Anatomical and Radiographic study of the Portal and Hepatic Veins in *Ovis Aris* and *Capras Hircus*

S. Al- Sadi
Department of Veterinary Anatomy and Histology, College of Veterinary Medicine, University of Mosul, Iraq
E-mail: somaiassi@yahoo.com
Accepted on: 28/2/2013

Summary

The main purpose of this study was to convey a more precise explanation of the intrahepatic pattern of the tributaries of portal and hepatic veins in sheep and goats. Also to give broad information on the portal and hepatic vein and there topographic relation that may give a useful base for the hepatic segmentation, aiming to provide a correct base for surgical procedures and liver transplantation. Twelve livers collected from adult sheep and goats of both sexes. The portal and hepatic veins were studied by using cross dissection, corrosion cast and radiographic examination. Subject of this investigation show the portal vein of the sheep is slightly narrower than that of the goat. Also the pattern of intrahepatic branches of portal vein in sheep is similar to that of goat. on reaching the portal hepatic, gave of a right dorsal interlobular branch and then terminate into a right ventral interlobular and left interlobular branches , the right dorsal interlobular branch was short and large, supplied the caudate process and right dorsal hepatic lobe .The right ventral interlobular branch is distributed only in the ventral part of the right lobe, while the left branch was long and narrow, supplied the left and quadrate lobes as well as the papillary process, However the caudate process receives the separate branch from the parotid vein in goat. Moreover, the study revealed that the hepatic veins in sheep and goats can be classified into two groups ; large and small , the work also shows that there are (3-4) large hepatic veins in sheep, while in goats usually gives off a left large branch and two smaller right and intermediate branches, and in both animals the hepatic vein, pour in the caudal vena cava independently, the veins of the left, right and intermediate lobes empty themselves close to each other, while of these of the caudate and papillary processes open separately and a way from hepatic veins.

Keywords: Anatomical, Radiographic, Portal hepatic vein, Sheep, Goat.

Introduction

The liver is the largest gland in the body. The blood passes through liver sinusoids and finally leaves the liver by way of hepatic veins those drain into the vena cava. The liver sinusoids remove bacteria and other particulate matter those might enter the blood from the gastrointestinal tract. On the other hand the liver occupies a unique position with respect to the venous blood from the portal vein, which drain the blood or the gastrointestinal tract through the liver before entering the circulation. Portal vein is the main afferent vessel and supplies most of the blood to the liver (1 and 2).

The parenchymal distribution of the both the portal and hepatic veins in domestic animals have been studied in camel (3), in buffalo (4), in pig (5), in goats (6) and in sheep (7). The outcome of this investigation may served as guide for successful study to be able distinguish the portal and hepatic veins in the liver at autopsy and know the tributaries to the portal and hepatic vein and its branches in the liver to be able to diagnose a portosystemic shunt on venography and locate it at surgery (8 and 9) , and multiple collateral shunting vessels of the parenchyma dilated vessels in the hepatic parenchyma in arteriovenous fistula in the liver may be presented for evaluation of gastrointestinal foreign bodies (10).

The present work is therefore aims to give some information about the parenchymal distribution and topographic relation of both the portal and hepatic veins in both sheep and goat.

Materials and Methods

This study was carried out on the liver of 12 clinically healthy sheep and goat. The specimens were collected from the slaughterhouse in Mosul. To remove and

discharge of blood clots, the portal vein of livers was perfuse with normal saline and in order to demonstrate to the intrahepatic distribution of the portal and hepatic veins. Three techniques were used, cross anatomy the four livers of both animals with its related parts in situ then taken off portal and hepatic veins were dissected by use of routine dissection. The course and branches of portal and hepatic veins were studies and cast for other fresh specimens were injected with colored by Re acromed (consist of two solution A and B (Acromed 250 ml and cold cure Acrylic 500 gm.) Which were mixed by a ratio (1:1). The portal and hepatic veins were injected either separately or together to show their topographic relation and the injected specimens were left for 2-3 days to dry in the open air for solidification of Re acromed - then the specimens were macerated in potassium hydroxide (10 %) for (4-5) days for corrosion lastly. The specimens were generally washed in water until become free from the macerated tissue. The technique of (11) was choice .Radiological technique for another four specimens were inject with the contrast medium by hand using (20) ml of conray (280) (meghumine lothalamute injection BP 60% w / v). For (x) ray study certain parameters were used (50) KVP (2.3) m AS and (0.3) sec, the radiological image was fully described after examination of the films and the nomenclature used was adopted by (12).

