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Effect of Transition Period in Buffalo Cows on Some Biochemical Parameters

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Abstract

The transition period is defined as the period from three week before calving until three weeks after calving; however, there is insufficient available data reflecting changes in this period in buffaloes. The present study is carried out in Assuit Governorate, Egypt on 30 Egyptian buffalo cows from 4 to 6 years old. The average body weight between 350 and, 450 kg and her average daily milk yield was 10 kg per animal/day during the transition period. Whole blood samples were collected from these buffaloes for determination of Liver function enzymes (Aspartate aminotransferase, Alanine aminotransferase, lactate dehydrogenase, Total bilirubin and Total proteins), Kidney function test (Blood urea nitrogen and Creatinine), some Lipid profile (Total cholesterol and Triglyceride) and Minerals (Calcium, Potassium and Chloride). Blood samples were collected seven times from every animal every week three times before, after and during parturition. The result appeared that a highly significant increase in Aspartate aminotransferase, Alanine aminotransferase, Creatinine, Total cholesterol, Triglyceride and calcium in the Pre-partum period. But Lactate dehydrogenase, Total bilirubin, Total protein and, Blood urea nitrogen were a highly significant increase in Post-partum period. Non-significant changes in Potassium and Chloride along transition period.

Keywords: liver function, kidney function, lipid profile, minerals, metabolism

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Introduction

Buffaloes are the main source of good quality milk and meat in the valley of the River Nile in Egypt and some other developing countries despite this species is mostly reared under difficult socioeconomic conditions and shows low productive and reproductive potentials (El-Wishy, 2006). Buffalo is a large ruminant animal which has contributed to the integrated farming systems as a source of draught power, transportation, farm manure, meat, milk and livelihood of the farmers, diet flexibility, high disease resistance, and acceptability to a wide range of feeding, and management conditions (Wanapat and Kang, 2013).

During the transition period from late pregnancy to early lactation, most dairy cattle characterized by negative energy balance (NEB), hypocalcemia, insulin resistance, reduced immune function, and infectious diseases (Morsy et al., 2021). Buffaloes are a quiet different metabolic form in comparison with other ruminants and studies on physiology of the transition period in buffaloes are limited (Fiore et al., 2017).

Pregnancy and lactation are the most important stages in the life of dairy animals, which leads to metabolic alterations (Iriadam, 2007). Nutritional imbalances and production diseases is coming up in high yielding dairy animals during transition period which is based on metabolic profile test (Dhillon et al., 2020).

Measurement of liver function in transition period has important factor for identifying diseases and treatment (Elitok et al., 2006). There was significant increase at levels of Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) in lactation when compared to its level at pregnant group in buffaloes during transition period (Ashmawy, 2015). There was significant increase in Serum Lactate dehydrogenase (LDH) activity at the postpartum period compared to the pre-partum period in water buffaloes during transition period (Hryshchuk et al., 2021). The level of total protein at postpartum period more significant than its level at pre-partum period in Egyptian buffalo during transition period (El-Maghraby and Mahmoud, 2016). The level of Aspartate aminotransferase (AST) activity significant increase at second and third months of lactating animals when compared to its level at the first month of lactating cow due to physiological or pathological conditions (Mohamed et al., 2019). The level of serum urea at second- and third-week postpartum increase significantly during transition period in Egyptian buffaloes (Gomaa, 2021). Hryshchuk et al., 2021 said that the level of creatinine at postpartum period more than its level at pre-partum period in water buffalo. The lipid metabolism is an important feature of the physiology and energy metabolism of transition cows (Gross et al., 2013). Ashmawy, 2015 said that the higher level of total cholesterol with advancement of lactation during transition period. The level of triglycerides in postpartum period less significant than its level at calving and pre-partum periods in Buffaloes (Fiore et al., 2017 and Abdelrazek et al., 2018), in dairy cattle (Hassan et al., 2019). The decline at the level of blood calcium in the postpartum period is due to the redirection of this mineral towards the mammary gland for colostrum synthesis (Wu et al., 2008). Therefore, current study aimed to put insights on the physiology of transition period in Egyptian buffaloes in relation to liver function, kidney function, lipid profile as well as minerals during this period.

Materials and methods

Animals

The present study was carried in 30 Egyptian buffaloes 4 to 6 years old from July to December 2021 in Assuit Governorate, Egypt. The average body weight between 350 and, 450 kg and her average daily milk yield was 10 kg per animal/day. Buffaloes during the period of study were kept together in open half shelter system and fed daily on a mixture of yellow corn, 44% soybean meal, wheat bran, lime stone, sodium chloride, little amount of sunflower, corn gluten feed, Rice straw, multi vitamins, mineral mixture, hay, Protein in ration usually 16% and tap water were available all time.

