the fundamental components of amino acids. They regulate several essential physiological functions of organisms and are found in all forms of life, including humans, plants, and microorganisms. Furthermore, they serve as vital energy sources and also act as neurotransmitters. An analysis of the kidneys of Pterocles alchata, an Iraqi Pin-tailed sandgrouse, revealed the presence of 18 specific amino acids. The data indicate that there were no significant differences in the total amounts of amino acids among the three renal lobes. The concentrations in the anterior, middle, and posterior lobes were measured to be 14.154±97.273, 12.437±87.255, and 11.882±88.157 correspondingly, with a significance level of p≤0.05. There were considerable variations in the amounts of amino acids among different areas of the kidney. A glutamine, serine, and asparagine surplus was most pronounced in the kidney lobes. Glutamate proportions were 14.38±226.661 in the back lobe, 22.9±231.929 in the middle lobe, and 27.74±261.852 in the front lobe. The statistical significance of these changes was determined using a significance level of p≤0.05.. Applying a probability threshold of p≤0.01, the serine concentrations in the kidney lobes were measured as 29.59±226.65, 17.74±202.183, and 7.71±199.840 in the anterior, middle, and posterior lobes, respectively. The concentration of the amino acid asparagine (Asn) in the anterior lobe was 12.61±153.952, in the middle lobe it was 7.47±135.278, and in the posterior lobe it was 10.23±128.885. These concentrations were observed at a probability threshold of p≤0.05

INTRODUCTION

Birds are important animals, especially the domestic ones, because of their economic importance as they are very important in the biological control of insects and rodents. Due to the importance of birds in biological research, many studies have been conducted, including (Abed and Al-Bakri, 2011; Abed et al., 2018; Hamad et al., 2021).

According to Overton and Burhans (2006), the molecular structure of an amino acid is an amine group (NH2) attached to a carboxyl group COOH-.A wide variety of microbes, including those found in humans and other animals, play a key role in enhancing plant resilience and production (Shyaa and Kisko, 2024; Al-Hashimi and Zeboon, 2024). Furthermore, microbes also harbour these entities (Tshouhot et al., 2003). Amino acids, like pharmacologists, have a vital role in regulating essential functions, such as gene expression, which controls the production of proteins throughout translation processes (Verrey et al., 2009).

Amino acids can be classified into two main categories depending on their functional roles: Ali (2023) and Salman (2014) have categorised the amino acids isoleucine, leucine, lysine, methionine,

phenylalanine, threonine, tryptophan, valine, and histidine as essential. Alanine, arginine, cysteine, glutamine, glycine, proline, serine, and tyrosine are examples of non-essential amino acids that can be produced by intermediate metabolic pathways (Qaid and AL-Garadi, 2021; Akram et al., 2011).The Iraqi Pterocles alchats birds- belonging to the family Pterocilidae with full bodies and long beaks and feathers in colours close to the nature of the wild environment in which they live- feed on seeds and grains and do not land nor build their nests on trees. However, their hatcheries are found on the ground and are called the (mother of three) because they do not lay more than three eggs at a time (Al-Loos, 1962).

The kidney is one of the important organs of mammalian bodies, including birds (Al-Taai and Nasif, 2020). The kidneys in all organisms perform important functions to maintain the continuity of life (Ali et al., 2023), and they are no less important than other organs such as the heart and lungs, as the kidney maintains the balance of fluids inside the body and removes the resulting waste, excess water and electrolytes (Hamad et al., 2019; Khadhim and Dauod, 2014).

Multiple amino acids rely on the kidneys for their production and distribution throughout the body. Their functions include the production of nitrogen, regulation of acid-base balance, and the conversion of citrulline to arginine acid, the latter of which is a result of glutamine breakdown in the intestines (Van de poll, 2004). Finding out what kinds of amino acids are present in the kidneys of the Iraqi pin-tailed sandgrouse, or Pterocles alchats, was the main goal of this study.