Results and Discussion

The results of this study revealed that the portal vein lies between the hepatic artery dorsally and bile duct ventrally, the portal vein of the sheep is slightly narrower than the portal vein of the goats while the pattern of intrahepatic branches of portal vein in sheep is similar to goats. The portal vein immediately divided into right dorsal interlobular, right ventral interlobular (Fig. 1) and left interlobular branches in both animals (Fig. 2 and 3).

Right dorsal interlobular branch of the portal vein in sheep and goats, the branch run obliquely with ascended dorsally to ramify within the dorsal part of the right lobe, then continued dorsolaterally for about (3-4 cm), gave off branches of papillary process and caudate lobe, the parent vessel when it was accompanied by the corresponding hepatic vein (Fig. 4 and 5).

Right ventral interlobular branch extended ventrally forming a double curve along its course toward the ventral border of the medial part of the right lobe it gave 3-4 branches of variation size. These branches run in different directions. Near its origin, a central branch to the middle of diaphragmatic surface of the liver, supplying adjoining parts of the quadrate, caudate and right lobes, and the caudate process receives the separate branch from the parotid vein in goat (Fig. 5 and 6).

Left interlobular branch insistra runs at first in the long axis of the liver from porta toward the left lobe and at the boundary between the quadrate and caudate lobes covered by the papillary process, fat and hepatic lymph nodes. The left interlobular branch is divided for transverse and umbilical branch (Fig. 6).
The transverse branch that extends from the porta to flexure was nearly (4-5) cm length and gives of several branches to the caudate and quadrate lobe .The umbilical branch also gives off several branches of the quadrate lobe which lie close to the visceral surface , and a diaphragmatic quadrate branch that turns to the dorsal border (Fig. 7 and 8) .

Hepatic veins (Vena hepatica) showed the opening of the hepatic vein in the caudal vena cava are best seen from the lumen (Fig. 9 and10) .In the present study, the membranous flap showed over the entrance of hepatic veins into the caudal vena cava in both animals. There are 3-4 large hepatic veins and two small veins in sheep, while in goats usually gives off a left large branch and two smaller right and intermediate branches. In both animals the hepatic vein interning the caudal vena cava independently , the veins of the left, right and intermediate empty themselves close to each other, while of these of the caudate and papillary processes open separately and a way from hepatic veins (Fig. 9 and 10). The three main hepatic veins run generally perpendicular to the branches of the portal vein and hepatic artery, extending from the vena cava toward the ventral border of the liver and they lie in the core of the liver parenchyma (Fig. 11).

The right hepatic vein (vena hepatica dextra) extending towards the ventral border of the lobe, along the course give 2-3 branches to the right lobe and one to the caudate process (Fig. 12). The intermediate hepatic vein (vena hepatica intermediate) extended dorsally through the parenchyma of quadrate and caudate lobe, given off branches to each side in sheep while in goats. The right and intermediate hepatic veins were relatively small veins and proceeded crossed the corresponding portal branches and ramified with in the right lobe and caudate process (Fig. 7 and 11).

The left hepatic vein (vena hepatica insistra) connected the caudal vena cava near the esophageal impression and divided into dorsal and ventral branches in sheep. The dorsal and ventral branches arborize in a tree -like manner with the two third of the lobe , while in goats the left hepatic vein was relatively large vessel which was drain the different part of the left lobe and the adjacent part of the quadrate lobe (Fig. 12 and 13). The left hepatic vein divided into dorsal middle and ventral branches that across the corresponding portal branches to be distributed with in the dorsal, middle and ventral parts of left lobe respectively. The opening of the major hepatic vein is arrange in two widely separated clusters (Fig. 9 and 10).

The vein of the papillary and caudate process (Vena processi papillares and caudati) were represented by (2-3) small veins are arising separately from the caudal vena cava (Fig. 7 and 14). This study revealed that the portal vein immediately divided into right dorsal interlobular, right ventral interlobular and left interlobular branches in both species, this didn't agree with (13) who stated that the portal vein divided immediately upon entering the liver into very short right branch and a left long branch . The division of the portal vein in sheep into right dorsal, right ventral and left branch within the portal hepatic as observed in this study are in accordance with (14).