Clinical examination

All animals in present study were examined carefully and inspected during the transition period for presence of any abnormal clinical signs and for evidence of any metabolic diseases Rosenberger, 1990. The result of physical examination all animals were apparent healthy.

Blood samples

Blood samples were collected in early morning; avoid stress or physical efforts as possible, avoid sick buffaloes, every sample: 10 ml of blood samples were collected from the jugular vein into clean dry sterile labeled sample tubes without anticoagulant from all buffaloes under the study. Blood samples were collected seven times from every animal, three weeks before, during and after parturition every week. Samples were left to clot for 30 to 60 minutes.

After that, Samples were transported in an ice box within 30 minutes from collection to the research laboratory at the department of Internal Animal Medicine, Faculty of Veterinary Medicine, Assuit Universality, Egypt, then centrifuged at 3000 rpm for 20 minutes and, a clear, non-hemolyzed sera were collected in Eppendorf tubes then used for the biochemical analysis (Coles, 1986).

Biochemical analysis

Measurement of all biochemical analysis colorimetrically using Egyptian Company for Spectrum kits by spectrophotometer, serum aspartate aminotransferase (AST) and serum alanine aminotransferase (ALT) according to (Reitman and Frankel, 1957), Serum Lactate Dehydrogenase (LDH) (Dito, 1979), Total bilirubin (Balistreri and Shaw, 1987), total protein level (Gornall et al., 1949), Urea (Patton and crouch, 1977), Creatinine (Bowers and Wong, 1980), Cholesterol (TC) (Ellefson and Caraway, 1976), Triglycerides (Bucolo and David, 1973), Calcium (Barnett, 1965), Potassium (Hillman et al., 1967) and Chloride (Bablok, 1988).

Statistical analysis

The metabolic profile data were presented as Mean±SD and analyzed statistically by using one-way analysis (ANOVA). The statistical significance of difference between period's means was determined by using Duncan’s Multiple Range Test (DMRT) (Steel and Torrie, 1980).

Results

Biochemical analysis:

Comparison between biochemical parameters before and after parturition

There is a deficiency of research worldwide dealing with metabolic profiles of transition period in buffaloes.

As shown in Table 1, the data of 30 dairy buffaloes revealed there were a highly significant increase in the mean value of lactate dehydrogenase, Total

bilirubin, Total protein and Blood urea nitrogen in postpartum period compared with prepartum period, while there were a highly significant increase in the mean value of Aspartate aminotransferase, Alanine aminotransferase, Creatinine, Total cholesterol, Triglyceride and calcium in the Pre-partum period compared with postpartum period, but there were a non-significant changes in Potassium and Chloride along transition period.
As shown in (Table 2 & Figure 1, 2, 3, 4).

Table 1: Mean values ± S.D of metabolic profile at transition period in Egyptian buffaloes before and after parturition

Time of samples / Analyses	Pre-partum	Post-partum	P-value
AST (U / L)	90.71±1.44	89.58±0.64	**0.000***
ALT (U / L)	28.25±0.28	27.56±0.26	**0.000***
LDH(U/ L)	810.36±21.08	1245.9±11.45	**0.000***
Total bilirubin (µmol/l)	1.07±0.13	3.81±0.43	**0.000***
Total protein (g /dL)	6.89±0.13	8.17±0.16	**0.000***
Urea (mg / dL)	26.00±0.59	48.66±1.17	**0.000***
Creatinine (mg / dL)	1.31±0.19	0.97±0.03	**0.000***
Total cholesterol (mg / dL)	67.10±3.67	42.49±0.90	**0.000***
Triglycerides (mg / dL)	28.11±0.74	19.02±0.49	**0.000***
Calcium(mg / dL)	9.56±0.44	8.28±0.35	**0.000***
Potassium (mmol/L)	4.71±0.52	4.53±0.31	**0.101** ^{NS}
Chloride(mmol/L)	99.03±2.69	99.03±1.67	**0.994** ^{NS}

NS: Non-significant, *: Significant (P ≤ 0.05)