MATERIALS AND METHODS

Animal breeding

All birds were male adult Pterocles alchats aged 11–12 months, weighing 200–260 grammes, and purchased at Al-Ghazal market in Baghdad. Grain, drink, and lights were provided to the birds.

An HPLC system was used to separate and analyse renal amino acids in a lab that is associated with the Materials Research Department at the Ministry of Science and Technology. The analysis was based on the lab's standard models.

Following the procedure outlined by Fierabracci et al. (1991), a manual homogenizer was used to combine one gramme of P. alchats bird kidney with twenty millilitres of deionized water. Then, 1.5 grammes of sulfosalicylic acid were added. After one hour in the centrifuge, the samples were discarded.

The supernatant was subjected to treatment with 0.1N HCl at a pH of 2.0. The samples were rotated in the centre centrifuge at a speed of 3000 revolutions per minute. Combine 10 microliters of PITC reagent with 10 microliters of clearing solution. Then, bring the liquid to a pH of 7.0 by adding 50 microliters of sodium acetate (0.1). Just let the mixture a minute to sit. By using high-performance liquid chromatography, the amino acid concentrations were ascertained. The following equation was used to calculate the concentrations of amino acids: Multiply the standard concentration by the number of dilutions to get the amino acid concentration. Then, use the formula, which is samples in band area divided by standard band area, to get the final value.

RESULTS

The kidney of the Pterocals alchata bird contained the following amino acids: asparagine, serine, glutamine, glutamic acid, threonine, histadine, citrulline, alanine, proline, glycine, arginine, tyrosine, valine, methionine, isoleucine, leucine, phenylalanine, and lysine.

The data shown in Table 1 and Figure 1 demonstrate that the study's results reveal a lack of statistically significant variation in the total amino acid levels among the three renal lobes. The amino acid rates in the posterior, middle, and anterior lobes were 88.157±11.882, 87.255±12.437, and 97.273±14.154, respectively.
Furthermore, there were statistically significant variations in the concentrations of amino acids among the various kidney lobes. The concentrations of glutamic acid (261.852±27.74) in the anterior lobe of the kidney were statistically more significant than those of phenylalanine (Phe), which had a percentage of 42.426±10.85 at a probability threshold of p≤0.001.

In the middle lobe of the kidney, the differences were significant between Glutamic acid and Threonine (Thr), which recorded 41.154±0.66, while the percentage of Glutamic acid was 231.929±22.99. There were also significant differences between Glutamic acid and phenylalanine (Phe) in the posterior lobe of the kidney, with concentrations of 226.661±14.38 and 44.236±4.32 respectively at p≤0.001 probability levels.

Table (1): Total amino acid concentration in the kidney lobes of Pteroclas alchata bird.

Parts	Concentration of total amino acids (µg/mL) (mean±S.E)
Anterior lobe of kidney	97.273±14.154
Middle lobe of kidney	87.255±12.437
Posterior lobe of kidney	88.157±11.882

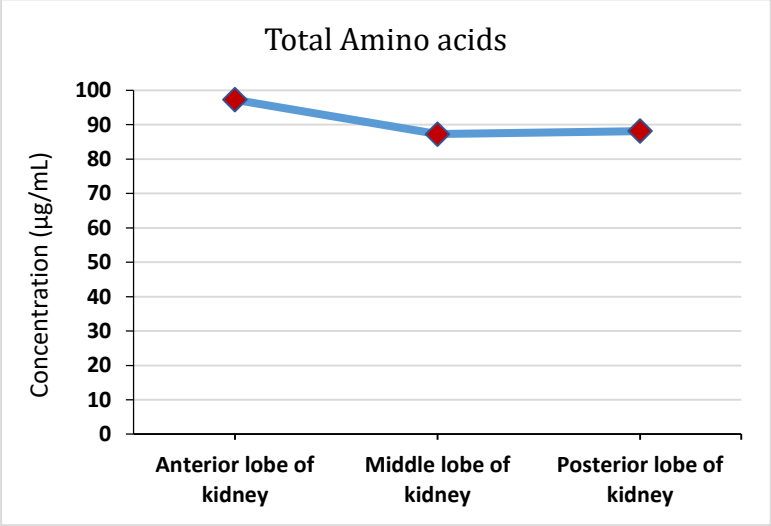


Figure 1: Total amino acid concentration in the kidney lobes of *Pteroclas alchata* bird.

