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Estimation Of Age In Rahmani Sheep By Determination Of Epiphyseal Closure Times Of The Stifle Joint

Mohamed T. Samy*, Nabela I. El-Sharkawy, Khlood M. Ibrahim and Taghred S. Mohamed

* Dept. of Surgery, Faculty of Veterinary Medicine, Zagazig University Forensic Medicine and Toxicology Dept., Faculty of Veterinary Medicine, Zagazig University

ABSTRACT

There is a lack in previous studies aiming to determine epiphyseal closure times in Rahmani Sheep in relation to age estimation. Thirty Rahmani sheep of both sexes and of different ages (one day to forty four months old) were examined radiographically for determination of epiphyseal plate closure time of the stifle joint. The present study recorded that the patella was completely ossified at 6 months old. The closure of the distal femoral physis and the proximal tibial physis was achieved at 30 months of age in Rahmani sheep while the apophyseal line closure of the tibial tuberosity was completed at 42 months in Rahmani sheep. This study concluded the possibility of age determination using x-ray in Rhamani sheep.

INTRODUCTION

Estimation of age is an important task for forensic experts especially in developing countries where birth records are often not well maintained *(1)*.

Age determination in animals constitutes a medicolegal importance whereas; it helps in identification of both living and dead animals, evaluation of meat quality, assessment of skeletal maturity and detection of animal adulteration.

Appearance and fusion of different ossification centres with their corresponding bones has been proved to be a reliable tool for this purpose *(1)*.

The latest scientific method available today for estimation of age is the radiological study of epiphyseal union of long bones *(2)*. The accurate determination of the epiphyseal closure times has a great importance in determination of the approximate age of an animal when the exact date of birth is not available.

This study was carried out owing to the limited literature regarding age estimation in sheep with aid of timing of epiphyseal closure of the stifle joint. However, *(3)* studied the time of epiphyseal fusion of limb bones of sheep. He found that, the distal epiphysis of femur fused at 18-20 months. At 25 months old, the proximal epiphysis of tibia was fused to the shaft. The complete union of the tubercle and shaft was at 30 months old. Furthermore, both of the distal epiphysis of the femur and the proximal tibial epiphysis were closed anatomically at 3.5 years of age in small ruminants *(4)*.

The objective of this work was to determine the epiphyseal plates closure times of the stifle joint in relation to estimation of the age in Rahmani sheep.

MATERIAL & METHODS

The present study was carried out on 30 Rahmani sheep of both sexes having different ages (one day to forty four months old). The animals were collected from different villages in Sharkia Province. The ages of these animals were obtained from the birth date known by the owner and confirmed by dentition *(5)*. They were put under investigation for radiographic description of the normal epiphyseal lines and their closure times in stifle joint. The stifle joint of each animal was examined radiographically (latero- medial and antero-posterior views).The focal film distance was nearly constant 90 cm in all radiographs.

Fischer mobile x-ray unit with maximum output of 125 K.V. and 100 to 300 mA was used. The exposure factors used were 50 K.V. and 5 mAs.

RESULTS

The ossification centres and normal radiographic changes of the stifle joint at different ages in sheep (one day-44 months old).

The different ossification centres of the distal femur, proximal tibia & patella and their closure times at the stifle joint are illustrated in the Table 1.

Table 2. Illustrated the different ossification centres of the distal femur, proximal tibia and patella and their closure times at the stifle joint.