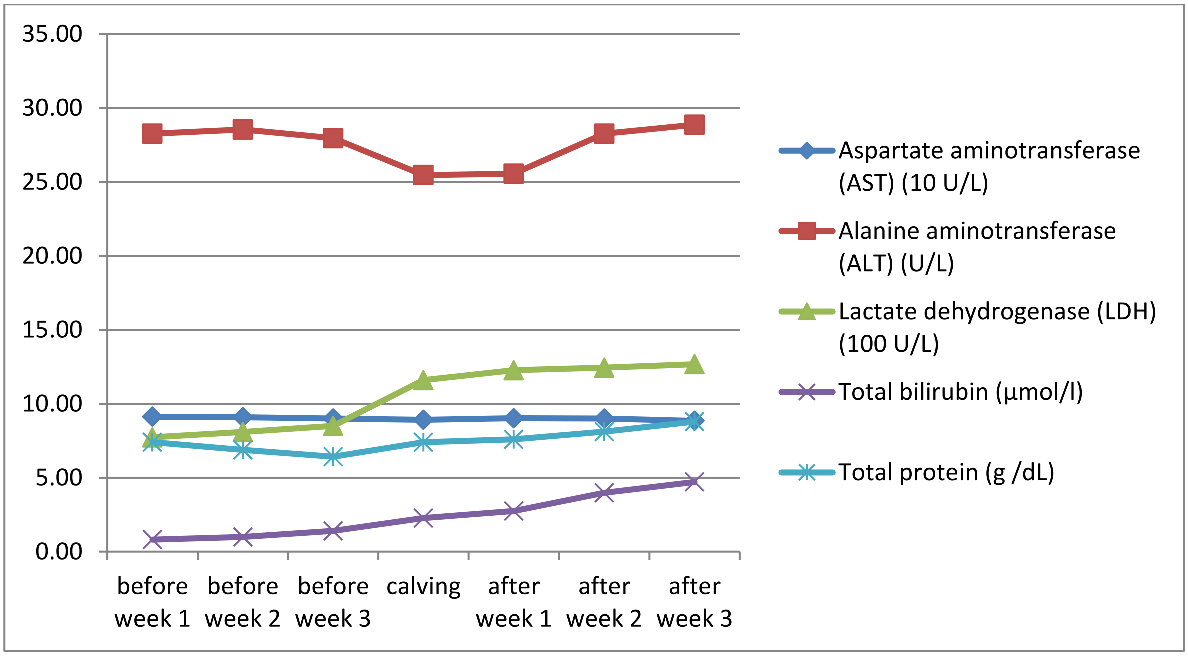

Figure (1): Changes in Liver function test during the transition period

Comparison between biochemical parameters among weeks before, during and after parturition

Liver function test

There was a significantly increase of AST at first- and second-week pre-partum compared with third week pre-partum, significant decrease at calving day compared with pre calving periods. Significant increase at first- and second-week post-partum compared with calving day, non- significant difference at calving day compared with post calving periods during transition period. There was a significantly decrease of ALT at third week pre-partum compared with week first- and second-week pre-partum, significant decrease at calving day compared with pre calving periods. Significant increase at second- and third-week post-partum compared with calving day. There was a significantly increase of Lactate dehydrogenase (LDH) at third week pre-partum compared with first- and second-week pre-partum, significant increase at calving day compared with pre calving periods. Significant decrease at calving day compared with post calving periods. There was a significantly increase of Total bilirubin at third week pre-partum compared with first- and second-week pre-partum. Significant increase at calving day compared with pre calving periods. There was a significantly decrease of Total protein at third week pre-partum compared with first- and second-week pre-partum, significant increase at calving day compared with second- and third-week pre-partum. Significant decrease at calving day compared with second- and third-week post-partum.