Discussion

Amino acids are crucial for a diverse range of biological functions since they serve as the basic building blocks of proteins and peptides (Al-Zuhary, 2017). The functional activity of natural amino acids facilitates cellular and tissue healing. Miyoshi et al. (2012) state that the kidneys play a crucial role in the production and movement of various amino acids.

Al-Hamawandy and Al-Bakri (2019) found that fully developed Pterocles alchats had a collective count of 18 amino acids. Furthermore, the embryos and adults of the domestic fowl species Gallus

gallus domestica exhibited the existence of 18 amino acids. Abed et al. (2018) found that embryos of the Coturnix bird species have a total of sixteen amino acids. Al-Musawiu and Al-Bakri (2022) found that the kidneys of mature mice had a total of 18 amino acids. In their study, Mus musculus, Ali, and Al-Bakri (2023) verified that albino mouse embryos have a total of 18 amino acids in their kidneys.Glutamic acid was shown to be the predominant amino acid discovered in the kidney, as indicated by the research. The concentration at the top of the anterior lobe is 261.852±27.74. Glutamic acid is a non-essential amino acid synthesised from glutamine by the action of renal glutaminase. In their study, Kuikarni et al. (2005) provided evidence that this process regulates cellular metabolism and stimulates the activity of neurons. Upon entering the circulation and undergoing transamination, the enzyme generates alpha ketoglutaric acid.

Glutamine, an amino acid, plays a crucial role in the synthesis of proteins, sugar acids, nitrogenous bases such purines and premidins, as well as the generation of total glucose. According to Ebdaiasl (2011), it is more abundant in blood plasma compared to other amino acids.(Young,1991;Kuikarni et al., 2005).

In addition, the content of glutamine amino acid was very stable in all three renal chambers. The posterior lobe had a concentration of 72.113±4.88, while the anterior and middle lobes displayed values of 76.986±4.88 and 76.746±5.46, respectively.

Al-Hamawandy and Al-Bakri (2019) did a study to examine the types of amino acids found in the livers of fully grown domestic chickens and developing embryos. An investigation of Gallus gallus domesticus found that the glutamine level in adult domestic hens is 365.85±24.11.

Al-Musawiu and Al-Bakri (2022) found that the group of individuals who did not use hydroxychloroquine (HQC) medication had Mus musculus kidneys with the lowest proportion of amino acids, measuring 19.63±1.75%. After measuring the highest concentration of 61.73±11.24, which occurred at a dose of 30 mg/kg/day, the opposite was shown to be true.

Tyrosine, aspartic acid, and glutamic acid have the ability to inhibit the enzyme chondroitinase, which is produced by the bacterium Proteus vulgaris and is responsible for causing urinary tract infections (Al-Imam and Al-Rubaii 2016). This research highlights the importance of certain amino acids in inhibiting infections.

The research found that the concentration of serine acid was greatest in the anterior region of the kidney (266.651±29.59) and lowest in the posterior region (199.840±7.71). In the 2019 study conducted by Al-Hamawandy and Al-Bakri, it was determined that the liver amino acid percentage in adult domestic hens (Gallus gallus domesticus) was 145.25±2.69. The embryos treated for 11 days had the lowest concentration, measuring 53.71±9.43. The most minimal concentration was seen in the posterior region of the kidney, measuring 199.840±7.71. The acid concentration in the control group was 50.43±6.15, whereas in the experimental group it was 95.94±19.10. The present investigation verified that the anterior kidney lobe exhibited the most elevated concentration of this acid (85.86±7.41). The acid content in the middle and posterior kidney lobes was comparable.

