Menoufia J. Animal, Poultry & Fish Prod., Volume 9 Issue 8 (2025) : 167 – 178

MENOUFIA JOURNAL OF ANIMAL, POULTRY AND FISH PRODUCTION

https://mjapfp.journals.ekb.eg/

BLOOD MINERALS AS A POTENTIAL RISK FACTOR FOR GENITAL PROLAPSE IN EGYPTIAN BUFFALOES

Reem S. Mourad

Animal Production Department, Faculty of Agriculture, Menoufia University, Egypt

Received: Aug. 11, 2025 Accepted: Aug. 30, 2025

ABSTRACT: This study examines the concentrations of certain macro- and micro-minerals in the blood serum of Egyptian buffaloes with genital prolapse and compares them with those of non-prolapsed postpartum buffaloes in the Menoufia Governorate, Egypt. The investigation included forty-five buffaloes from some Menoufia veterinary units; fifteen non-prolapsed buffaloes served as the control group. In comparison, the remaining thirty buffaloes exhibited signs of genital prolapse (15 buffaloes with uterine prolapse and another 15 with vaginal prolapse). Blood samples were collected, and blood Serum analysis included macro-minerals such as Ca, P, and Mg. In contrast, micro included Cu, Zn, Mn, Se, and Fe. The findings revealed a significant reduction in serum macro-mineral levels in prolapsed buffaloes compared to controls ($P < 0.01$). Ca concentrations were 6.22 and 10.98 mg/dL, P concentrations were 2.60 and 5.60 mg/dL, and Mg concentrations were 1.30 and 2.50 mg/dL in the prolapsed animals versus the control group, respectively. Levels of Cu, Se, Zn, Mn, and Fe were also markedly lower in the prolapsed group ($P<0.05$). Concentrations of Cu were 73.45 ±1.52 vs. 59.95 ±1.41µg/dL, Zn were 171.45 ±2.71 vs. 122.45 ±3.16 µg/dL, Fe were 366.05 ±2.85 vs. 349.60 ±4.73 µg/dL, Mn were 5.33±1.05 vs. 5.13 ±0.91 µg/dL, and Se were 0.14 ±0.05 vs. 0.11 ±0.06 µg/dL in non-prolapsed and prolapsed animals, respectively. Interestingly, buffaloes suffering from vaginal prolapse exhibited higher Ca levels compared to those with uterine prolapse ($P<0.05$). However, buffaloes with vaginal prolapse exhibited higher Zn levels compared to those with uterine prolapse ($P<0.05$). Deficiencies in Ca, P, Mg, Cu, Zn, Mn, Fe, and Se may contribute to the development of genital prolapse in Egyptian buffaloes.

Keywords: Blood Serum Minerals, Genital Prolapse, Vaginal Prolapse, Uterine Prolapse, Egyptian Buffalo.

INTRODUCTION

Genital prolapse, one of the most significant reproductive disorders in buffaloes, is commonly observed in the late stages of gestation and immediately postpartum. This condition constitutes a significant source of economic loss within the livestock industry by negatively affecting critical reproductive parameters, such as the interval to postpartum estrus, conception rates, and subsequent calving intervals (El-Wishy, 2007). Genital prolapse represents a significant obstetrical concern in buffaloes, accounting for 42.9% of all reproductive complications. Uterine prolapse is an acute postpartum emergency that typically occurs within 24 hours after parturition. If left untreated, this condition frequently results in death or serious medical complications. (Sharma *et al.*, 2025).

Poor myometrial contractions during the postpartum period and excessive traction during dystocia are two postulated etiologies for uterine prolapse in buffaloes. Furthermore, hypocalcemia (low serum calcium levels) has been identified as a significant risk factor, likely due to its critical role in facilitating effective uterine muscle tone and contraction (Purohit *et al.*, 2018). Vaginal prolapse occurs most frequently during gestation (Purohit, 2013) and the postpartum period (Purohit *et al.*, 2018), while uterine prolapse is predominantly a postpartum event (Medina *et al.*, 2004). Although less common, cases of vaginal prolapse have also been documented in non-pregnant buffaloes (Mishra *et al.*, 1997) and, rarely, during estrus (Krishna *et al.*, 2012). The underlying etiology of prolapse is primarily attributed to the relaxation or weakness of the

* Corresponding author: reem.mourad@agr.menofia.edu.eg

constrictor vestibuli muscle and vaginal muscular atony (Purohit, 2012).

Imbalances in minerals, especially Ca, P, Mg, and micro-minerals such as Cu and Zn, have been associated with a range of reproductive disorders, including uterine and vaginal prolapse. Both macro-and micro-minerals play critical roles in reproductive physiology, exerting direct and indirect influences on fertility and the overall productivity of livestock (Khan *et al*., 2014). The condition is multifactorial, with nutritional imbalances, particularly deficiencies in Ca, P, Mg, and micro-minerals such as Cu, Zn, and Se, playing a central role in weakening uterine and pelvic muscle tone (Ahmed *et al*., 2023).

The higher incidence of prolapse observed during summer months is associated with environmental factors, notably elevated temperature and humidity. The proposed mechanism involves the compounding physiological stresses of hormonal imbalance and nutritional challenge (Khan *et al*., 2021; Purohit, 2013).

Additionally, poor peripartum management, traction during difficult calvings, and delayed uterine involution may further predispose animals to prolapse (Akhtar *et al*., 2008). The identification of specific risk factors is crucial for developing effective preventive strategies and enhancing reproductive performance in buffalo herds. Documented seasonal patterns indicate a higher incidence of prolapse, with prepartum vaginal prolapse occurring most frequently in May and postpartum uterine prolapse peaking in July and September. These periods coincide with extreme summer heat and humidity, environmental stressors that compound hormonal and nutritional challenges. Central to this issue is mineral nutrition, as imbalances, whether deficiencies or excesses, can severely compromise reproductive function and overall productivity.