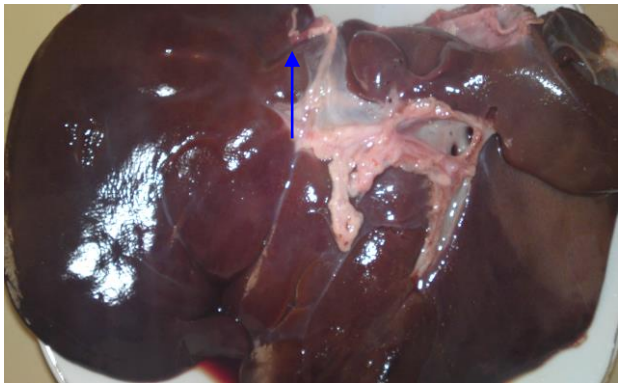
The terminology and distribution of the right and left branches matter and divergence in different species, however (15) in goats recorded that the right branch supplied the ventrolateral part of the right lobe and quadrate lobe. On the other hand in this connection the present work stated that, the right branch is represent by right dorsal and right ventral.

The course of the portal vein as revealed in the present work is in accordance with the results of (11) in goats, (12) in sheep , and with (16 and 17)in bovine and buffalo respectively studied. The origin, course and fine ramification of portal vein in Indian water buffaloes regarding the right dorsal and ventral branches divides into (3-4) branches is indicated by their names. In camels (18) stated that the right branch of portal vein is short and runs towards the ventral border of the right lobe and the secondary branches lies for the most part close to the visceral surface and ramification in different parts of the right lobe . It seen that the present results about distribution of the right interlobular branch is in agreement with reports in buffalo (19).

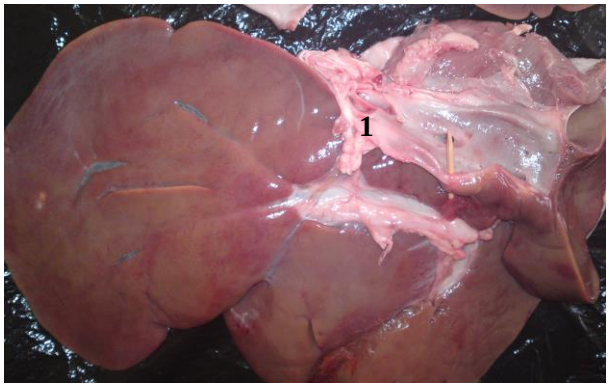
In sheep, the left branch curves ventrally and to the left within deep depression on the liver surface with number of small branches, at the level of the umbilical fissure (12). The left branch divided into dorsal intermediate and dorsal branch. The left branch of the portal vein in camel (18) also divided into umbilical and transverse part. The transverse part gives off many branches to the caudate lobe and a few to the quadrate lobe. The present results showed that the left interlobular branch run at first in the long axis of the liver from porta toward left lobe. Nevertheless, the current work did not observe any anastomosis between the terminal branches of the portal vein and a similar result was recorded by (18) in camel. Search in the available literature revealed no investigation concerning the portal vein of the sheep, which is slightly narrower than the portal vein of the goats.

In the present study revealed that the membranous flap over the orifices of hepatic veins into the caudal vena cava in both animals was also observed by (20) in goats. This work revealed that there are 3-4 large hepatic veins in sheep, while in goats usually gives off a left large branch and two smaller right and intermediate branches, and in both animals, the hepatic vein entering the caudal

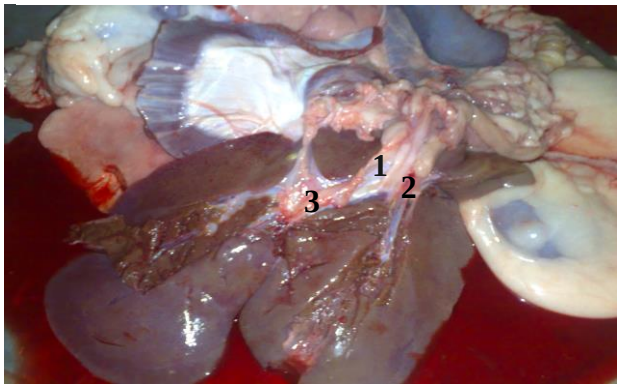
vena cava independently. The veins of the left, right and intermediate lobes empty themselves close to each other, while of these of the caudate and papillary processes open separately and a way from hepatic veins .In this connection, (11) reported that in the goats the right hepatic vein was substituted by a small veins originated from the middle one, while (21 and 19) stated that in the buffalo, it was represented by (4-6) medium sized veins, (12) similar number of branches reported in sheep, (22) in goats recorded three hepatic vein while (23) observed two large two medium sized and about nine small hepatic veins in camel.



