

**Hypocalcaemia in an eight-month-old lactating New Zealand White rabbit doe:  
A case report**

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**Abstract**

Hypocalcaemia, though well recognised in some animal species, is infrequently reported in rabbits, particularly during lactation. The present case report describes an eight-month-old primiparous, lactating New Zealand White rabbit doe that presented two weeks post-kindling with acute recumbency and inability to ambulate. Vital signs were normal and no fractures or pain responses were detected. The doe was found lying in an abnormal posture (sternal recumbency of forequarters, lateral of hindquarters), and two other does in the same rabbitry had previously exhibited similar signs under comparable management conditions. Blood sample was collected from the doe and subjected to serum electrolyte assay, while the feed was analyzed for mineral constituents. The serum electrolyte levels (mMol/L) were as follows (with the normal/reference values in brackets) – Bicarbonate: 24 (20 – 30), Chloride: 110 (90 – 110), Sodium: 146 (135 – 150), Potassium: 28.90 (3.8 – 7.8), Phosphorus: 10.09 (1.5 – 3.5), and Calcium: 1.84 (2.6 – 3.5). Results of feed mineral analysis of the self-formulated diet that was fed to the rabbit were as follows: Calcium – 0.91%, Phosphorus – 0.35%, Potassium – 1.20%, Sodium – 1.55%, Chloride – 0.027%, and Bicarbonate – 0.71%. Relative to normal/reference values for rabbits, the serum levels of potassium and phosphorus were markedly elevated, while serum calcium levels were notably low, suggesting hyperkalemia, hyperphosphatemia and hypocalcemia. The low levels of dietary calcium relative to phosphorus indicated a marginal Ca: P imbalance, and the high dietary sodium and potassium could have contributed to their elevated serum levels. These findings point to electrolyte derangement likely associated with dietary mineral imbalance and lactation-induced increased physiological demand. No medical intervention was attempted. However, emphasis was placed on confirmatory diagnosis and herd-level preventive adjustments. Vigilant dietary formulation, periodic mineral monitoring and awareness of such metabolic alterations may help prevent recurrence in intensive rabbitry systems.

**Keywords:** Rabbit; Lactation; Hypocalcaemia; Hyperkalemia; Hyperphosphatemia; Dietary mineral imbalance.

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## Introduction

A good state of health is basically necessary for efficient reproduction in animals and humans. According to Castellini *et al.*, (2010), profitability in rabbit production can be enhanced with optimisation of rabbit doe's reproductive performance. However, late gestation and lactation periods are metabolically quite challenging in the reproductive life of rabbit does (Manal *et al.*, 2010). Rabbit does with high milk producing ability likewise show milk fever signs as seen in dairy cows (Barlet, 1980).

Calcium and phosphorus make up to 65 – 70% of the total minerals in the animal body (Eshburiyev *et al.*, 2024). Hypocalcaemia in does may occur as a result of insufficient calcium in the feed or as a result of continuous use-up of calcium in milk production. In order to meet up with this demand, there will be calcium mobilisation from the bone into the serum pool, which is usually inadequate to replace the efflux of calcium used for lactation by the mammary glands. This further causes calcium imbalance that result to hypocalcaemia during lactation (Barlet, 1980). This condition has been reported to manifest as paresis and recumbency, and sometimes, death might eventually ensue (Bhanugopan and Livaart, 2014).

## Case History and Clinical Examination

An eight-month-old primiparous lactating New Zealand rabbit doe, housed in a cage with its kittens at the National Agricultural Extension and Research Liaison Services Rabbitry Unit, Zaria, Nigeria was presented to the Laboratory Animal Clinic Unit of Faculty of Veterinary Medicine Teaching Hospital of Ahmadu Bello University, Zaria with primary complaint of inability to walk. The case was presented the day that the clinical sign was observed, which occurred two weeks post kindling of seven kittens by the affected doe. The vital parameters were taken and were within the

normal range (Temperature – 39<sup>0</sup>C; Respiratory rate – 38 cycles/min and Pulse rate – 156 beats/minute), and the ocular mucous membranes were normal. Upon physical examination, the doe was seen lying on sternal recumbency in the forequarter with the fore-limbs extended while the hindquarter was in left lateral recumbency (Figure 1). During palpation of the limbs, there was no response to pain and there was no sign of fracture. Two similar cases have been previously reported in other multi-parous non-pregnant, non-lactating female rabbits of different physiological state in the same rabbitry. The rabbits in the pen were all fed self-formulated concentrate and dried groundnut haulms.