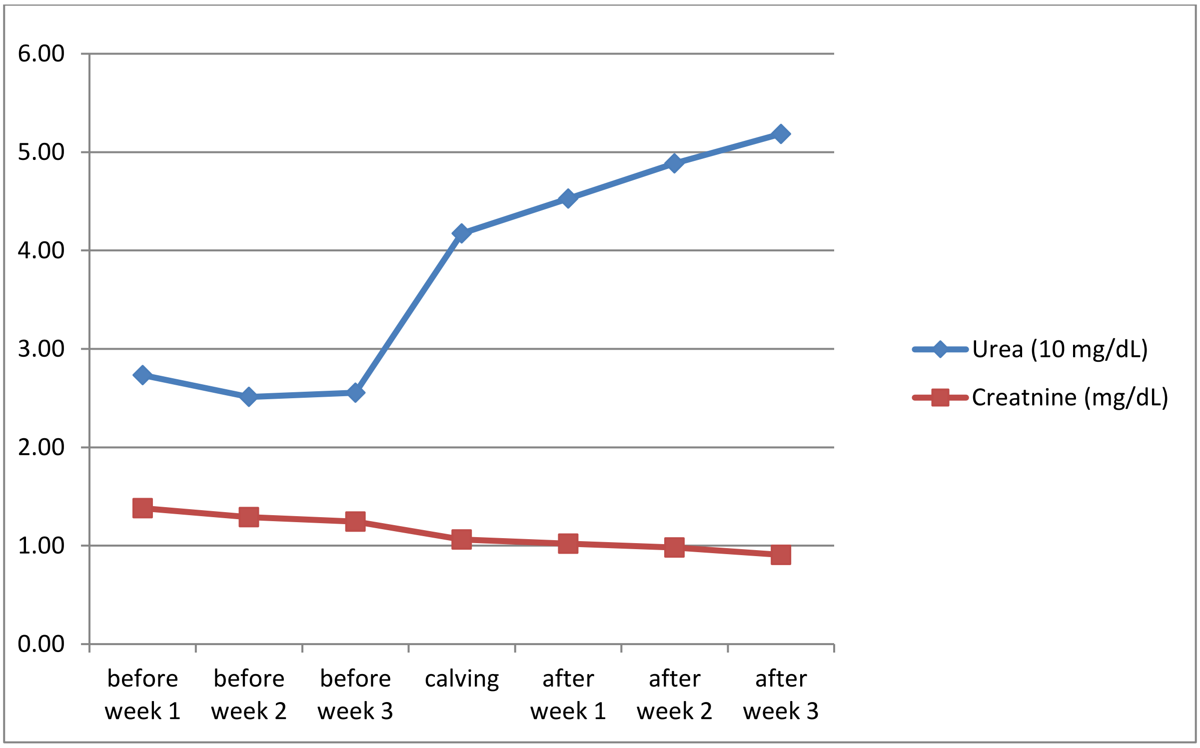

Figure (2): Changes in Kidney function test during the transition period

Table 2: Mean values ± S.D of metabolic profile at transition period in Egyptian buffaloes among weeks before, during and after parturition

	-1	-2	-3	0	+1	+2	+3	P- value
AST (U / L)	91.18ᵃ±1.48	90.93ᵃᵇ±1.78	90.02ᶜ ±2.28	89.09ᵈ±1.63	90.27ᵇᶜ±1.58	90.05ᶜ±0.72	88.4ᵈ±0.96	11.89
ALT (U / L)	28.26ᵇ±0.54	28.54ᵇ±0.47	27.95ᶜ±0.60	25.46ᵈ±0.71	25.55ᵈ±0.44	28.26ᵇ±0.39	28.86ᵃ±0.48	199.42
LDH(U/ L)	773.18ᶜ±24.87	808.22ᵇ±38.97	849.67ᵃ±27.54	1160.1ᵉ±172.48	1226.8ᵈ±12.91	1244.1ᵈᶠ±14.38	1266.9ᶠ±16.44	431.66
Total bilirubin (µmol/l)	0.81ᶠ±0.1	0.99ᶠ±0.27	1.40ᵉ±0.23	2.27ᵈ±0.25	2.75ᶜ±0.53	3.98ᵇ±0.62	4.71ᵃ±0.52	399.42
Total protein (g /dL)	7.4ᵈ±0.15	6.87ᵉ±0.27	6.42ᶠ±0.36	7.4ᵈ±0.26	7.59ᶜ±0.16	8.12ᵇ±0.39	8.79ᵃ±0.31	221.14
Urea (mg / dL)	27.35ᵉ±0.45	25.12ᶠ±0.59	25.54ᶠ±1.56	41.73ᵈ±0.74	45.26ᶜ±2.72	48.87ᵇ±0.83	51.86 ᵃ±1.54	19.3
Creatinine (mg / dL)	1.38ᵃ±0.33	1.29ᵃᵇ±0.32	1.25ᵇ± 0.25	1.06ᶜ±0.12	1.02ᶜᵈ ±0.05	0.98ᶜᵈ±0.03	0.91ᵈ±0.04	21.55
Total cholesterol (mg / dL)	74.87ᵃ±3.15	67.45ᵇ±5.57	58.99ᶜ±4.42	50.43ᵈ±0.93	49.66ᵈ±1.08	42.89ᵉ±2.39	34.91ᶠ±1.63	544.57
Triglycerides (mg / dL)	28.79ᵃ±0.51	28.42ᵃ ±1.42	27.14ᵇ±1.12	23.89ᶜ±1.08	21.11ᵈ±1.21	18.34ᵉ±0.27	17.62ᶠ±0.6	709.58
Calcium (mg / dL)	10.14ᵃ±0.87	9.56ᵇ±0.48	8.97ᶜ±0.41	8.42ᵈ±0.31	8.16ᵈ±0.40	8.34ᵈ±0.80	8.35ᵈ±0.54	44.33
Potassium (mmol/L)	4.70ᵃ±0.78	4.74ᵃ±0.88	4.69ᵃ±0.57	4.39ᵃ±0.29	4.47ᵃ±0.65	4.57ᵃ±0.53	4.54ᵃ±0.45	1.09
Chloride (mmol/L)	99.3ᵃ±4.08	99.03ᵃ±3.28	98.76ᵃ±2.51	98.75ᵃ±1.14	98.76ᵃ±2.23	98.95ᵃ±1.69	99.38ᵃ ±1.73	0.291