Figure, 1: Right dorsal and right branches of portal vein in sheep

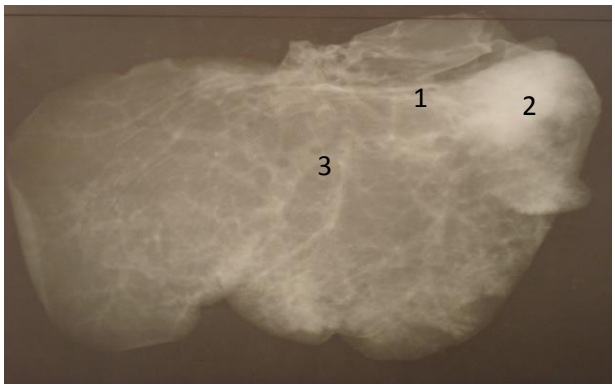


Figure, 2: papillary1; caudate; left intrahepatic branch of portal vein 3.

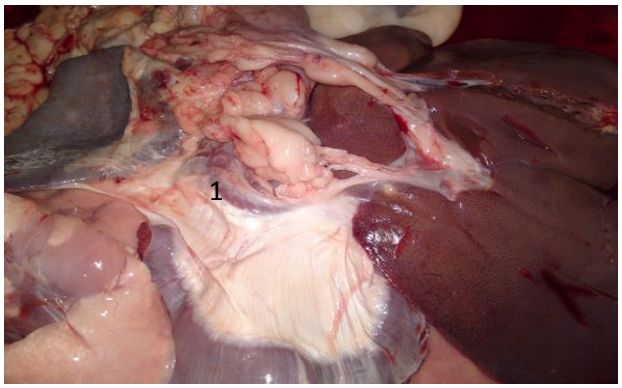


Figure, 3: Portal vein (1): dorsal vein (2) and left Interlobular (3) in goat.

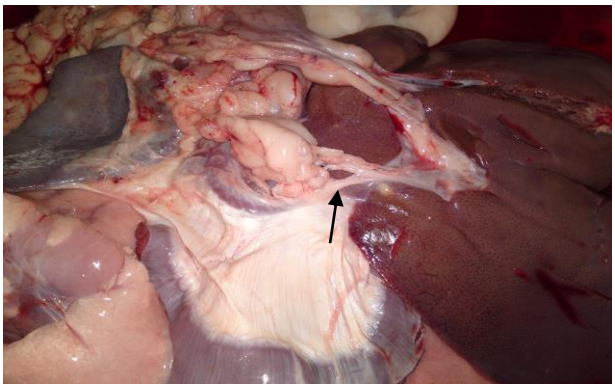
Figure 4: X-Ray image of hepatic vein (1);caudal vein (2); papillary right dorsal branch of portal vein in sheep.



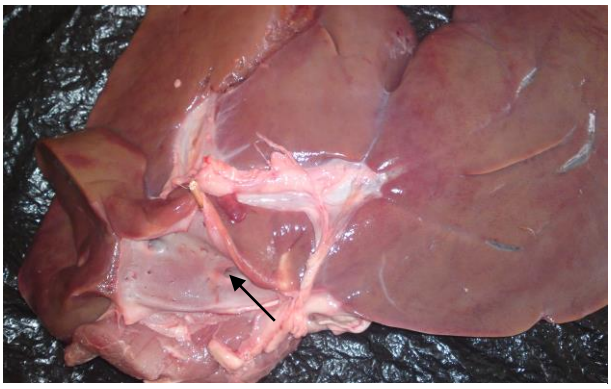
Figure, 5:X-Ray image of portal vein (1); caudate (2) and quadrate(3) in goat.



Figure, 6: Parenchyma distribution of the 1- the diaphragmatic branch of portal vein in goat.