	The ossification centres of the distal femur			The ossification centres of the proximal tibia						Patella
	Distal femoral physis			Proximal tibial physis			Apophyseal centre of the cranial tibial tuberosity			
	Dorsal third	Middle third	Planter third	Dorsal third	Middle third	Planter third	Proximal third	Middle third	Distal third	
1 day old	2 mm	1.5 mm	1.5 mm	1.5 mm	1.5 mm	1.5 mm	4 mm	2 mm	4 mm	Incompletely ossified (irregular contour and granular subchondal bone opacity)
1 month old	1.8 mm	1.3 mm	1.2 mm	1.2 mm	1 mm	1.4 mm	3 mm	1.5 mm	3.7 mm	
3 months old	1.3 mm	1.1 mm	1.2 mm	1 mm	0.7 mm	1.4 mm	2.7 mm	1.5 mm	3.3 mm	
6 months old	1 mm	0.5 mm	1.2 mm	0.8 mm	0.5 mm	1.1 mm	2.4 mm	1.2 mm	3.3 mm	
9months old	1 mm	C.F.	1 mm	0.7 mm	0.3 mm	0.9 mm	1.8 mm	1.1 mm	3.3 mm	Disappearance of its subchondal bone opacity (smooth concave articular surface & regular contour)
12months old	0.8 mm	C.F.	0.9 mm	0.3 mm	C.F.	0.8 mm	1.8 mm	0.8 mm	2.7 mm	
15 months old	0.5 mm	C.F.	0.7 mm	C.F.	C.F.	0.6 mm	1.5 mm	0.8 mm	2.4 mm	
18 months old	I.F.	C.F.	0.5 mm	C.F.	C.F.	0.4 mm	1.5 mm	0.7 mm	2.4 mm	
21 months old	C.F.	C.F.	0.5 mm	C.F.	C.F.	0.4 mm	1.2 mm	0.6 mm	2.2 mm	
24 months old	C.F.	C.F.	F.F	C.F.	C.F.	F.F.	0.9 mm	0.4 mm	2 mm	
30 months old	C.F.	C.F.	C.F.	C.F.	C.F.	C.F. + Radio opaque line	C.F.	0.2 mm	1.4 mm	
33 months old	C.F.	C.F.	C.F.	C.F.	C.F.	C.F. without radio opaque line	C.F.	C.F.	1.2 mm	
36 months old	C.F.	C.F.	C.F.	C.F.	C.F.		C.F.	C.F.	0.7 mm	
42 months old	C.F.	C.F.	C.F.	C.F.	C.F.		C.F.	C.F.	C.F. + Radio opaque line	
44 months old	C.F.	C.F.	C.F.	C.F.	C.F.		C.F.	C.F.	No radio opaque line	

