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**CLINICAL AND BIOCHEMICAL ASPECTS ASSOCIATED
 WITH RICKETS IN YOUNG GOATS**
 (With One Table & 3 Figures)

By

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الصورة الإكلينيكية والبيوكيميائية المصاحبة للكساح في صغار الماعز

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أوضحت الدراسة أن أهم الأعراض الإكلينيكية للكساح في صغار الماعز هي حدوث تصلب أثناء الحركة وتعثر في المشي والميل للرقاد مع وجود تشوه في الأرجل الأمامية وتورم في مفاصل الركبة وأماكن اتصال الضلوع بعظمة القص . وقد أظهر الفحص الراديولوجي وجود تضخم في نهايات العظام الطويلة للأرجل الأمامية وكذلك عند اتصال الضلوع بعظمة القص مع وجود إنحناء في عظام الأرجل الأمامية . كما وقد لوحظ إنخفاضا معنويا في مستوى كل من فيتامين د₃ ، الكالسيوم والفسفور غير العضوي وإرتفاع معنوي في نشاط أنزيم الفوسفاتيز القلوي في مصل دم الحيوانات المصابة عنها في السليمة - بينما لم يتأثر مستوى كل من الماغنسيوم والحديد والنحاس في مصل دم الحيوانات المريضة عنها في الحيوانات السليمة . مما يرجح أن نقص فيتامين د₃ يمكن أن يكون سببا في حدوث المرض في الحيوانات المصابة .

SUMMARY

Clinical rickets was detected in eight young goats showed stiffness, stumbling gait, enlargement of carpal joint and costochondrial junctions, bending of forelimbs and increased tendency to laydown and kneeling. Three animals were dyspnoeic. Curvature of long bones and enlargement of epiphyses and costochondrial junctions were revealed on radiographic examination. Hypovitaminosis D₃, hypocalcaemia, hypophosphataemia and increased activities of serum alkaline phosphatase, were the remarkable biochemical alterations in rachitic young goats.

INTRODUCTION

Rickets was known to be an important disease affecting young animals causing severe locomotor disturbances and decreases their growth performance. The disease

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occurs due to poor mineralization of the growing bones and characterized by a defective calcification leading to bending of long bones, widened and irregular growth plates particularly at the costochondrial junctions (ROBINSON and HAUXTABLE, 1988). Rapid growth, dietary deficiencies of energy and protein and low vitamin D reserves especially during the winter months, were related to the occurrence to clinical rickets (Bonniwell *et al.*, 1988 and SMITH, 1990).

Clinical manifestations of nutritional rickets in lambs were described (ROSSOW *et al.*, 1977; ATTIA, 1984; BONNIWELL *et al.*, 1988 and MOHAMED, 1990). However the clinical rickets in goats was available only in the article presented by YOUSIF *et al.* (1986).

Still scanty the literature on the relationship between the deficiency or imbalanced levels of calcium, phosphorus and vitamin D and the incidence of clinical rickets in goats. These were investigated by NISBET *et al.* (1966); FIELD *et al.* (1975) and ROSSOW *et al.* (1977). The authors, stated that vitamin D and calcium deficiency either associated with deficiency or excess of dietary phosphorus were responsible for clinical rickets in lambs.

This work aimed to investigate clinical, radiological findings as well as alterations in some serum constituents associated with clinical rickets in young goats.

MATERIAL and METHODS

Out of thirteen young goats of both sexes of 2-6 months old, eight showed signs of stiffness and bone deformities, the other five young goats were clinically healthy and used as control. All animals were related to the goat flock of the farm station Faculty of Vet. Medicine, Suez Canal University. The doeses were fed on commercial concentrate mixture at a rate of 0.5 kg/head daily. Kids were left to suckle naturally and kept indoors till weaning.

All animals under study were clinically examined according to KELLY (1984). Blood samples were obtained from diseased and clinically healthy animals for separation of serum. Serum calcium, inorganic phosphorus, magnesium, copper, iron and serum alkaline phosphatase levels were determined colorimetrically using test kits after GINDLER and KING (1972); EL-MERZABANI *et al.* (1977); NEILL and NELLY (1956); ZAK (1958); DIXON (1973) and EL-AASER *et al.* (1978), respectively. Serum vitamin D₃ was assayed by high performance liquid chromatography (HPLC), after VUILLEUMIER *et al.* (1983) using Beckman HPLC model 432 at wavelength 254 nm. Radiographic examination was adopted after GILLETTE *et al.* (1977).

RESULTS

Clinical findings:

Stiffness, enlargement of the carpal joint, bending of the forelegs (Fig. 1) and enlargement of the costochondrial junctions (rachitic rosary) were observed among

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all clinically rachitic animals. Three animals were unable to stand without assistance and when forced to move, a short stumbling gait was noticed, such animals showed signs of moderate dyspnoea with increased rate and depth of respiration (35/minute). Lameness and tendency to lie down and kneeling were common signs among the other affected animals. Body temperature was within the normal range (39.2 - 39.8°C). Appetite was not affected in all diseased cases.

Radiographical findings

Radiographic examination revealed an enlargement of the epiphyses of long bones. The metacarpal bones showed abnormal curvature fore wards and outwards at the knee (Fig. 2). A visible thickening at the costochondral junction (Fig. 3) was also observed.

Biochemical findings

Serum biochemical findings of clinically healthy and rachitic animals are represented in table 1.