Key macro-minerals (Ca, P, Na, K) and trace elements (Cu, Co, Zn, Fe, Se, I, Mo, Mn) are all considered vital for sustaining normal reproductive physiology. Therefore, integrating environmental management with precise nutritional supplementation to address these seasonal stressors is essential for mitigating loss and improving herd health (Underwood, 1981).

MATERIALS AND METHODS

The present investigation was conducted over a period of five months, from May 2023 to September 2023, in selected veterinary units located in Menoufia Governorate, Egypt. The veterinary units affiliated with the Directorate of Veterinary Medicine in Menoufia Governorate are distributed across various villages and administrative centers to ensure comprehensive service coverage. The Betanoun Veterinary Unit is in Betanoun village, Shebin El-Kom District (GPS: 30.5701°N, 30.9756°E). The Dabaiba Veterinary Unit is situated in Dabaiba village, Barka El-Sabaa District (GPS: 30.6396°N, 31.0079°E). The El-Mai Veterinary Unit (Mit Masoud), located in Mit Masoud village, Shebin El-Kom District, (GPS: 30.5890°N, 30.9612°E). This study was conducted in accordance with the guidelines approved by the Scientific Research Ethics and Animal Use Committee (SRE & AUC) at the Faculty of Agriculture, Menoufia University, Egypt. [Approval №: 28 – SRE & AUC-MUAGR - 06-2025]

Animals and Experimental Design: A total of forty-five postpartum Egyptian buffaloes were included in this study. The animals ranged in age from 4 to 10 years, with live body weights ranging between 450 and 600 kg, and were in their second to sixth parity. The study group was divided into two categories: fifteen non-prolapsed buffaloes served as the control group. In contrast, the remaining thirty buffaloes exhibited signs of genital prolapse (15 buffaloes diagnosed with uterine prolapse and another 15 with vaginal prolapse).

Feeding and Management: All buffaloes were raised under comparable feeding and management practices that reflect the traditional rural farming systems commonly used by smallholder farmers in the Menoufia Governorate, Egypt. The animals were fed a conventional diet consisting of a locally formulated concentrate mix estimated to contain 60% yellow corn, 15% wheat bran, 23%

soybean meal, 1% common salt, and 1% mineral mixture. This was offered alongside Egyptian green clover and rice straw as primary roughage sources. The ration was designed to meet the daily maintenance and lactation requirements of Egyptian buffaloes. Milking was performed manually twice a day, “in the early morning and late afternoon,” following traditional village practices.

Sample Collection and Mineral Analysis: Blood samples were collected aseptically from the jugular vein using clean test tubes. The samples were transported promptly to the laboratory, where they were centrifuged at 3,000 rpm for 15 minutes. The serum was carefully separated and stored at –20 °C until further chemical analyses were conducted. For mineral analysis, a 1 mL aliquot of blood serum was subjected to a digestion process using 10 mL of concentrated sulfuric acid and two drops of hydrogen peroxide. Following heating until the solution cleared, the digest was diluted 1:50 with distilled water. The concentrations of Ca, P, and Mg in the prepared samples were then quantified using spectrophotometry. An atomic absorption spectrophotometer (Unicam 929 AA) was employed for the analysis of serum Cu, Zn, Mn, Se, and Fe concentrations. For additional verification, a standard inductively coupled plasma optical emission spectrometer (ICP-OES, PerkinElmer Optima 2000 DV) was used, as described by Mourad (2019).

Statistical analysis: Data were statistically analyzed using the Statistical Analysis System software, SAS version 9.1 (SAS, 2004). Descriptive statistics were calculated for all variables. One-way analysis of variance was performed to assess the effect of prolapse status (non-prolapsed vs. Genital prolapse) and prolapse type (Uterine vs. Vaginal) on serum mineral concentrations. When significant differences were detected, the means were compared using Duncan’s Multiple Range Test at a significant level of $\alpha = 0.05$. The following model was used for the analysis: $Y_{ij}=\mu+T_i+e_{ij}$; **where:** Y_{ij} = the observation of the j^{th} animal under the i^{th} treatment group in model-1 (e.g., 1=non-prolapsed, 2= genital prolapse) and in model-2 (e.g., 1= uterine prolapse, 2= vaginal prolapse); μ = overall mean; T_i= fixed effect of the treatment group (i = 1, 2); e_{ij} = random error associated with each observation, assumed to be typically and independently distributed with mean zero and constant variance σ^2.

RESULTS AND DISCUSSION

1. Serum Macro-minerals

1-1 Non-prolapsed and genital prolapse buffaloes

A significant reduction (P<0.01) in serum Ca, P, and Mg levels was observed in buffaloes with genital prolapse compared to non-prolapsed postpartum controls. Specifically, the mean concentrations of Ca, P, and Mg were 6.22, 2.6, and 1.3 mg/dl, respectively, in the prolapsed group, compared to 10.98, 5.6, and 2.5 mg/dl in the control group. The findings in the non-prolapsed group are consistent with previously reported serum macro-mineral levels in late-pregnant Egyptian buffaloes, where Ca averaged 10.86 ± 1.72 µg/dL (a ref. range: 7.45–13.82 µg/dl), P averaged 7.91 ± 1.17 µg/dL (a ref. range: 5.71–10.35 µg/dl), and Mg was 3.09 ± 0.46 µg/dl (a ref. range: 2.20–3.93 µg/dl) (Abd Ellah *et al*., 2013). In the present study, hypocalcemia was evident in the prolapsed group compared to the control group, with a highly significant decrease in serum Calcium levels (P < 0.01). Calcium is critical for uterine/vaginal muscle tone; hypocalcemia weakens contractions, predisposing to prolapse. Ca is crucial for maintaining normal uterine and vaginal muscle tone, especially around parturition. Hypocalcemia impairs smooth muscle contractions, predisposing buffaloes to uterine and vaginal prolapse. P, which interacts with Ca in neuromuscular function, also tends to decrease in such cases, further compromising muscular integrity. Recent studies have demonstrated significantly lower serum levels of both Ca and P in prolapsed buffaloes compared to healthy controls. For instance, Khan *et al*. (2021) reported a marked reduction in Ca and P levels in Nili-Ravi buffaloes with vaginal prolapse before parturition.