**Figure 1:** Photograph of the hypocalcaemic rabbit doe lying on sternal recumbency in the forequarter with the fore-limbs extended, with the hindquarter in left lateral recumbency.

## Laboratory Evaluations

Blood sample (3 ml) was collected through the jugular vein into a sterile plain sample bottle for blood serum biochemical analysis at the Department of Chemical Pathology, Ahmadu

Bello University Teaching Hospital, Zaria, Nigeria. The blood sample was centrifuged at 3,000 revolutions per minute for 10 minutes (Özkan and Pekkay, 2019) using a macro centrifuge machine (COLEMAN, 90-1, Brazil). The serum electrolytes ( $\text{HCO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Na}^+$ ,  $\text{K}^+$ , P, and  $\text{Ca}^{2+}$ ) were automatically determined using Ion Selective Electrodes (Audicom model AC9900, China). Furthermore, the feed given to the rabbits was also analysed for minerals such as Calcium, Phosphorus, Sodium, Potassium, Chloride and Bicarbonate. Sodium and Potassium were determined by Flame photometry, Phosphorus by spectrophotometry, and Calcium, Chloride and Bicarbonate were determined by Atomic Absorption Spectrometry.

As shown in the Table 1, the serum bicarbonate and chloride levels of the rabbit doe were within the normal/reference values, while the sodium was slightly above the reference range. The serum potassium and phosphorus values were extremely higher compared to the reference values, while the serum calcium level was lower than the normal serum lower threshold.

The feed ingredients that the owners stated that they used in formulating the rabbit doe's feed were: maize, soya bean meal, groundnut haulms, maize offal, bone meal, mineral-vitamin premix and salt; the proportions are listed in Table 2. Results of mineral analysis of the feed are presented on Table 3.

**Table 1:** Serum electrolytes levels (mMol/L) of the New Zealand White rabbit doe with hypocalcaemia, compared to normal/reference values.

Serum Electrolytes	Values obtained for the Rabbit doe (mMol/L).	Reference/Normal value (mmol/L).
<b>Bicarbonate</b>	24.00	16.2 – 38.0 (Vennen and Mitchell (2009)
<b>Chloride</b>	110.00	104.9 – 116.4 (Özkan <i>et al.</i> , 2012)
<b>Sodium</b>	146.00	139.3 –145.7 (Özkan <i>et al.</i> , 2012)
<b>Potassium</b>	28.90	3.02 – 4.67 (Özkan <i>et al.</i> , 2012)
<b>Phosphorus</b>	10.09	1.09 – 1.68 Özkan <i>et al.</i> , 2012)
<b>Calcium</b>	1.84	2.5 – 3.72 Özkan <i>et al.</i> , 2012)

**Table 2:** Feed ingredients and their amount used in making feed fed to the rabbit doe (as stated by the owner of the rabbit).

S/N	Ingredients	Amount (kg)
1.	Maize	20
2.	Soya beans meal	11.5
3.	Groundnut haulms	9.25
4.	Maize offal	7.5
5.	Bone meal	1.5
6.	Mineral-Vitamin Premix	0.125
7.	Salt	0.125
	Total	50 kg

**Table 3:** Percentage Mineral Composition of concentrate fed to the lactating rabbit doe that had hypocalcaemia.

S/No.	Minerals	Composition of feed (%)	Reference value (%) *
1.	Calcium	0.91	1.20
2.	Phosphorus	0.35	0.50
3.	Potassium	1.20	0.90
4.	Sodium	1.55	0.30
5.	Chloride	0.027	0.30
6.	Bicarbonate	0.71	–

\* All reference values are specific for lactating doe (Lebas, 1989).

### Management

No treatment/medical intervention was done. The decision to salvage the doe was reached by the client. Moreover, preference was given to confirmatory diagnosis in order to be armed with information that will help prevent further occurrence in the herd.