DISCUSSION

Rickets is a disease of young rapidly growing animals due to inadequate mineralization of young newly formed bones. Rickets per se is not a fatal disease but complications and intercurrent infections as tetany, pneumonia and enteritis are likely to cause death in rachitic than normal animals (BLOOD *et al.*, 1986).

The clinical signs of stiffness, enlargement of the carpal joint, bending of the forelegs and enlargement of the costochondral junctions (rachitic rosary) and increased tendency to laydown, reported in affected animals, were similar to that described by YOUSIF *et al.* (1986) in clinically rachitic goats and by ATTIA (1984), BONNIWELL *et al.* (1988) and MOHAMED (1990) in rachitic lambs.

Radiographic findings revealed an enlargement of the epiphyses of long bones; bending of radius and ulna as well as thickening of the epiphyseal growth plates at the costochondral junctions. These findings were coincided with that reported by MOHMED (1990) in rachitic lambs. The radiographic changes may be attributed to failure of ossification of the growth plates and improper mineralization of normally formed osteoid tissue (ROBINSON and HAUXTABLE, 1988 and GILLETTE *et al.*, 1977).

Regarding biochemical analysis (table 1), there were a highly significant ($P < 0.01$) decreases in serum calcium (6.68 ± 0.46 mg%) and serum inorganic phosphorus (2.73 ± 0.28 mg%) in clinically rachitic young goats in comparison with clinically healthy ones.

Similar hypocalcaemia and hypophosphataemia were recorded by ATTIA (1984), MOHAMED (1990) and YOUSIF *et al.* (1986) in clinical rickets in sheep and goats.

In the present work, there was an extremely lowered serum concentration of vitamin D₃ (1.73 ± 0.16 ng/ml in rachitic young goats versus 7.33 ± 0.87 ng/ml in

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clinically healthy animals). This was in accordance to the results obtained by BONNIWELL *et al.* (1988) in rachitic young sheep.

This extremely low vitamin D₃ may point to a primary vitamin D deficiency as an important cause of rickets in this study. It has been established that vitamin D deficiency cause lack of absorption of calcium and phosphorus from the intestine (COLES, 1986 and ROBINSON and HAUXTABLE, 1988).

A highly significant ($P < 0.01$) elevation of serum alkaline phosphatase concentration (866.4±52.3 i.u/L) were characteristic in rachitic animals. Our data were in accordance with these reported by ROSSOW *et al.* (1977) MAHIN *et al.* (1984) and BONNIWELL *et al.* (1988). This may be attributed to the disturbance in mineral metabolism of the oestoid and cartilaginous matrix of developing bone (EL-SHERIF and FAHMY, 1981). Furthermore, HARPER (1969) and JONES (1971) stated that the activity of alkaline phosphatase increases significantly and is almost diagnostic in rickets. The authors added that, it is possible that the animal endeavours in this way to provide more phosphorus.

Serum levels of magnesium, iron, copper were non significantly ($P > 0.05$) changed in rachitic young goats in comparison with clinically healthy ones. Similar data were obtained by MAHIN *et al.* (1984), BONNIWELL *et al.* (1988) and MOHAMED (1990) in rachitic young sheep.

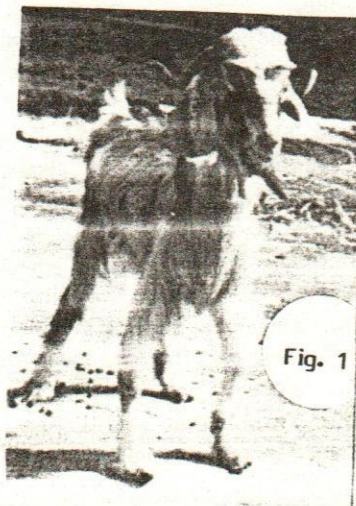
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Fig. 1: A five month old goat showed clinical rickets: note the enlargement at knee joint and the abnormal forward and outwards curvature of the long bones of the forelimbs.



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Fig. 2: Dorso-palmar radiograph of a forelimb of a five month old goat showing bending of long bones and enlargement of epiphyses at carpal joint.

Fig. 3: Lateral chest radiograph of a five month old goat showing marked thickening of costochondral junctions (rachitic rosary).

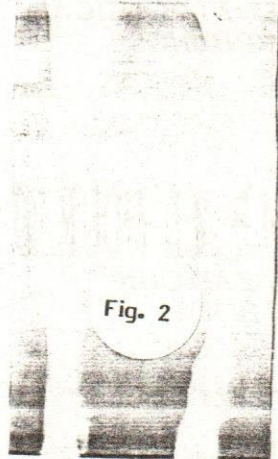


Table 1: Mean values \pm S.E of some serum constituents in clinically healthy and rachitic young goats.

Parameter	Unit	Clinically healthy	Rachitic animals
		N = 5	N = 8
Calcium	mg %	10.8 \pm 0.68	6.63* \pm 0.46
Inorganic phosphorus	mg %	6.2 \pm 0.74	2.73* \pm 0.28
Magnesium	mg %	2.4 \pm 0.38	1.87 ^{N.S.} \pm 0.14
Iron	mg %	230.0 \pm 8.90	205.20 ^{N.S.} \pm 16.90
Copper	mg %	173.0 \pm 7.80	156.00 ^{N.S.} \pm 6.58
Alkaline phosphatase	I.U/L	177.5 \pm 26.30	866.40* \pm 52.30
Vitamin D3	ng/ml	7.33 \pm 0.87	1.73* \pm 0.16

N.S. = Not significant

* = Significant at $P < 0.01$