Furthermore, significant reductions in the levels of P and Mg were also observed in prolapsed animals relative to the controls (P < 0.01), as shown in Table 1 and Fig. 1.

Table 1: Blood serum macro elements in non-prolapsed and prolapsed buffalo cows.

Items	Non-prolapsed	Genital Prolapse
	Mean ±SE (mg/dl)	Mean ±SE (mg/dl)
Ca	10.98 [a] ±0.65	6.22 [b] ±1.05
P	5.6 [a] ±1.51	2.6 [b] ±0.80
Mg	2.5 [a] ±0.53	1.3 [b] ±0.33
Ca: P ratio	1.96: 1	2.39: 1

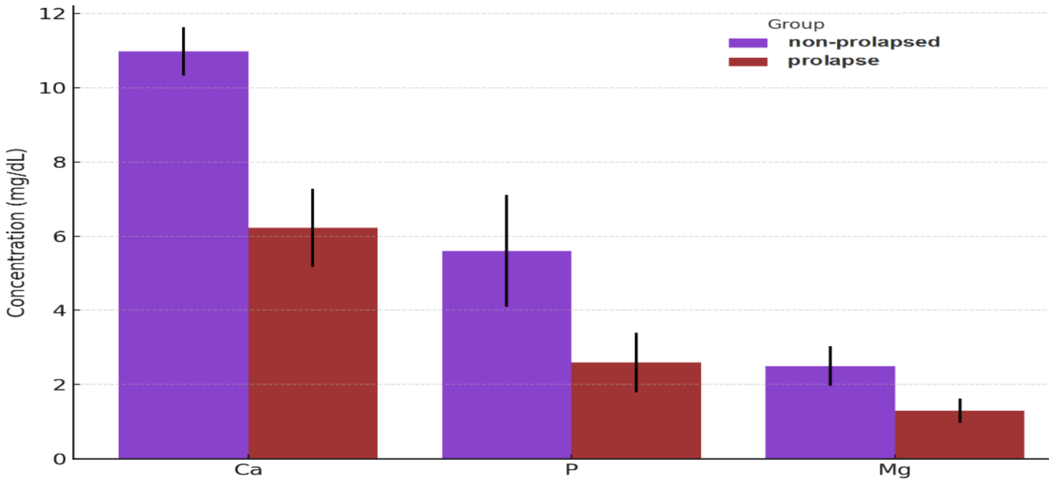

Fig. 1: Blood serum macro elements in non-prolapsed and prolapsed buffalo cows

Similarly, Ahmed *et al*. (2023) found that the levels of Ca (6.42 ± 1.05 mg/dl) and P (2.90 ± 0.85 mg/dl) were significantly lower (P<0.01) in prolapsed animals versus the control group. Also, the findings agree with a comparison of serum macro-minerals between healthy (control) and prolapsed buffaloes. Ca levels were significantly lower in the prolapsed group (7.03 ± 0.15 mg/dL) compared to the controls (9.16 ± 0.38 mg/dL, P = 0.00). In addition, prolapsed buffaloes exhibited markedly reduced serum Ca levels (7.25 ± 0.23 mg/100 ml) compared to controls (10.09 ± 0.08 mg/100 ml, P<0.01). Serum P was also lower in prolapsed buffaloes (3.88 ± 0.15 mg/100 ml). A significant difference in serum magnesium levels was observed on day 0, with prolapsed buffaloes exhibiting lower concentrations (1.50 ± 0.53 mg/100 ml) than those in the control group (2.40 ± 0.53 mg/100 ml) (Lakde *et al*., 2014). Although P and Mg levels were slightly reduced in prolapsed animals, the differences were not statistically significant (P = 0.07 and 0.65, respectively) (Gangwar *et al*., 2015).

These findings substantiate the critical pathophysiological role of macro-mineral deficiencies in the etiology of reproductive prolapse in buffaloes. This conclusion is consistent with earlier reports by Marques *et al.* (1996), who documented similar decreases in serum macro-mineral concentrations among affected animals. In particular, magnesium, which is essential for proper neuromuscular function, is frequently deficient in prolapsed buffaloes (Abbas & Fahed, 2016).

These results further align with those of Ahmed *et al.* (2005), who established a clear association between mineral deficiencies and reproductive disorders, especially genital prolapse. Their study revealed highly significant differences in key macro-minerals between prolapsed and non-prolapsed buffaloes.

Their study revealed highly significant differences ($P<0.01$) in key serum macro-minerals, with markedly lower calcium (6.42 ±1.05 vs. 10.96 ±0.95 mg/dL; t=11.55), reduced phosphorus (2.90 ±0.85 vs. 5.50 ±1.61 mg/dl; t=4.79), and decreased magnesium (1.50 ±0.53 vs. 2.40 ±0.53 mg/dL; t=4.38) in prolapsed compared to non-prolapsed buffaloes, indicating a strong link between these mineral deficiencies and the occurrence of prolapse.

While these findings underscore a significant association between macro-mineral deficiencies and genital prolapse, they contrast with the earlier report by Paul *et al.* (2000), who observed no significant differences in macro-mineral concentrations between affected and healthy animals. Notwithstanding this discrepancy, the observed hypocalcemia is physiologically critical, as it is likely to impair smooth muscle contraction, thereby compromising uterine tone and facilitating the occurrence of uterine prolapse. This mechanistic link between calcium deficiency and loss of reproductive tract integrity was previously elucidated by Risco *et al.* (1984), emphasizing the essential role of calcium in maintaining myometrial contractility in buffaloes.

1-2 Uterine prolapse and Vaginal prolapse in buffaloes

Vaginal prolapse is frequently attributed to the softening of pelvic tissues resulting from elevated estrogen concentrations in the late stages of pregnancy (Ali & Derar, 2015; Kumar *et al.*, 2015). As noted by Akhtar *et al.* (2012), prepartum vaginal prolapse often progresses to postpartum uterine prolapse due to the strain of parturition. It is accompanied by significant alterations in serum concentrations of estradiol, progesterone, and key minerals, such as Ca, P, and Mg, when compared to non-prolapsed buffaloes. However, in contrast to differences between prolapsed and healthy animals, the present study found no significant differences in serum Ca, P, or Mg levels between buffaloes with vaginal prolapse and those with uterine prolapse as shown in Table 2 and Figure 2, suggesting that while mineral deficiencies may predispose buffaloes to prolapse in general, the specific type of prolapse may not be distinguished by these mineral profiles.