The production of proteins, the functioning of enzymes at their active sites (such as serine protease), and the activation of neurotransmitters all need histidine significantly. The fact that histidine cannot be created naturally by humans is something that should be brought to your attention (Brosnan & Brosnan, 2020). The present investigation revealed an elevation in the concentration of this acid, reaching its highest point at 101.025±23.17 in the anterior kidney lobe, followed by a decline to 88.127±2.36 in the medial lobe.

The body produces an adequate amount of arginine (Arg) for growth and equilibrium. Abed et al. (2018) discovered that adult quail brains contained higher levels of Arginine, Tyrosine, and Phenylalanine, with increases of 0.064, 0.103, and 0.123, respectively, based on their research on

quail embryo birds. This research found no significant differences in kidney lobe Arginine, Tyrosine, or Phenylalanine. The anterior kidney lobe contained 53.366±6.61 arginine and 54.77±5.90 tyrosine acid concentrations. In contrast, the kidney's middle lobe exhibited the highest Phe levels (50.869±4.25). Plasma valine (Val) and leucine levels affect CKD patients' nutritional status. CKD patients had lower plasma Val and Leu concentrations than controls, Kumar et al. (2012) found. Al-Musawiu and Al-Bakri (2022) found that adult Mus musculus mice receiving a daily dosage of 30 mg/kg of HQC had considerably higher levels of Val, Ile, and Leu amino acids (72.57±8.66, 29.23±7.53, and 23.59±4.80, respectively).

Results indicated steady kidney valine levels. The results for these acids were 68.20±5.50, 61.81±7.74, and 61.31±15.94. Statistical significance is displayed when the probability threshold is below 0.001. The kidney lobes had isoleucine (Ile) levels of 74.51±2.25, 70.17±5.88, and 77.85±6.78. The renal lobes had leu levels of 69.138±3.24, 69.353±9.29, and 68.74±7.26.

- The administration of the medicine at a dosage of 30 mg/kg/day significantly increased the concentration of Ala to 72.37±12.64, as opposed to 33.50±4.01 in the control group. The analysis revealed that the alpha acid level in the anterior kidney lobe was the greatest, measuring 102.42±14.45.
  Proline (Pro), though not necessary, has an influence on protein synthesis and metabolism.
- Collagen regulates skin hydration, facilitates wound healing, participates in redox processes, stimulates cell differentiation, and preserves skin and tissue structure (Wu et al., 2011).

According to Al-Hamawandy (2019), the amino acid Pro in chicken liver (Gallus gallus) decreased significantly throughout embryonic development, reaching 99.80±7.54 after 19 days of incubation. This study found reduced levels of this acid in all renal lobes. The anterior lobe had the highest concentration (84.057±12.88) and the middle lobe the lowest (66.995±5.34).

Although not required for human survival, amino acids are needed for protein synthesis and histamine, arginine, and serine absorption regulation. Neuroendocrine tissues employ amino acids as neurotransmitters. This substance inhibits apoptosis and increases lymphocytes (Patzold et al., 2005). In a study conducted by Ahmad and Al-Bakri (2022), it was observed that adult Mus musculus mice who were administered 50,100 mg/kg/day of zinc exhibited the highest concentration of liver amino acids among the control group, measuring at 39.61±3.80.