F.F.: faint fusion I.F.: incomplete fusion C.F.: complete fusion

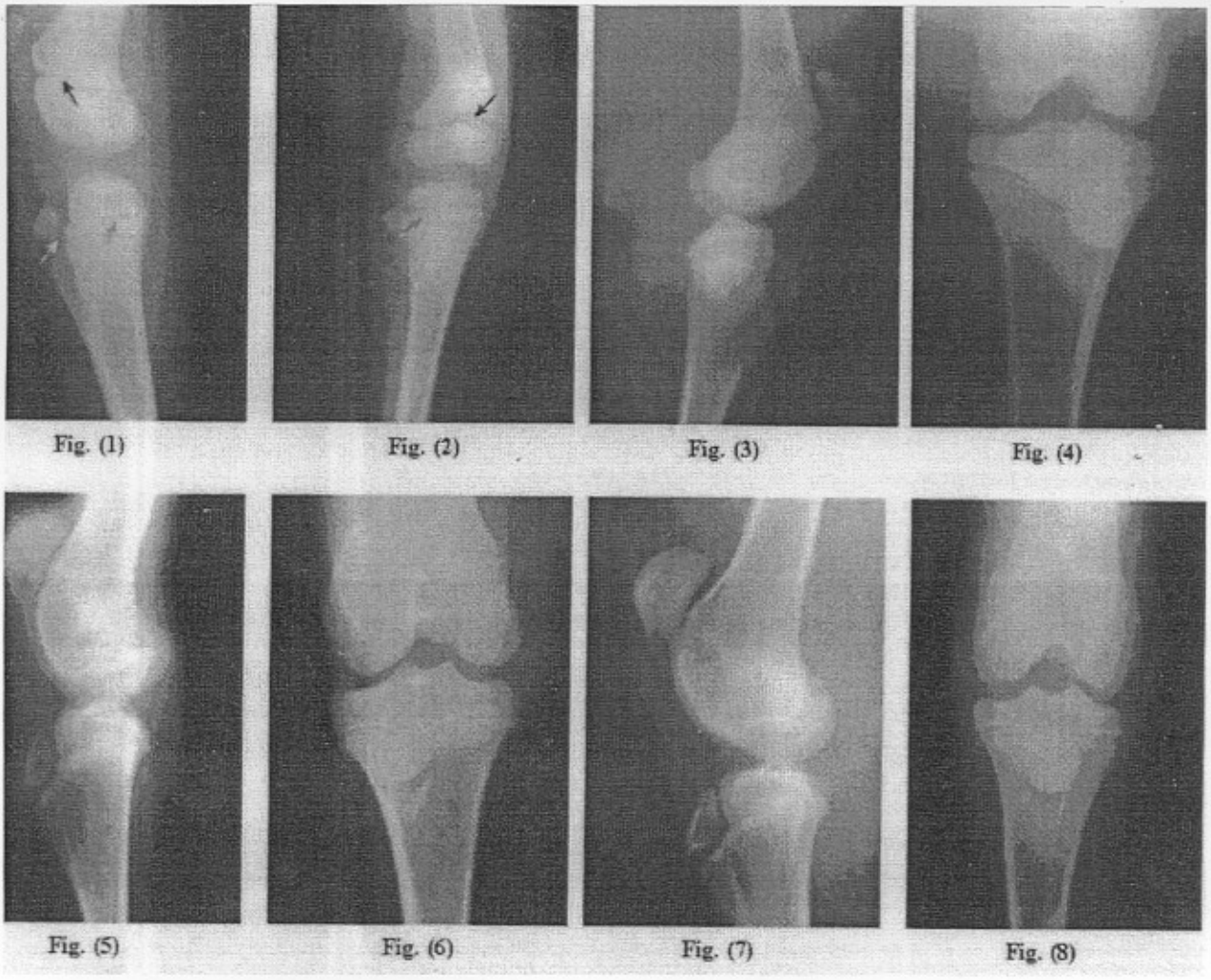

Fig. (1) Fig. (2) Fig. (3) Fig. (4)

Fig. (5) Fig. (6) Fig. (7) Fig. (8)

Fig. 1. Latero medial radiograph of the stifle joint of one day old sheep. Notice four ossification centres; distal femoral physis with irregular outlines, Patella with irregular contour, proximal tibial physis and apophysis of the tibial tuberosity.

Fig. 2. Antero-posterior radiograph of the stifle joint of one day old sheep. Notice distal femoral physis, proximal tibial physis and sloped tibial condyles.

Fig. 3. Latero-medial radiograph of the stifle joint of one month old sheep. Notice the narrowing of the proximal tibial physis and the cresentic shaped patella.

Fig. 4. Antero-posterior radiograph of the stifle joint of one month old sheep. Notice the slight increase of the medial intercondylar eminence of the tibia in height in comparison with the lateral one.

Fig. 5. Latero-medial radiograph of the stifle joint of three months old sheep. Notice narrowing of the distal femoral physis at its dorsal and middle thirds.

Fig. 6. Antero-posterior radiograph of the stifle joint of three months old sheep. Notice clear and deep intercondylar fossa. Pointed and higher medial intercondylar eminence is demonstrated.

Fig. 7. Latero-medial radiograph of the stifle joint of six months old sheep. Notice quadrilateral shaped patella with smooth concave articular surface and disappearance of subchondral bone opacity. Also narrowing of the proximal tibial physis at its middle third is evident.

Fig. 8. Antero-posterior radiograph of the stifle joint of six months old sheep. Notice The medial intercondylar eminence is clearly pointed and higher than the lateral one. The tibial condyles approach the horizontal plane.