This suggests that shared underlying pathophysiological mechanisms such as hypocalcemia, systemic inflammation, and physiological stress may contribute to both vaginal and uterine prolapse in buffaloes.

Discrepancies between these findings and those of previous studies may be due to variations in regional diet, environmental conditions, herd management practices, or sample timing. Nevertheless, the current results support the conclusion that deficiencies in calcium, phosphorus, and magnesium are significant contributing factors in the pathogenesis of genital prolapse in buffaloes.

In addition, these findings are consistent with those reported by Ahmed *et al.* (2005), who conducted a comparative analysis of macro-mineral levels in buffaloes affected by vaginal versus uterine prolapse. Their results indicated slightly higher calcium levels in the vaginal prolapse group (6.48 ± 1.04 mg/dL) compared to the uterine prolapse group (6.30 ± 1.12 mg/dL). Similarly, phosphorus concentrations were marginally elevated in cases of vaginal prolapse (3.05 ±0.90 mg/dL) relative to uterine prolapse cases (2.61 ±0.74 mg/dL). Magnesium levels also showed a modest increase in the vaginal prolapse group (1.52 ±0.61 mg/dL) compared to the uterine prolapse group (1.46 ±0.40 mg/dL). The Ca:P ratios were calculated as 2.12:1 and 2.41:1 for vaginal and uterine prolapse, respectively. However, none of these differences reached statistical significance, indicating that the mineral profiles between the two prolapse subtypes are broadly analogous.

Table 2: Blood serum macro elements in uterine and vaginal prolapsed buffalo cows.

Items	Uterine prolepses	Vaginal prolepses
	Mean ±SE (mg/dl)	Mean ±SE (mg/dl)
Ca	6.36 ±1.12	6.49 ±1.04
P	2.71 ±0.71	3.04 ±0.91
Mg	1.46 ±0.40	1.52 ±0.61
Ca: P ratio	2.39: 1	2.10: 1

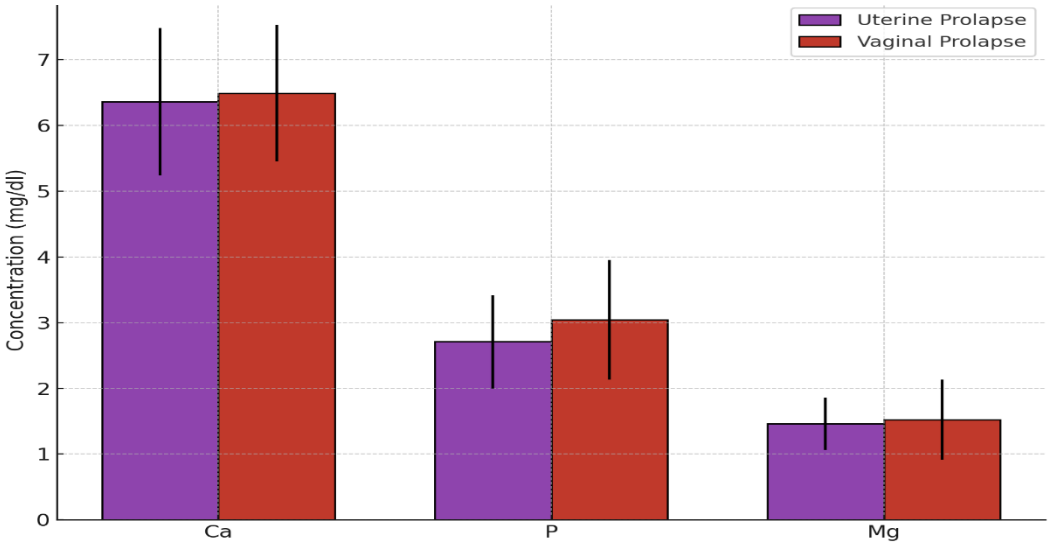

Fig. 2: Blood serum macro elements in uterine and vaginal prolapsed buffalo cows

It can be inferred that deficiencies in Ca and P, along with imbalances in Mg, may predispose buffaloes to prepartum vaginal prolapse. Moreover, Akhtar *et al.* (2008) noted that mineral levels, particularly those of Ca, P, and Mg, can be influenced by region- or zone-specific factors such as soil composition, forage quality, and management practices, further complicating the interpretation of their specific roles in reproductive health.

Mosa and Tahir (2016) further concluded that hypocalcemia, hypophosphatemia, and hypomagnesemia during late gestation and parturition are probable causative factors for postpartum uterine prolapse in buffaloes. Collectively, these studies underscore the essential role of macro-mineral homeostasis in maintaining reproductive tract integrity and preventing obstetrical complications. This is consistent with the findings of Ahmed *et al.* (2005), which also identified deficiencies in Ca, P, and Mg as significant predisposing factors for uterine prolapse.

2. Serum Micro-minerals

2-1 Non-prolapsed and genital prolapse buffaloes

In the present study, a highly significant ($P<0.01$) decrease in serum Cu, Se, and Zn concentrations was observed in prolapsed buffaloes compared to the non-prolapsed (control) group. In contrast, no significant differences were found in serum Fe and Mn levels between prolapsed and control animals. However, their values were numerically higher in the control group, as shown in Table 3 and Figure 3.

Table 3: Blood serum microelements in non-prolapsed and prolapsed buffalo cows.