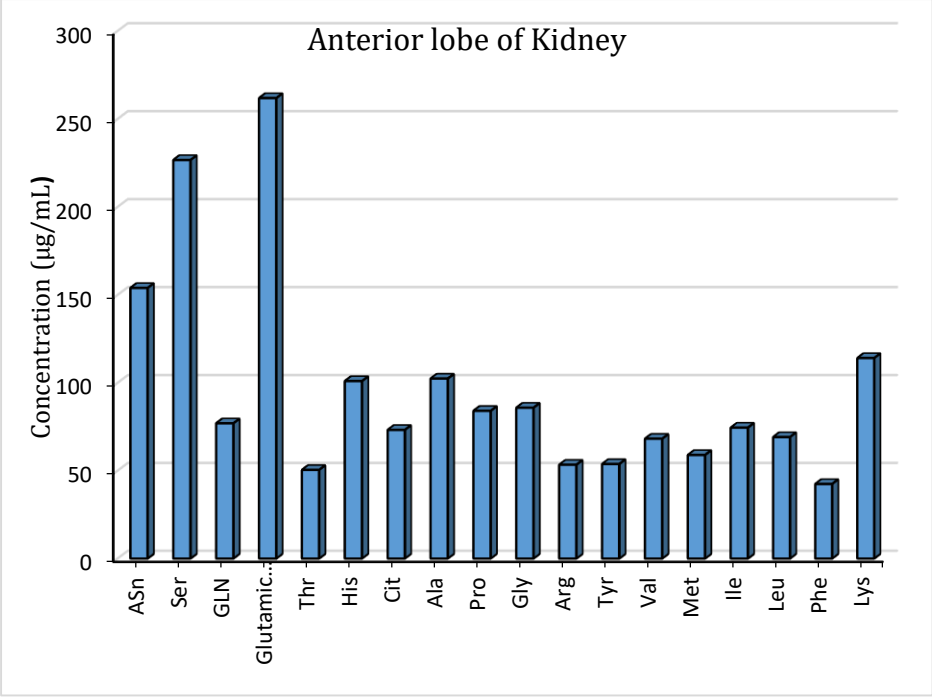
Research by Al-Hamawandy and Al-Bakri (2019) found that fully grown domestic hens (Gallus gallus domesticus) had the highest amino acid content in their livers (259.17±4.66). In the research, acid concentrations ranged from 128.885±10.23 in the posterior kidney lobe to 153.952±12.61 in the anterior.

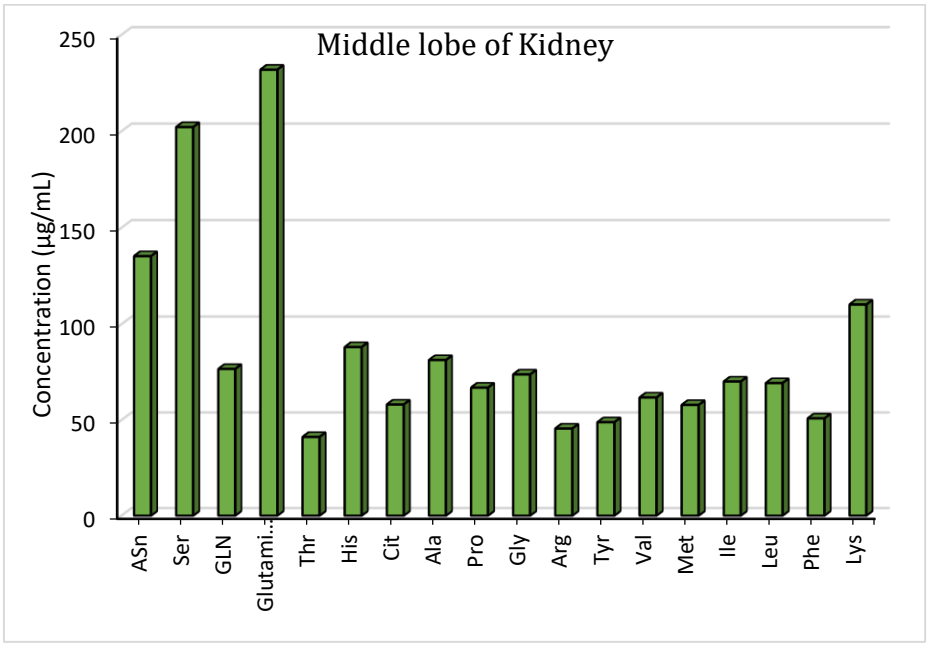
Kidneys absorb cit, an intestine-produced non-essential amino acid. Failure of liver. It aids small intestine glutamine metabolism and nitrogen production (Van de poll, 2004). Study found identical acid levels in all three renal lobes. The anterior lobe had the highest concentration (73.217±10.53), whereas the middle lobe had the lowest.