### Discussion

The main clinical sign observed in this case was paralysis. This indicates an underlying metabolic or systemic disturbance. Paralysis has been reported to be associated with calcium and potassium imbalances (Melillo, 2007). These minerals are important for muscle contraction and nerve impulse transmission (Bushinsky and Monk, 1998). The clinical presentation was exacerbated because the doe was lactating. Pregnancy and lactation are known to impose high metabolic demands on animals (Tanritanir *et al.*, 2009). In rabbits, lactation is especially demanding due to the high mineral content of rabbit milk (Jekl and Redrobe, 2013). Thus, increasing susceptibility to metabolic disorders when nutritional provisions are limited or inadequate.

The serum biochemical findings revealed marked hyperkalaemia, hyperphosphataemia and hypocalcaemia. Collectively, these explain the observed neuromuscular impairment

observed in this case. Hyperkalaemia in the affected doe is abnormal and may be attributed to severe tissue damage, leading to leakage of potassium from the intracellular to the extracellular space (Melillo, 2007). Also, pathological hyperphosphataemia may result from decreased renal excretion of phosphorus due to renal impairment (Hall and Hall, 2020). It could result from haemoconcentration associated with dehydration, or cellular release of phosphorus following cellular lysis (Walsh and O'Donovan, 2020).

The elevated serum phosphorus level is significant, as excess phosphorus can precipitate serum calcium, with resultant concurrent hypocalcaemia (Murray and Wolf 2024). The hypocalcaemia observed in this case is probably due to impaired calcium homeostasis, which is critical during lactation.

Rabbit milk has been reported to contain three to five times more calcium and phosphorus than cow milk (El-Sayiad *et al.*, 1994). This is a pointer to the high calcium requirement of lactating does. Furthermore, rabbits absorb nearly all dietary calcium through passive diffusion in the intestine and excrete excess calcium via the kidneys (Kucera *et al.*, 2017). Consequently, inadequate dietary calcium intake during lactation can lead to hypocalcaemia and possibly neuromuscular dysfunction (Liesegang *et al.*, 2024). Similar

findings of hypocalcaemia in lactating rabbit does have been reported by Barlet *et al.*, (1980).

Results of the feed analysis was a pointer to the aetiology of the observed biochemical abnormalities. According to de Blas and Wiseman (2003), rabbits require a dietary calcium-to-phosphorus ratio of approximately 1.5:1 to 2:1 for optimal metabolic balance. In this case, the dietary formulation showed low calcium content relative to phosphorus when compared with recommended reference values (Table 3). Additionally, maize constituted the largest proportion of the diet (20 kg) among all ingredients (Table 2). Cereals and grains, including maize have been reported to contain high levels of phosphorus (Halls, 2010). This may have contributed significantly to the excess serum phosphorus observed in this case.

The high dietary phosphorus and low calcium intake likely resulted in the calcium–phosphorus balance, thus, predisposing the lactating doe to hypocalcaemia. Such nutritional imbalance during periods of increased physiological demand can precipitate metabolic disorders linked to negative energy and mineral balance (Menchetti *et al.*, 2020). It is therefore believed that the feed composition is a major contributing factor to the clinical and biochemical abnormalities observed in this case.

**Conclusion:** The recumbency seen in the lactating rabbit doe was probably due to hypocalcaemia, as evident by the serum electrolyte and feed analysis result. The outcome of this case report shows that this condition may be the same as one of the metabolic diseases (milk fever) seen in cow during late pregnancy and lactation period, although this type of condition is not frequently reported in rabbit as seen in dairy cows.

### Conflict of interest

The authors declare no conflict of interest.