a, ab, d,c, bc, b, f, cd, e Values with different superscripts, within the row, significant differ (P ≤ 0.05).

Kidney function test

There was a significantly decrease of BUN at third week pre-partum compared with first week pre-partum, significant increase at calving day compared with third week pre-partum. Significant increase at post calving periods compared with calving day. There was a significantly decrease of Creatinine at calving day compared with First- and third-week pre-partum. Significant decrease at first week post-partum compared with first week pre-partum, significant decrease at post calving periods compared with calving day.

Lipid profile

There was a significantly decrease of Cholesterol at third week pre-partum compared with first- and second-week pre-partum, significant decrease at calving day compared with pre calving periods. Significant decrease at second- and third-week post-partum compared with calving day. There was a significantly decrease of Triglyceride at third week pre-partum compared with first- and second-week pre-partum, significant decrease at calving day compared with pre calving periods. Significant decrease at second- and third-week post-partum compared with calving day.

Minerals

There was a significantly decrease of Calcium at third week pre-partum compared with first- and second-week pre-partum, significant decrease at calving day compared with pre calving periods. Significant decrease at post calving periods compared with pre calving periods, non-significant difference at calving day compared with post calving periods. Non-significant changes in Potassium (K) and Chloride (CL), among weeks before, during and after parturition.