Items	Non-prolapsed	Genital Prolapse
	Mean ±SE (µg/dL)	Mean ±SE (µg/dL)
Cu	73.45^{a} ±1.52	59.95^{b} ±1.41
Zn	171.45^{a} ±2.71	122.45^{b} ±3.16
Fe	366.05 ±2.85	349.60 ±4.73
Se	0.14^{a} ±0.05	0.11^{b} ±0.06
Mn	5.33±1.05	5.13 ±0.91

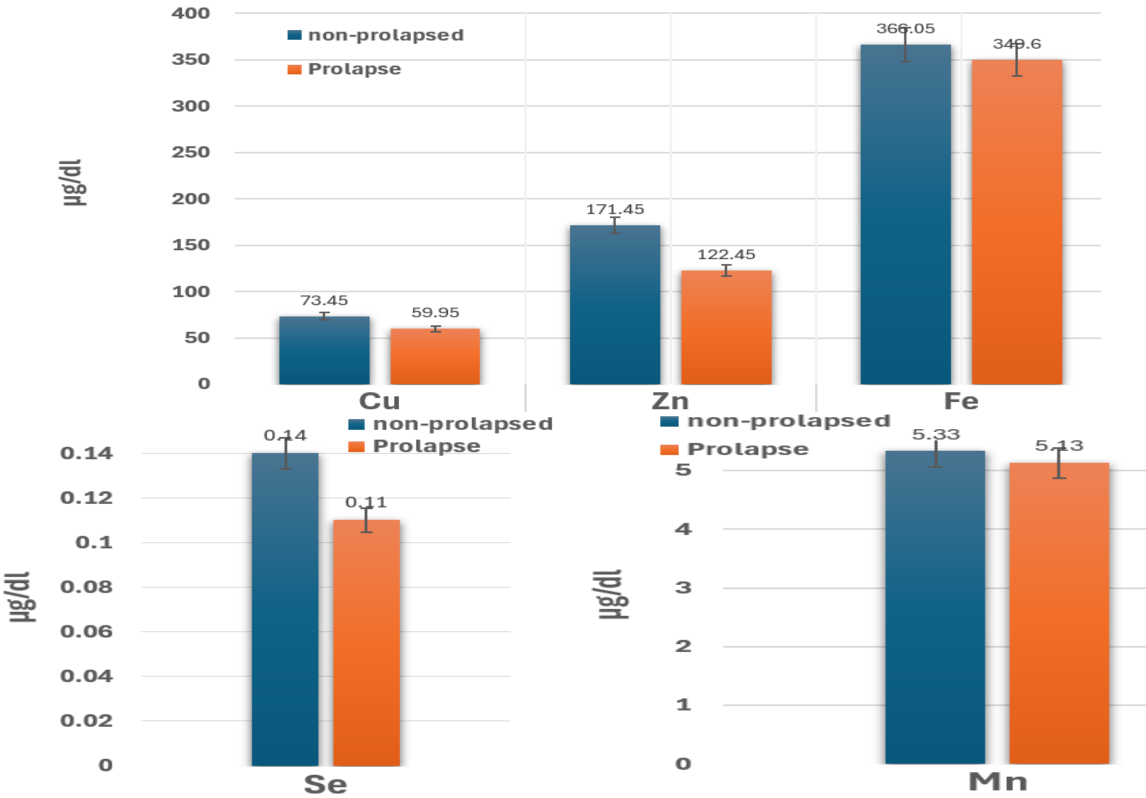

Fig. 3: Blood serum microelements in non-prolapsed and prolapsed buffalo cows

The findings in the non-prolapsed group are also in agreement with previously reported serum Cu concentrations in late-pregnant Egyptian buffaloes, which averaged 78.91 ± 21.86 µg/dL (with a reference range of 51.08–151.15 µg/dL) (Abd Ellah *et al.*, 2013). The analysis revealed that serum concentrations of Cu and Zn were significantly lower ($P<0.01$) in prolapsed buffaloes compared to the controls, with mean Cu levels of 59.95 vs. 73.45 µg/dL, Zn levels of 122.45 vs. 171.45 µg/dL, and Se levels of 0.11 vs. 0.14 µg/dL in the prolapsed and control group, respectively. In contrast, Fe and Mn levels did not differ significantly between the two groups. Further comparison between uterine and vaginal prolapse cases revealed that Zn levels were significantly higher ($P < 0.05$) in vaginal prolapse cases (127.15 µg/dL) compared to uterine prolapse cases (115.15 µg/dL).

The analysis revealed non-significant differences in the concentrations of Cu, Fe, Se, and Mn between the prolapsed and control animals. This outcome partially supports the hypothesis that micro-mineral deficiencies are involved in the pathogenesis of genital prolapse, specifically implicating elements like Zn, while suggesting that Cu, Fe, Se, and Mn may not be primary factors. This pattern is consistent with the results of Bhatti *et al.* (2006), who found a similar distinction between significant and non-significant micro-mineral levels in affected versus healthy buffaloes. Cu and Zn levels were significantly lower in prolapsed animals, with Cu decreasing from 73.45 ±7.52 µg/dL in non-prolapsed to 59.95 ±6.41 µg/dL in prolapsed animals (t = 6.10, P<0.01), and Zn decreasing from 171.45 ±20.71 µg/dL to 122.45 ±13.16 µg/dL (t = 8.92, P<0.01). In contrast, no significant differences were observed in Fe and Mn levels between the groups, as Fe levels were 366.05 ±42.85 µg/dL in control and 349.60 ±40.73 µg/dL in prolapsed buffaloes (t = 1.24, NS), while Mn levels were 5.33 ±1.05 µg/dl and 5.13 ±0.91 µg/dl, respectively (t = 0.64, NS). These findings suggest a strong association between Cu and Zn deficiencies and the occurrence of genital prolapse in buffaloes.

The findings of the present study align with those of Kelkar *et al*. (1989), who reported that serum Mn concentrations in buffaloes with genital prolapse did not differ significantly from those in non-prolapsed pregnant animals. This consistency suggests that sufficient levels of Mn were present in the diet, and that its serum concentration may not be significantly influenced by physiological changes associated with genital prolapse in buffaloes.