### References

- Barlet JP (1980): Plasma calcium, inorganic phosphorus and magnesium levels in pregnant and lactating rabbits. *Reproduction Nutrition Development*, 20 (3A): 647 – 651.
- Bhanugopan MS and Livaart J (2014). Survey on the occurrence of milk fever in dairy cows and the current preventive strategies adopted by farmers in New South Wales, Australia. *Australian Veterinary Journal*, 92(6): 200 – 205.
- Bushinsky DA and Monk RD (1998). Electrolyte quintet: Calcium. *The Lancet*, 352(9124): 306 – 311.
- Castellini C, Dal Bosco A, Arias-álvarez M, Lorenzo PL, Cardinali R, and Rebollar PG (2010). The main factors affecting the reproductive performance of rabbit does: a review. *Animal Reproduction Science*, 122: 174 – 182.
- de Blas C and Wiseman J (2003). *The Nutrition of the Rabbit*. CABI Publishing, Oxon, UK
- El-Sayiad GA, Habbeb AA and Maghawry AM (1994). A note on the effects of breed, stage of lactation and pregnancy status on milk composition of rabbits. *Animal Production*, 58: 153 – 157.
- Eshburiyev S, Mamatova Z, Achilov O, Karshiyev U, Aliyarov S, Eshimov D, Kholbekova G and Sattorov J (2024). Causes and prevention of disorders of calcium-phosphorus exchange in rabbits. *Bio Web of Conferences*, 118: 01013.
- Hall JE and Hall ME (2020). *Guyton and Hall Textbook of Medical Physiology*, 14th ed., Elsevier.

- Halls AE (2010). Nutritional Requirements for Rabbits. Shur-Gain, Nutreco, Canada Inc.
- Jekl V and Redrobe S (2013). Rabbit dental disease and calcium metabolism – the science behind divided opinions. *Journal of Small Animal Practice*, 54(9): 481 – 490. <https://doi.org/10.1111/jsap.12124>
- Kucera J, Koristkova T, Gottwaldova B and Jelk V (2017). Calcium sulphate dihydrate urolithiasis in a pet Rabbit. *Journal of the American Veterinary Medical Association*, 250: 534 – 537.
- Lebas F (1989). Nutritional Requirements of Rabbits: Bibliography and Perspectives. *Cuniculture Science*, 5: 1 – 28.
- Liesegang A, Burger B, de Vries de Heekelingen T, Schroeter-Vogt C, Hatt JM, Kowalewski MP, Clauss M (2024). Rabbits (*Oryctolagus cuniculus*) increase caecal calcium absorption at increasing dietary calcium levels. *Journal of Animal Physiology and Animal Nutrition*, 108(1): 185 – 193.
- Manal AF, Tonyb MA and Ezzo OH (2010). Feed restriction of pregnant nulliparous rabbit does: consequences on reproductive performance and maternal behaviour. *Animal Reproduction Science*, 120: 179 – 186.
- Melillo A (2007). Rabbit Clinical Pathology. *Journal of Exotic Pet Medicine*, 16 (3): 135 – 145.
- Menchetti L, Barbato O, Sforza M, Vigo D, Mattioli S, Curone G and Brecchia G (2020). Effects of diets enriched in linseed and fish oil on the expression pattern of toll-like receptors 4 and proinflammatory cytokines on gonadal axis and reproductive organs in rabbit buck. *Oxidative Medicine and Cellular Longevity*, 2020: 4327470.
- Murray SL and Wolf M (2024). Calcium and Phosphate Disorders: Core Curriculum. *American Journal of Kidney Diseases*, 83(2): 241 – 256.
- Özkan C, Kaya A and Akgül Y (2012). Normal values of haematological and some biochemical parameters in serum and urine of New Zealand White Rabbits. *World Rabbit Science*, 20: 253 – 259.
- Özkan Ö and Pekkaya S (2019). Normal values of biochemical parameters in serum of New Zealand White Rabbits. *Turkish Bulletin of Experimental and Tropical*, 76(2): 157 – 162.
- Tanritanir P, Dede S and Ceylan E (2009). Changes in some macro minerals and biochemical parameters in female healthy Siirt hair goats before and after parturition. *Journal of Animal and Veterinary Advances*, 8(3): 530 – 533.
- Vennen KM and Mitchell MA (2009). *Manual of Exotic Pet Practices*, Saunders, St. Louis, pp. 375-405.
- Walsh PA and O'Donovan DJ (2020). The kinetics of inorganic phosphate excretion in the acidotic rabbit during intravenous phosphate loading: A pseudo-ruminant model. *Scientific Reports*, 10(1): 3988. <https://doi.org/10.1038/s41598-020-61069-0>