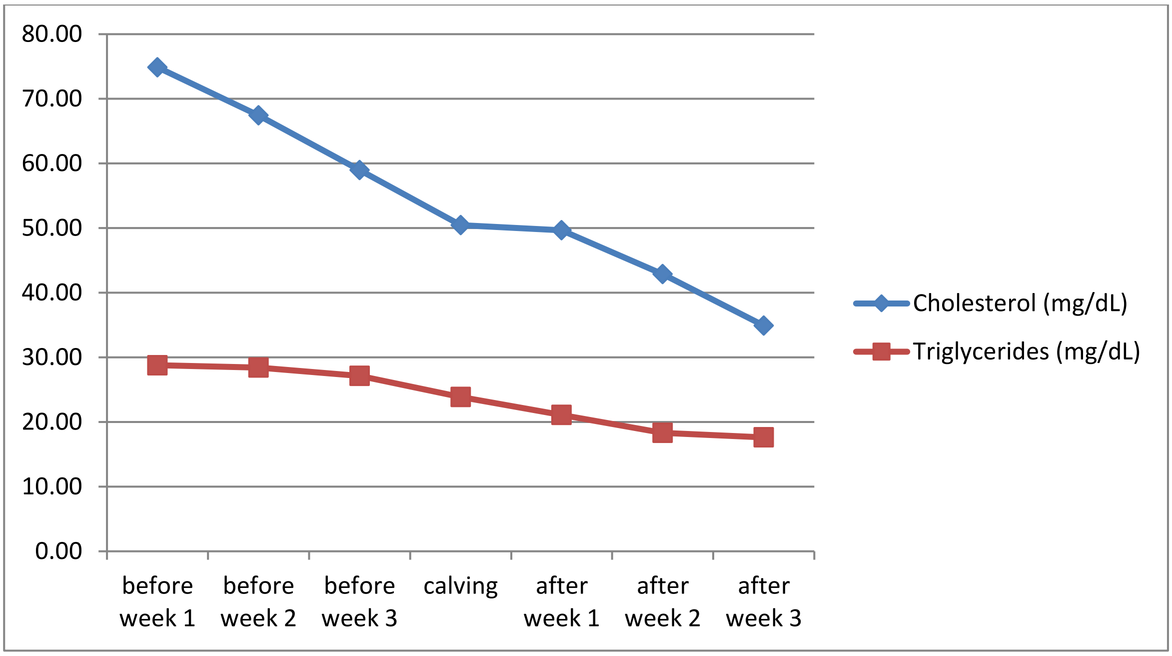

Figure (3): Changes in lipid profile during the transition period

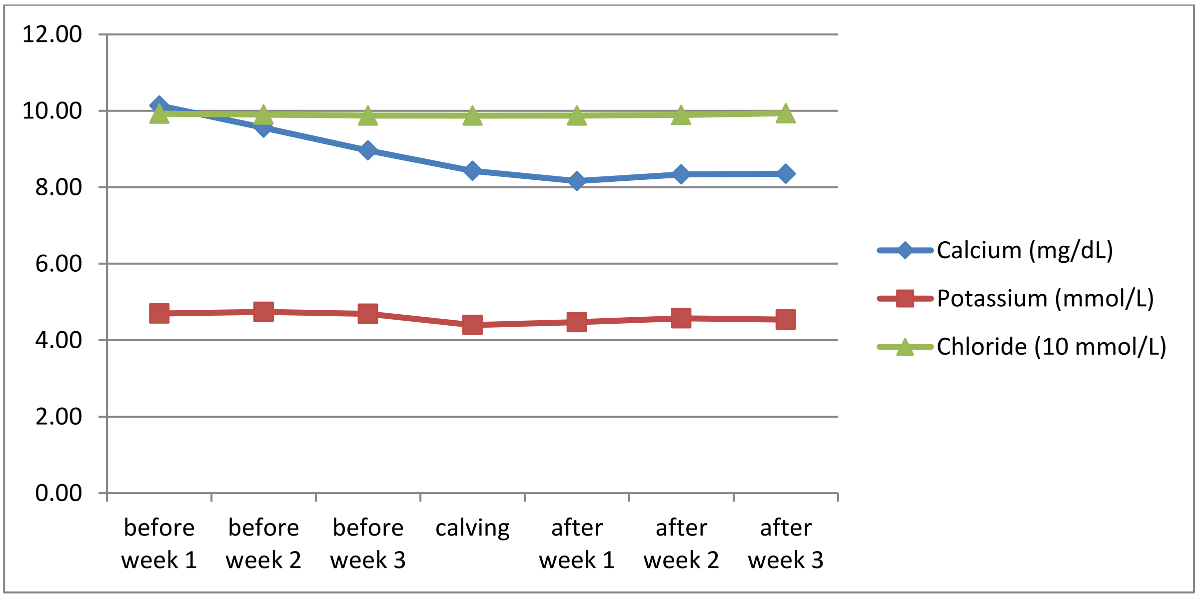

Figure (4): Changes in Minerals concentrations during the transition period

Discussion

During the transition period, several hormonal changes take place, firstly to regulate parturition and initiate lactation, and secondarily to adapt metabolism to those events (Ingvartsen, 2006). Calving is a difficult physiological process which leads to significant variations in the metabolism of the cow's body (Roman et al., 2020).

Liver function test

Aspartate aminotransferase (AST)

The aspartate aminotransferase (AST) is the most sensitive indicator for diagnosing fatty liver (Lubojacka et al., 2005). In present study a significantly higher concentration of AST was observed in the pre-partum period compared with the post-partum period buffalo cow, this result agrees with Serdaru et al., 2011 and Hryshchuk et al., 2021. The observed per partum increase in AST and ALT due to increase hepatic effort during transition period (Mohamed et al., 2015), also related to reduce dry matter intake around calving, which lead to hepatic lipidosis to alter the normal function of the liver (Greenfield et al., 2000).

While disagreement with (Ashmawy, 2015) in buffaloes and (Abdulkareem, 2013) said that level of Aspartate aminotransferase (AST) higher at postpartum periods more than its level at calving in buffaloes. Gomaa, 2021; El-Maghraby and Mahmoud, 2016 said that non-significant difference in liver enzyme levels (Alanine aminotransferase and Aspartate aminotransferase) at pre and postpartum period in Egyptian buffaloes.

Alanine aminotransferase (ALT)

Liver enzymes (ALT and AST) activities were reported to be useful indicator of liver function for postpartum dairy animals (Stojević et al., 2005).

In present study a significantly higher concentration of ALT was observed in the pre-partum period compared with the post-partum period buffalo cows, this result agrees with (Hryshchuk et al., 2021; Talvelkar et al., 2008 and Serdaru et al., 2011) in buffaloes. While disagreement with (Ashmawy, 2015; El-Maghraby and Mahmoud, 2016; Gomaa, 2021).