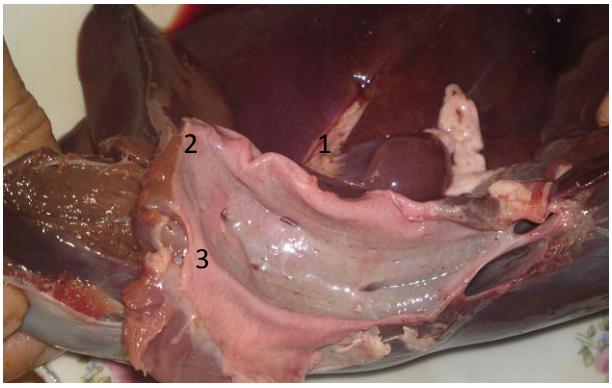


Figure, 7: The diaphragmatic branch of portal vein in goat.



Figure, 8: Opening of the hepatic vein in sheep .

Figure, 9:The opening of hepatic vein in goat.



Figure, 10:Hepatic vein divided into 1-right 2-intermediate and 3-left branches by X ray ingoat.

Figure, 11: The divisions of the hepatic vein into 1-right 2-intermediate left branches in sheep.

Figure, 12:The division of the hepatic vein into 1-right 2-intermediate 3-left and 4-papillary branches by cast in sheep.

References

1. Guyton, A.C. and Hall, J.E. (2012). Text Book of Medical Physiology. Philadelphia, WB Saunders, USA., PP:804 -805.
2. Dyce, K.M.; Sack, W.O. and Wensing, C.J. (2010). Text Book of Veterinary anatomy. 4th ed. China. Saunders, PP: 695.
3. Tadjalli, M. and Akhavan, R. (2003). Anatomical study on intrahepatic

branches of portal vein in camel one dromedaries. Indian J. Camel Pract. Res., (10):201-206.
4. Ranjbar, R. and Chadiri, A.L. (2011). Observation of intrahepatic branching pattern of the portal vein in water buffaloes of Iran. Asian J. Anim. Vet. Adv., 6(5):508-516.
5. Osman, F.A.; Wally, Y.R.; EL-Nady, F.A. and Rezk, H.M. (2008). Gross anatomical on the portal vein, hepatic artery and bile duct in the liver of pig. J. Vet. Med., 1(1):59-72.
6. Hagras, S.M. and Osman, F.A. (1986). Gross anatomical study on the hepatic veins in goats. Zagazig Vet. J., 13:20-26.
7. Ruchton, B. and Murray, M. (1976). Morphology and classification of subdivision of the intrahepatic vascular and biliary system in sheep. Vet. Sci., (31):159-168.
8. Anuradha, R.K.; Bansal, N. and Uppai, V. (2002). Radiological investigation of intrahepatic supply of the liver in buffalo. Indian J. Anim., 72:1108-1111.
9. Anuradha, R.K. and Sing, H.O. (2002). Venography of intrahepatic portal veins of the liver in buffalo. Indian J. Anim., 74:1024–1026.
10. Fossum, T.W. (2007). Small animal Surgery. Philadelphia USA. 3rd ed., PP: 541-545.
11. Alloush, G.M. (2001). Some anatomical studies on the heart and thoracic aorta of the goats with special reference to the pattern of its distribution. PhD Thesis, Faculty of Vet Med Cairo Uni. Egypt, P: 15.
12. Nomina Anatomica Veterinaria Submitted by the International Committee on Veterinary Nomenclature Vienna. (2005). PP:152.
13. Habel, R.E. (1975). Ruminant digestive system. In: Sisson and Grossmans. The anatomy of the domestic animals Rev by R Getty 3rd ed. WB Sanders comp. Philadelphia, P:912.
14. Hagras, S.M. and Swielim, G.E. (1990). Cross anatomy of the blood vessels and bile duct in the liver of sheep. New Egyption J. Med., 1(2):1066-1082.
15. Osman, F.A. and Hagras, S.M. (1989). Intrahepatic distribution of portal vein in the goat. Zagazig Vet. J., 13:27-33.
16. Zanco, N.A.; Reginat, O.M.; Miglin, M. and Dildo, A. (1997). The structures of the portal vein in bovine fetuses of nelore breed. Brazil J. Vet. Res. Anim. Sci., 31:13-18.
17. EL-Gaafary, M.A.; EL-Gindy, E.M. and Anis, H. (1979). Some morphological features of the intrahepatic part of the portal vein in buffalo in Egypt. Egypt Vet. Med. J., 27:61-69.
18. Osman, F.A. and Ragab, S.A. (1986). Intrahepatic veins and bile ducts of one humped camel (*Camelus dromedaries*) Egypt J. Histo., 9(2):245-249.
19. Mobarak, A.M.; Anas, H. and EL-Gaafary, M.A. (1980). Some anatomical study on the liver of the buffaloes in Egypt (*Bos bubalis*). Portal and hepatic veins. Vet. Med. J., 27:265-267.
20. Brikas, P. and Tsiamitas, G. (1980). Anatomic arrangement of the hepatic vein in goats. Am. J. Vet. Res., 41(5): 796-797.
21. Anas, H. (1977). Some anatomical studies on the liver of buffalo in Egypt *Bos bubalis*. Res. Med. Vet., 120:161-167.
22. Zutlua, W.X. and Ding, D.Z. (1997). Branching and distribution in the liver in goats. Chinese J. Vet. Sci., 1:85-88.
23. Arnautovic, I.; Fahmy, M.F. and Abdalla, O. (1971). Anatomical study of the liver in camel (*Camelus dromedaries*). Part II. The course and distribution of the portal vein, hepatic vein and bile duct. Acta. Anat., 9:211-220.