2-2 Uterine prolapse and Vaginal prolapse in buffaloes

Table 4 and Figure 4 show that there were no statistically significant differences in the serum concentrations of Cu, Fe, Se, and Mn between buffaloes with uterine and vaginal prolapses. However, the serum levels of these elements (Cu, Fe, Se, and Mn) were numerically lower in animals with vaginal prolapse compared to those with uterine prolapse. Specifically, their concentration did not show a significant difference between the two groups.

Table 4: Blood serum microelements in uterine and vaginal prolapsed buffalo cows

Items	**Uterine prolepses**	**Vaginal prolepses**
	Mean ±SE (µg/dL)	**Mean ±SE (µg/dL)**
Cu	61.02 ±2.56	59.27 ±2.54
Zn	115.15[a] ±3.99	127.15[b] ±3.01
Fe	344.0 ±3.96	352.66 ±4.75
Se	0.11 ±0.04	0.10 ±0.05
Mn	4.71 ±1.08	5.37 ±0.75

In contrast, serum Zn levels in buffaloes with vaginal prolapse were significantly higher than those recorded in buffaloes with uterine prolapse ($P < 0.05$), indicating a distinct pattern in Zn metabolism associated with the type of reproductive disorder. There was no significant difference in serum Cu, Se, Fe, and Mn concentrations; meanwhile, serum values of buffaloes with vaginal prolepses were lower than those recorded in animals with uterine prolepses. So, serum Cu levels did not differ significantly between the animals of the two groups (Table 4). However, serum zinc concentrations in buffaloes with vaginal prolapses were significantly higher than in animals with uterine prolapses (P < 0.05), as shown in Table 4.

Cu has a considerable effect on fertility (Dabas *et al.*, 1987). All previous factors were suspected to cause genital prolapse in buffalo cows. Furthermore, it has been shown that hypocalcemia results in myometrial fatigue and delays cervical involution, both of which could predispose to uterine prolapse (Murphy & Dobson, 2002). The reduced values of micro-minerals in the mother at the time of parturition might also be a cause of this postpartum prolapse (Ahmed *et al.*, 2005).

The results of this study demonstrate a significant association between genital prolapse in Egyptian buffaloes and deficiencies in certain macro- and micro-minerals, particularly Ca, P, Mg, Cu, and Zn. The observed hypocalcemia in prolapsed buffaloes is consistent with findings from previous research, suggesting that low Ca levels impair uterine muscle contractility, increasing the risk of uterine prolapse.

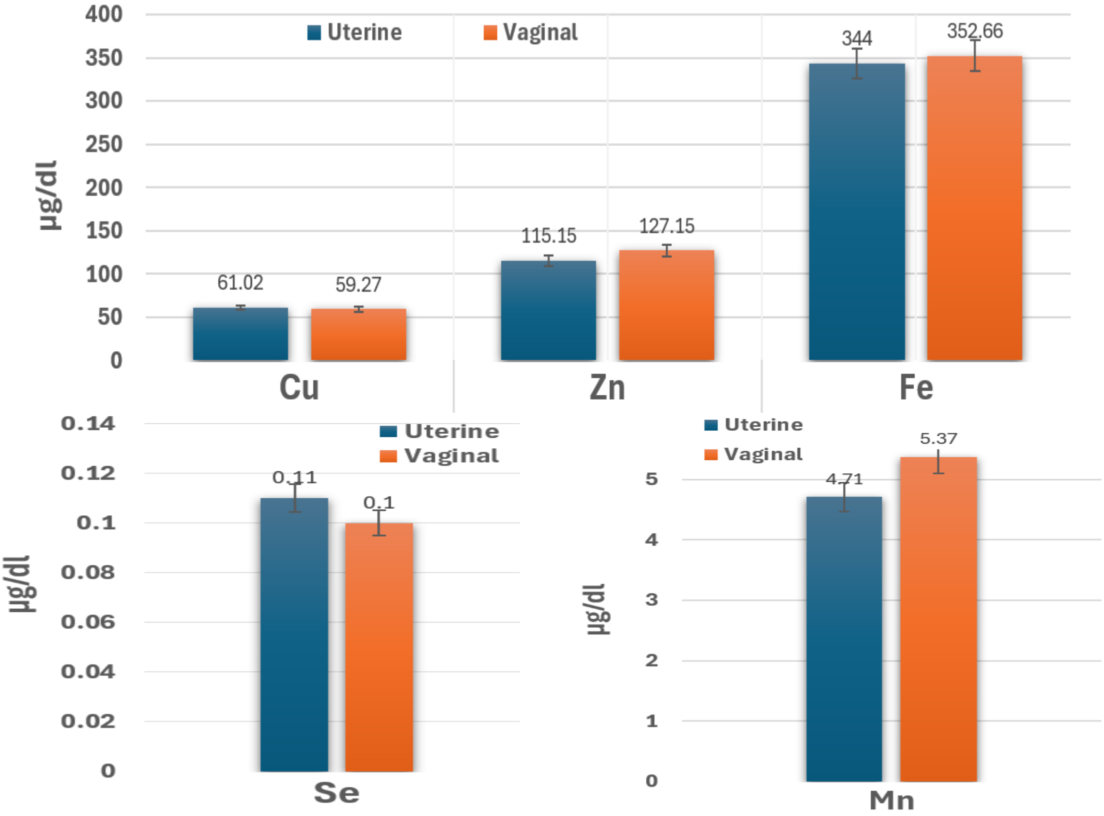

Fig 4: Blood serum microelements in uterine and vaginal prolapsed buffalo cows

Risco *et al*. (1984) noted that Ca deficiency can result in muscular atony, contributing to the failure of uterine involution and subsequent prolapse.

The current findings further reinforce the role of Ca, P, and Mg imbalances as potential contributing factors to genital prolapse, particularly during the periparturient period. Although no significant differences were detected in macro-mineral levels between vaginal and uterine prolapse cases, both conditions likely share similar pathophysiological mechanisms, such as mineral deficiency, inflammation, and metabolic stress.