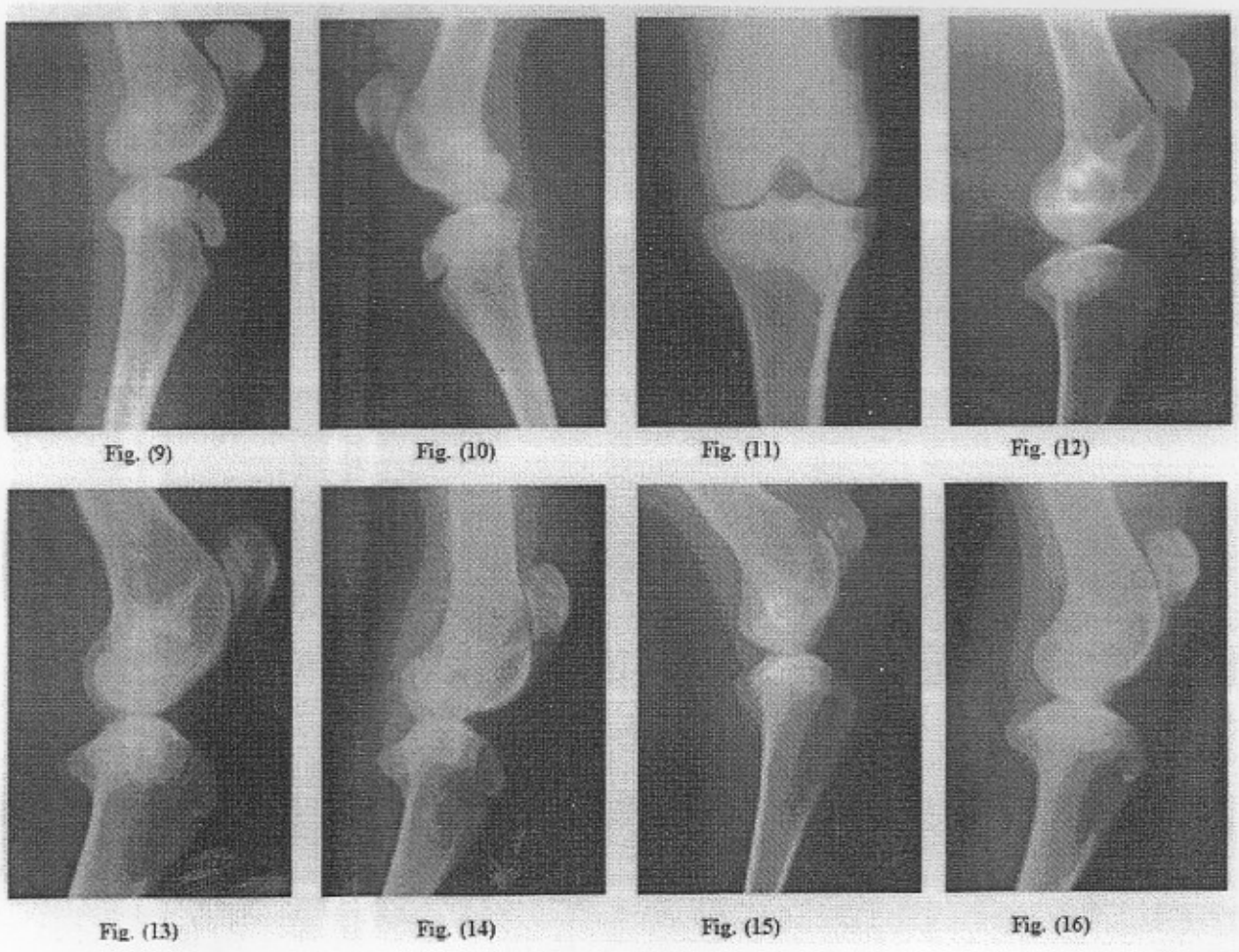

Fig. (9) Fig. (10) Fig. (11) Fig. (12)

Fig. (13) Fig. (14) Fig. (15) Fig. (16)

Fig. 9. Latero-medial radiograph of the stifle joint of nine months old sheep. Notice complete fusion of the middle third of the distal femoral physis.