دراسة نشريحية وشعاعية للأوردة البابية والكبدية في الاغنام ***Ovis aris*** والمعز ***Capras hircus***

سمية الساعدي
فرع التشريح و الانسجة - كلية الطب البيطري - جامعة الموصل - نينوى - العراق

الخلاصة

يهدف البحث لمعرفة الطوبغرافية لتشعبات الاوردة البابية والكبدية عند الاغنام والمعز لتوفير قاعدة اساسية عند المداخلات الجراحية للكبد وكذلك عند زرع عينات الكبد . اجري هذا البحث على (12) كبد من الاغنام والماعزالبالغة ومن كلا الجنسين واستعمل التشريح العياني وعمل قالب الراتنج التاكلي والتصوير الشعاعي لتبيان وتتبع مسارات التصريف الوريدي البابي والكبدي عند كلا الفصيلتين. اوضحت الدراسة عدم وجود اختلافات كبيرة في تفرعات الوريد البابي داخل الكبد عند الاغنام والماعز ولكن الوريد البابي في الاغنام اضيق قليلا مما هو عليه في الماعز, وبينت الدراسة ان الوريد البابي ينقسم الى ثلاثة افرع رئيسية ,فرع بين فصيصي ظهري ايمن ومن ثم فرعين بين فصيصيين بطني ايمن وايسر ,يجهز الفرع بين الفصيصي الظهري الايمن النتوء الذيلي والجزء الوحشي الظهري من الفص الايمن يقتصرتوزيع الفصيص الداخلي الأيمن على الجزء البطني من الفص الايمن وهو فرع قصير وعريض اما الفرع بين الفصيصي الايسر وهو فرع طويل وضيق يتفرع داخل اجزاء الفص الايسر والحلمي يجهز الفص الذيلي للمعز بفرع ذيلي صغير منفرد.اشارت الدراسة الى ان الاوردة الكبدية التي تصرف الدم من الكبد عند الاغنام والماعز تصنف الى مجموعتين من الاوردة (الكبيرة والصغيرة). وبينت الدراسة ان الاوردة الكبدية الكبيرة في الاغنام تشمل (الايمن والايسر والاوسط) بينما في الماعز وريد ايسر كبير ووريديين ايمن واوسط صغيرين وتنتهي مجتمعة في الوريد الاجوف السفلي على حين ان كل من الاوردة الصغيرة الذيلي والحلمي تنتهي باستقلالية تامة في الاجوف السفلي .كذلك بينت الدراسة ان الاوردة الكبدية الكبيرة عددها (3-4) تصرف الدم الوريدي من الفص الايمن والاوسط والايسر بينما تصرف الاوردة الصغيرة الدم الوريدي من الفص المذيل والحلمي .

الكلمات المفتاحية:مشاهدات عيانية ، شعاعية ، الوريد البابي الكبدي ، الأغنام ، المعز .