Lactate dehydrogenase (LDH)

Lactate dehydrogenase (LDH) enzyme is a bio-indicator for liver, muscular, and cancer troubles ((Zheng et al., 2017). In present study a significantly higher concentration of (LDH) was observed in the post-partum period compared with the pre-partum period buffalo cow along transition period, this result agrees with (Krsmanović et al., 2013 in cows; Hryshchuk et al., 2021 in water buffalo). The increasing concentration of LDH in the postpartum is a result of the use of lactate for glucose formation near calving due to deficiency of other sources for gluconeogenesis, making the Cori cycle essential for this period (Reynolds et al., 2003), also changes result from not only the growth of cell cytolysis but from the rise in absolute values of the activity of LDH enzyme, associated with increasing aerobic metabolism of glucose amid its reduction and the need for significant amounts of energy (Helmy et al., 2019).

This result disagreement with (Talvelkar et al., 2008) who said level of Lactate dehydrogenase (LDH) in last period of pregnancy were more than its level at postpartum period in buffaloes.

Total bilirubin

Total bilirubin levels are determinative for the evaluation of liver functions in transition animals (Van Saun, 2004). In present study a significantly higher concentration of Total bilirubin was observed in the post-partum period compared with the pre-partum period buffalo cows along transition period. The significant increase at calving day compared with pre-partum due to the minimal level of cellular damage developed in the liver due to the lipomobilization based on the energy deficit arising at calving approaches (Elsayed et al., 2019).

The postpartum increase may be resulted from the deficiency in liver functions developed due to the Negative Energy Balance (NEB) which occur in that period (Bobe et al., 2004). This result agrees with Djokovic et al., 2011. Elsayed et al., 2019 who said that the level of serum total bilirubin was significant increase at calving day and post calving periods compared with pre calving periods, reached maximum at day 14 post-partum except one week before calving in buffalo during transition period. Celeska et al., 2015 who said that the level of total bilirubin was significant increase at day 5 post calving compared with day 5 pre calving and day 30 post calving in dairy animals.

Total protein

Total Protein levels are signs of sufficient protein intake from diets (Toharmat et al., 1999). In present study a significantly higher concentration of Total protein was observed in the post-partum period compared with the pre-partum period buffalo cows along transition period, this result agrees with El-Maghraby and Mahmoud, 2016 in buffalo. Protein synthesis and accretion are the cornerstones of growth which provide the structural framework and enzymatic mechanism necessary for fetal development (Abdulkareem, 2013). The increasing of total protein level with the progress of lactation due to the maternal requirements of protein needed for milking and providing immunoglobulins (Mohri et al., 2007). Significant decrease of total protein at third week before calving caused by foetus muscular development (El-Sherif and Assad, 2001). Serum total proteins as calving approach Significant decreased compared with post calving period may be due to the haemoconcentration and water losses occurred following calving (Ghanem et al., 2012).

While disagree with Ashmawy, 2015 and Hryshchuk et al., 2021. Abdulkareem, 2013 who said non-significant change in Total protein level in Iraqi riverine buffaloes during transition period, in Egyptian buffalo (Gomaa, 2021) and in dairy animals (Vasantha et al., 2020) may be related to animals innate ability to minimize physiological alteration which is an adaptability characteristic. Also, Serdaru et al., 2011 found the total protein concentration was higher in pregnant than in lactating buffaloes.

Kidney function test

Blood urea nitrogen

Urea level is a good indicator of long term of dietary protein intake (Kida, 2003). In present study a significantly higher concentration of BUN was observed in the post-partum period compared with the pre-partum period buffalo cows along transition period. The post-partum significant increase of urea indicates the growth in catabolic processes in this period (Sundrum, 2015), also excess dietary protein intake after parturition which increases the metabolic activity of hepatic microsomes which helps the transformation of alimentary ammonia into urea (Campanile et al., 2006) and leads to promotion of rumenal propionic acid production that increased microbial protein supply (Heck et al., 2009).This result agree with Abdelrazek et al. 2018; Gomaa, 2021; El-Maghraby and Mahmoud, 2016 and Ashmawy, 2015 in buffaloes. While disagree with Campos et al., 2012 who said non-significant change in Blood Urea Nitrogen level in Harton Del Valle and Holstein cows during transition period.