These findings are consistent with the results of Bhatti *et al*. (2006), who reported that the mean serum micro-mineral concentrations in uterine and vaginal prolapse buffaloes, Zn levels were significantly higher in animals with vaginal prolapse (127.25 ±12.04 µg/dl) compared to those with uterine prolapse (115.25 ±11.98 µg/dl), with a t-value of 2.18 ($P<0.05$). No significant differences were observed in Cu, Fe, or Mn concentrations between the two groups. Cu levels were 61.00 ± 6.54 µg/dL in uterine prolapse cases and 59.25 ± 6.52 µg/dL in vaginal prolapse (t = 0.58, NS). Fe levels were slightly higher in the vaginal group (354.66 ± 39.75 µg/dL) compared to the uterine group (342.00 ± 43.69 µg/dL), but the difference was not statistically significant (t = 1.62, ns).

Similarly, Mn levels showed no significant variation between the two conditions. These findings suggest that Zn may play a differential role in the pathophysiology of uterine versus vaginal prolapse in buffaloes. This is supported by Akhtar *et al*. (2012), who also found similar mineral profiles among diverse types of prolapse.

The notable decrease in serum copper and zinc in prolapsed animals corresponds with findings by Bhatti et al. (2006), who documented analogous patterns in buffaloes across various production systems. Although no significant differences were observed in serum iron and manganese levels, the reduced mean values in prolapsed buffaloes may indicate subclinical deficiencies or imbalances that require further investigation.

Interestingly, Zn levels were found to be higher in vaginal prolapse cases compared to uterine prolapse ($P<0.05$), which may reflect differences in the timing or physiology of these conditions. However, the clinical significance of this finding remains to be determined and may relate to localized tissue responses or hormonal regulation.

Conclusion

This study highlights the critical role of mineral nutrition in maintaining reproductive health in buffaloes. The results emphasize the need for regular monitoring of mineral status, especially during late gestation and the postpartum period, to prevent complications such as genital prolapse.

Genital prolapse in Egyptian buffaloes is significantly associated with deficiencies in key macro- and micro-minerals, particularly Ca, P, Mg, Cu, Se, and Zn. These imbalances may impair uterine tone and delay involution, predisposing animals to prolapse. While Fe and Mn levels showed no significant changes, lower mean values in prolapsed cases suggest possible subclinical roles.

Regular monitoring and targeted mineral supplementation during late gestation and early postpartum periods are recommended to reduce the risk of prolapse and enhance reproductive performance.

REFERENCES

Abbas, M.F. & Fahad, T.A. (2016). Effect of deficiency of some minerals (calcium, non-organic phosphorus, and magnesium) on the occurrence of uterine prolapse in the local buffalo breed in Basra province. Basrah J. Vet. Res., 15(3): 27–33.

Abd-Ellah, M.R.; Hamed, M.; Ibrahim, D.R. and Rateb, H.Z. (2013). Reference values for hematological and serum biochemical constituents in late pregnant buffaloes. Assiut Vet. Medical J. 59: 35–46.

Ahmed, M.; Farooq, U.; Ullah, H.; Khan, M.F.; Yousaf, A. and Ahmad, I. (2023). Association of serum macro-minerals with uterine prolapse in Nili-Ravi buffaloes. Pakistan Vet. J., 43(1): 102–106.

Ahmed, S.; Ahmad, I.; Lodhi, L.A.; Ahmad, N. and Samad, H.A. (2005). Clinical, hematological and serum macro-mineral contents in buffaloes with genital prolapse. Pakistan Vet. J., 25(4): 167–170.

Akhtar, M.S.; Lodhi, L.A.; Ahmad, I.; Qureshi, Z.I. and Muhammad, G. (2008). Serum concentrations of calcium, P, and Mg in pregnant Nili-Ravi buffaloes with or without vaginal prolapse in irrigated and rain fed areas of Punjab. Pak. Vet. J., 28(3): 107–110.

Akhtar, M. S.; Lodhi, L. A.; Ahmad, I.; Qureshi, Z. I. and Muhammad, G. (2012). Serum ovarian steroid hormones and some minerals concentrations in pregnant Nili-Ravi buffaloes with or without pre-partum vaginal prolapse. Pakistan Vet. J., 32(2); 265–268.

Ali, A. and Derar, D.R. (2015). Comparative Theriogenology, Qassim Univ., Baraydah, Saudi Arabia.

Bhatti, M.S.; Ahmad, I.; Ahmad, N.; Lodhi, L.A. and Ahmad, M. (2006). Epidemiological survey of genital prolapses in buffaloes kept under different systems and serum micro-mineral contents. Pakistan Vet. J., 26(4): 197–200.

Dabas, Y. P. S.; Singh, S. P. and Saxena, O. P. (1987). Serum concentrations of certain minerals in anestrus cows and buffaloes. Indian J. Animal Reproduction, 7: 98–101.

El-Wishy, A. B. (2007). The postpartum buffalo: I. Endocrinological changes and uterine involution. Anim. Repro. Sci., 97: 201–215.

Gangwar, C.; Kumar, R.; Singh, S.P.; Singh, S.K.; Srivastava, M.K. and Saxena, A. (2015). Serum metabolites and macro mineral profile of prepartum buffaloes affected with cervicovaginal prolapse. Indian J Anim. Sci, 85(6): 575-577.

Kelkar, M.A.; Khar, S.K. and Mandakhot, V.M. (1989). Studies on antepartum prolapse of vagina in buffaloes and plasma trace element concentrations. Arch. für exper. Vet., 43(2): 315–318.

Khan, H.M.; Bhakat, M.; Mohanty, T.K. and Pathbanda, T.K. (2014). Influence of vitamin E, macro-and micro-minerals on reproductive performance of cattle and buffalo, A review. Agricultural Review, 35(2): 113–121.

Khan, M.A.; Javed, K.; Niaz, M.; Sattar, A.; Khan, M. S. and Saeed, M. (2021). Hemato-biochemical profile and mineral imbalance in Nili-Ravi buffaloes with vaginal prolapse. Tropical Anim. Health and Prod., 53(6): 1–7.