Fig. 10. Latero-medial radiograph of the stifle joint of twelve months old sheep. Notice complete fusion of the middle third of the proximal tibial physis.

Fig. 11. Antero-posterior radiograph of the stifle joint of twelve months old sheep. Notice the tibial condyles become horizontal.

Fig. 12. Latero-medial radiograph of the stifle joint of fifteen months old sheep. Notice complete fusion of the dorsal third of the proximal tibial physis.

Fig. 13. Latero-medial radiograph of the stifle joint of eighteen months old sheep. Notice some what fusion of the dorsal third of the distal femoral physis except a small part dorsally.

Fig. 14. Latero-medial radiograph of the stifle joint of twenty one months old sheep. Notice complete fusion of the dorsal third of the distal femoral physis.

Fig. 15. Latero-medial radiograph of the stifle joint of twenty four months old sheep. Notice faint fusion of the planter third of the distal femoral physis and faint fusion of the planter third of the proximal tibial physis.

Fig. 16. Latero-medial radiograph of the stifle joint of thirty months old sheep. Notice complete fusion of the planter third of the distal femoral physis and complete fusion of the planter third of the proximal tibial physis. Complete fusion of the proximal third of the tibial tuberosity apophyseal line is also evident.

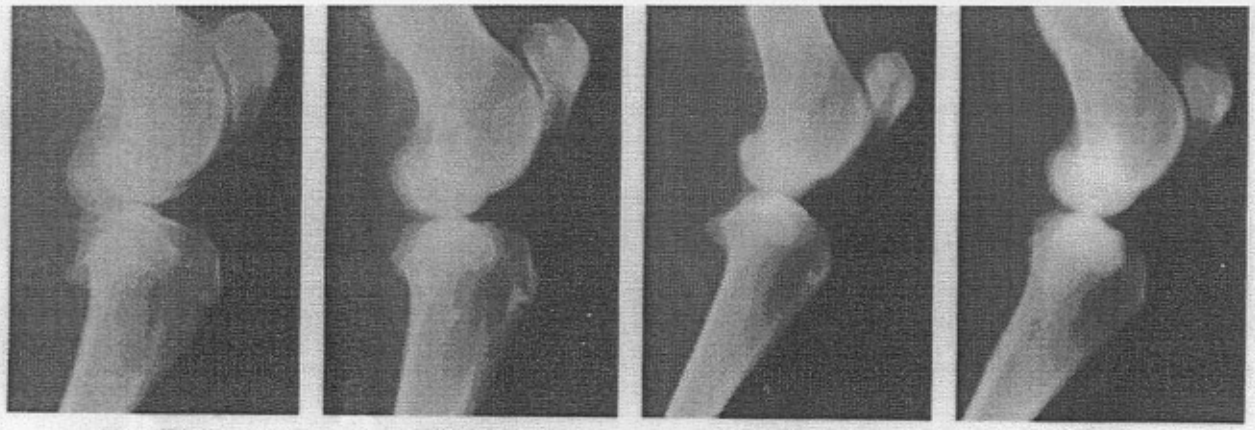

Fig. (17) Fig. (18) Fig. (19) Fig. (20)

Fig. 17. Latero-medial radiograph of the stifle joint of thirty three months old sheep. Notice complete fusion of the middle third of the tibial tuberosity apophysis.

Fig. 18. Latero-medial radiograph of the stifle joint of thirty six months old sheep. Notice marked narrowing of the distal third of the tibial tuberosity apophysis.

Fig. 19. Latero-medial radiograph of the stifle joint of forty two months old sheep. Notice complete fusion of the apophyseal line of the tibial tuberosity with presence of the radio-opaque line at its distal third.

Fig. 20. Latero-medial radiograph of the stifle joint of forty four months old sheep. Notice disappearance of the radio-opaque line at fused apophyseal line.