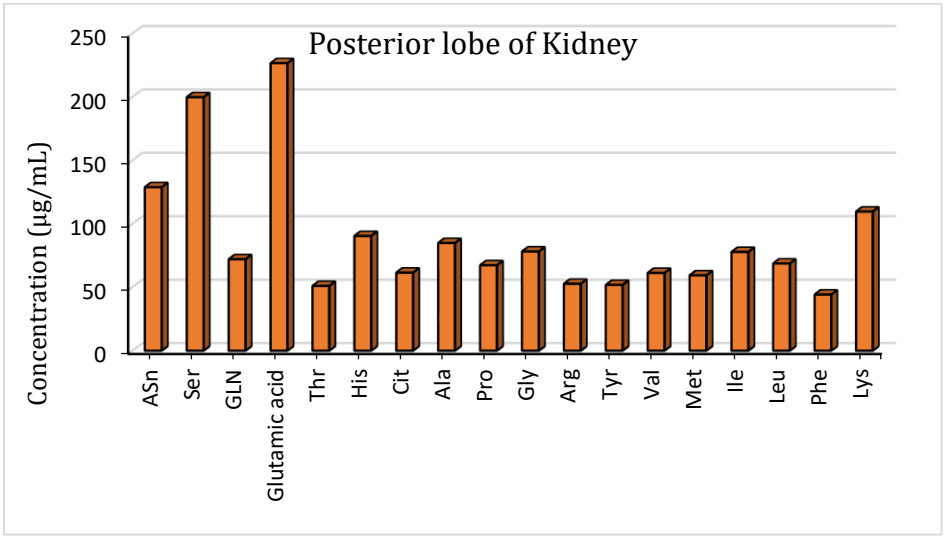
Table 2: Amino acid concentration in *Pteroclas alchata* kidney for the anterior, middle and posterior lobes

Amino acid	Concentration of amino acids (µg/mL) (Mean±S.E)		
	Anterior lobe	Middle lobe	Posterior lobe
Asparagine (Asp)	153.952±12.61	135.278±7.47	128.885±10.23
Serine (Aer)	226.651±29.59	202.183±17.74	199.840±7.71

Glutamine (Gln)	76.986±11.91	76.746±5.46	72.113±4.88
Glutamic acid	261.852±27.74	231.929±22.99	226.661±14.38
Threonine (Thr)	50.443±14.96	41.154±0.60	51.073±11.99
Histadine (His)	101.025±23.17	88.127±2.36	90.429±2.65
Citrulline (Cit)	73.217±10.53	58.135±6.74	61.553±4.34
Alanine (Ala)	102.420±14.45	81.396±3.03	84.893±3.47
Proline (Pro)	84.057±12.88	66.995±5.34	67.339±5.62
Glycine (Gly)	85.861±7.41	73.882±4.07	78.200±9.86
Arginine (Arg)	53.366±6.61	45.576±5.04	52.745±10.11
Tyrosine (Tyr)	53.777±5.90	48.875±6.10	51.856±10.68
Valine (Val)	68.200±5.51	61.810±7.74	61.312±15.94
Methionine (Met)	58.935±12.76	57.914±10.04	59.401±7.57
Isoleucine (Ile)	74.505±2.25	70.171±5.88	77.845±6.78
Leucine (Leu)	69.138±3.24	69.353±9.29	68.741±7.26
Phenylalanine (Phe)	42.426±10.85	50.869±4.25	44.236±4.32
Lysine (Lys)	114.103±15.09	110.203±6.48	109.701±11.76
P value	<0.0001**	<0.0001**	<0.0001**







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