Creatinine

Creatinine is one of the biochemical markers that monitoring the kidney condition (Gwaze et al., 2010). In present study a significantly higher concentration of creatinine was observed in the pre-partum period compared with the post-partum period buffalo cows along transition period. The pre-partum increasing of creatinine at pre-partum as compared to post-partum months due to development of the fetal musculature (Roubies et al., 2006). This result agrees with Singh et al., 2014 and Ghanem et al., 2012. Disagreement with Hryshchuk et al., 2021.

Lipid profile

Total cholesterol

The level of total cholesterol was considered as an indirect index of liver function in transition cow (Alamouti et al., 2009). In present study a significantly higher concentration of Cholesterol was observed in the pre-partum period compared with the post-partum period buffalo cows along transition period. Serum total cholesterol was significantly affected by the physiological status of animal (Piccione et al., 2012). Reduced cholesterol level starting from the time of parturition and postpartum period may be associated with reduced dry matter intake (Soca et al., 2013). Last stage of pregnancy, increasing of cholesterol level due to the increased needs of the fetus for growth and development, and also the need of the ovaries for synthesis of steroid hormones (Turk et al., 2013). The reduction in Cholesterol level at the calving and post-partum period in our study to the finding of (El-Sharawy et al., 2019). Also, agree with (Elshahawy and Abdullaziz, 2017; Serdaru et al. 2011 and Vasantha et al., 2020). Abayawansa et al., 2013 said that the level of cholesterol high significant during the pre-calving period, and low its level at calving in buffaloes.

While disagreement with Cernescu et al., 2010 and Quiroz-Rocha et al., 2009 said that the level of cholesterol in dry pregnant less than its level in lactating cows and Hagawane et al., 2009 in buffalos. Abdulkareem, 2013 had observed non-significant differences in Cholesterol levels in Iraqi riverine buffaloes during transition period.

Triglyceride

Blood triglycerides level is a critical source of long chain fatty acid for milk production which explains significant triglyceride decrease at the onset of lactation (Kessler et al., 2014). In present study a significantly higher concentration of Triglyceride was observed in the pre-partum period compared with the post-partum period buffalo cows along transition period. The reasons for reduction in serum triglycerides values at calving and post-partum period may be upregulation of mammary gland lipoprotein lipase (Arfuso et al., 2016) which transfer of triglycerides to mammary gland for milk fat synthesis and secretion (Mantovani et al., 2010). This result was agreeing with Fiore et al., 2017; Abdelrazek et al., 2018 and Hassan et al., 2019. This result disagrees with El-Maghraby and Mahmoud, 2016 who said the level of triglycerides at second week postpartum more significant than its level at first, second, third week pre-partum, third, fourth week postpartum and at calving time in Egyptian buffaloes during transition period.

Minerals

Minerals are essential nutrients that play a significant role in reproduction because an increase or decrease in their levels has a notable effect on the animals' performance (Balamurugan et. al., 2017).

Calcium

Calcium is necessary for smooth and skeletal muscle contraction (Wilkens et al., 2020). In present study a significantly higher concentration of Calcium was observed in the pre-partum period compared with the post-partum period buffalo cows along transition period. The reduction in post-partum period may be related to drainage of a high amount of Calcium in colostrum during excessive lactation, mainly after calving, also, inadequate absorption of food metabolite from the gastrointestinal tract, inadequate Calcium bone mobilization and increased its excretion in urine (Elshahawy and Abdullaziz, 2017) and decreased numbers of receptors for 1,25-dihydroxyvitamin D in the intestine lead to decrease absorption of the mineral (Goff, 2000). This result was agreeing with (Serdaru et al., 2011; Moghaddam and Hassanpour, 2008). Disagreement with Nale, 2003 said that the stage of lactation progresses the level of serum Calcium increased in buffaloes. Hryshchuk et al., 2021 said that the level of Calcium in post-partum more significant than its level at pre-partum period in water buffalo during transition period.

Potassium and Chloride

Non-significant changes in Potassium (K) and Chloride (CL) along transition period. This result was agreeing with Akhtar et al., 2010 and disagree with Kuhn et al., 2006 said that level of potassium plasma highest values at 7th day respect to 30th day both in lactation and dry period.

Conclusion

The metabolic profile is a useful tool that has progressed over time. By understanding the fluctuations that occur in serum biochemical analyses over the period of lactation, especially within the transition period, the value of the metabolic profile as a tool to differentiate between normal and compromised animals will be enhanced. In this study pointed of importance of transition period and effect on some biochemical parameters which have effect on health and production of animals. Buffaloes should be managed carefully during transition period to avoid occurrence of metabolic disorders and their subsequent reproductive failure.

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