DISCUSSION

Epiphyseal closure can be used to estimate an animal's age or specify its stage of development when the exact birth date is not available. Furthermore, radiographic studies of the development of the different ossification centres and their fusion times can help in determination of the degree of bone maturation in relation to the animal age.

The recorded radiological findings for determination of the ossification centres and their closure times in sheep are not completely described due to lack of literature concerning this subject. The most available literature concerning the epiphyseal closure times were concentrated mainly on carnivores and horses. Sporadic studies were carried out on small ruminants *(3, 4)*.

The present study indicated that the stifle joint in Rahmani sheep possesses four ossification centres; the distal femoral physis, the proximal tibial physis, the apophysis of the tibial tuberosity and patella.

Concerning the characters of the closure of both epiphyseal and apophyseal lines of the stifle joint; it was found that the closure of the distal femoral physis, the proximal tibial physis started first at the middle third then progressed to include the dorsal third and lastly the planter third. While the apophyseal line closure of the tibial tuberosity started firstly at the proximal third then the middle third and lastly the distal one.

The closure of the patella is indicated by disappearance of the granular subchondral bone opacity and appearance of smooth regular contour of the articular surface which occurred earlier at 6 months old.

The closure of the distal femoral physis, the proximal tibial physis was achieved at 30 months of age in Rahmani sheep. It has been recorded previously that in small ruminants, the anatomical closure of the distal femoral physis and the proximal tibial physis were completed at 42 months old *(4)*. Therefore, the radiological demonstration of the epiphyseal and apophyseal lines closure is considered more accurate than that of the anatomical studies. This is also supported the previous findings *(6)*. On the other hand, earlier fusion times in the stifle joint of sheep were recorded at 18-20 months for the distal femoral physis

and 25 months for the proximal tibial physis *(3)*.

The present study reported that the closure of the tibial tuberosity was achieved at 42 months of age in Rahmani sheep. This result differs from that which stated that the closure of the centre occurred at 30 months of age in sheep *(3)*. This may be attributed to whether the examination was anatomical or radiographical, breed of animals, nutrition, vitamins supply and hormonal balance *(7-10)*.

Concerning the radio-opaque line, its appearance is an indication for complete closure of the epiphyseal plates as that mentioned times and it disappeared with aging. It was disappeared at 33 months of age at the proximal tibial physis and at 44 months of age at the apophysis of the tibial tuberosity.

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الملخص العربى

دراسات طبية شرعية لتقدير العمر في الأغنام الرحمانية باستخدام الأشعة السينية

محمد تيسير سامي* ، نبيلة امام الشرقاوي، خلود محمد ابراهيم ، تغريد صابر محمد

* قسم الجراحة - كلية الطب البيطري - جامعة الزقازيق

قسم الطب الشرعى والسموم- كلية الطب البيطري - جامعة الزقازيق

يوجد نقص في الدراسات السابقة التي تهدف الي تقدير العمر في الأغنام الرحمانية عن طريق تحديد أوقات إلتئام الصفائح الغضروفية. أجريت هذه الدراسة علي ثلاثون من الأغنام الرحمانية لكلا الجنسين في أعمار مختلفة من عمر يوم واحد وحتي أربعة و أربعون شهرا وذلك لتحديد أوقات إلتئام الصفائح الغضروفية لعظام مفصل الركبة الخلفية باستخدام الأشعة السينية. وقد أوضح الفحص أن عظمة الرضفة تتمعظم عند عمر سته أشهر. وقد وجد أن كلا من الخط الكردوسى السفلى لعظمه الفخذ و الخط الكردوسى العلوى لعظمه الساق يلتحم عند عمر ثلاثون شهرا بينما النتوء الامامى لعظمه الساق يلتحم عند عمر أثني و أربعون شهرا. ومما سبق يتضح أنه يمكن استخدام الأشعة السينية كوسيلة لتقدير العمر فى الأغنام الرحمانية.