Kumar, S.R.; Verma, H.K.; Umapathi, L.; Gandotra, V.K. and Kasrija, R. (2009). Plasma estradiol concentrations during prepartum vaginal prolapse in buffaloes. Indian J. Anim. Sci., 79: 1001-1003

Krishna, K. M.; Dharani, S. and Prabhakar, K. (2012). Estrual prolapse and its clinical management in bovines: A report of three cases. Intas Polivet, 13: 31–33.

Lakde, M. B.; Markandeya, N. M.; Sanap, N. A.; Biradar, B. P. and Chaudhari, R. J. (2014). A haemato-biochemical study of postpartum buffaloes with uterine prolapse. Intas Polivet, 15(2): 400-402.

Marques, L. C.; Marques, J. A.; Peiro, J. R.; Oliveira, J. A. and Mendes, L. C. N. (1996). Serum calcium, P, and magnesium levels in cows with cervicovaginal or uterine prolapse. Arquivo Brasileiro de Medicina Vet. e Zootecnia, 48(2): 165–173.

Medina, N. P.; Torres, E. and Landicho, E. (2004). Uterine prolapse in Bulgarian Murrah buffaloes (Bubalus bubalis L.) and its association with post-parturient serum calcium level and other related risk factors. Philippine J. Vet. and Anim. Sci., 30(2): 153–159.

Mishra, U. K.; Agrawal, R. G. and Pandit, R. K. (1997). Clinical study on prolapses of genitalia in Murrah buffaloes. Indian J. Anim. Reproduction, 18(2): 124–126.

Mosa, F. A. and Tahir, A. F. (2016). Effect of deficiency of some minerals (calcium, non-organic P, and magnesium) on occurrence of uterine prolapse in local buffaloes breed in Basra province. Basrah J. Vet. Res., 15(3): 27–33.

Mourad, RS. (2019). Retained placenta in Relation with Blood Components in Egyptian crossbred cattle. JITV 24(3): 103-111.

Murphy, A. M. and Dobson, H. (2002). Predisposition, subsequent fertility, and mortality of cows with uterine prolapse. Vet. Record, 151: 733–735.

Paul, S. S.; Chawla, D. S. and Lall, D. (2000). Serum mineral profile and its relationship with reproductive disorders in Nili-Ravi buffaloes. Ind. J. Anim. Nut., 17(4): 324–327.

Purohit, G.N. (2012). Postpartum complications in large animals. In G. N. Purohit (Ed.), Domestic Animal Obstetrics (pp. 551–603). Lambert Academic Publishing.

Purohit, G.N. (2013). Maternal complications of gestation in the buffalo: Etiology, antenatal diagnosis, and management. Bubaline Theriogenology. Inter. Vet. Inf. Service.

Purohit, G.N.; Arora, A.S.; Gocher, T.; Gaur, M.; Saraswat, C.S. and Mishra, P. (2018). Uterine prolapse in buffaloes: A review. Asian Pac J Reprod.; 7(6): 241-247.

Risco, C. A.; Reynokls, J. P. and Hird, D. (1984). Uterine prolapse and hypocalcemia in dairy cows. J. the American Vet. Medical Association, 185 (12): 1517–1519.

Sharma, A.; Jamwal, K. and Ahuja, A. (2025). Vaginal cystocele along with evisceration in uterine prolapsed buffalo. Buffalo Bulletin, 44(1): 21-25.

SAS (2004). SAS/STAT® 9.1 User's Guide. Cary, NC: SAS Institute Inc.

Underwood, E. J. (1981). The Mineral Nutrition of Livestock (2nd ed.). Commonwealth Agric. Bureaux.

معادن الدم كعوامل خطر محتملة لانقلاب الأعضاء التناسلية في الجاموس المصري

ريم صابر مراد

قسم الإنتاج الحيواني، كلية الزراعة، جامعة المنوفية، مصر.

الملخص العربي

هدفت هذه الدراسة إلى تقييم مستويات بعض العناصر المعدنية الكبرى والصغرى في سيرم الدم لإناث الجاموس المصري المصابة بانقلاب في الأعضاء التناسلية، ومقارنتها بنظيرتها العشار السليمة في محافظة المنوفية، مصر. شملت الدراسة ٣٠ حالة من الجاموس المصاب بانقلاب في الأعضاء التناسلية و١٥ أنثى سليمة بعد الولادة كمجموعة كنترول. تم جمع عينات الدم وفصل السيرم، وتم تحليل العناصر الكبرى (الكالسيوم، الفوسفور، المغنيسيوم) باستخدام جهاز التحليل الضوئي، وتم تحليل العناصر الصغرى (النحاس، الزنك، المنجنيز، السيلينوم، الحديد) بجهاز الامتصاص الذري. أظهرت النتائج انخفاضًا ملحوظًا في تركيزات العناصر الكبرى لدى الإناث المصابة مقارنة بمجموعة الكنترول ($P<0.01$)، إذ بلغ متوسط تركيز الكالسيوم ٦,٢٢ مقابل ١٠,٩٨ ملجم/ديسيلتر، والفوسفور ٢,٦٠ مقابل ٥,٦٠ ملجم/ ديسيلتر، والمغنيسيوم ١,٣٠ مقابل ٢,٥٠ ملجم/ ديسيلتر بالنسبة للحيوانات المصابة والسليمة على التوالي. كما انخفضت مستويات النحاس والزنك والسيلينيوم انخفاض معنوي في الإناث المصابة ($P<0.01$)، في حين كانت الفروق معنوية في مستويات الحديد والمنجنيز ($P<0.05$) . قد لوحظ ارتفاع مستوى الكالسيوم والزنك في حالات الانقلاب المهبلي مقارنة بحالات الانقلاب الرحمي ($P<0.05$). و تُشير النتائج إلى أن النقص في العناصر المعدنية مثل الكالسيوم، الفوسفور، المغنيسيوم، النحاس والمنجنيز والسيلينيوم والزنك قد يُمثل عوامل محتملة للإصابة بانقلاب الأعضاء التناسلية في الجاموس المصري.

الكلمات المفتاحية: معادن سيرم الدم، انقلاب الأعضاء التناسلية، الجاموس المصري.