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LACTATE DEHYDROGENASE ACTIVITY AND CALCIUM CONTENT IN WASHED SPERM AND TESTICULAR PLASMA OF WHITE FULANI BULLS IN IBADAN

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ABSTRACT

Lactate dehydrogenase (LDH) activity and calcium content in plasma and washed sperm (WS) from the testes of mature White Fulani (WF) bulls, divided into four body-weight groups and within the weight range of 140-260kg were studied in a complete randomize design. Animals were weighed at slaughter. Their testes were weighed immediately after slaughter. A part of each testis was stored in the freezer for 48hrs and later homogenized with a pair of scissors in physiological saline. Ultraviolet (UV) and colorimetric methods were employed to assay the homogenate and WS for LDH and calcium respectively. The overall mean LDH activity in the Testicular plasma and WS were 0.57 ± 0.13 and 0.38 ± 0.09 imoles/min in $500x10^6$ sperm cells respectively. LDH activity in WS did not differ significantly from plasma of the testes. There were also no significant differences ($P>0.05$) between the live weight groups. The mean calcium content in the plasma and WS were 0.81 ± 0.15 mg and 0.73 ± 0.11 mg respectively. Testicular WS did not differ significantly between different live-weight groups nor did the testicular plasma. Testicular plasma calcium was higher than in testicular washed sperm.

LDH activity in the plasma could be a good measure of the fertility status of stored sperm. Calcium status of the sperm environment can be determined from its measure in the plasma. Enhancing reproductive potential of bulls through dietary calcium supplementation requires caution to prevent partial intoxication.

Keywords: Lactate dehydrogenase, calcium, testis, plasma, washed sperm, White Fulani

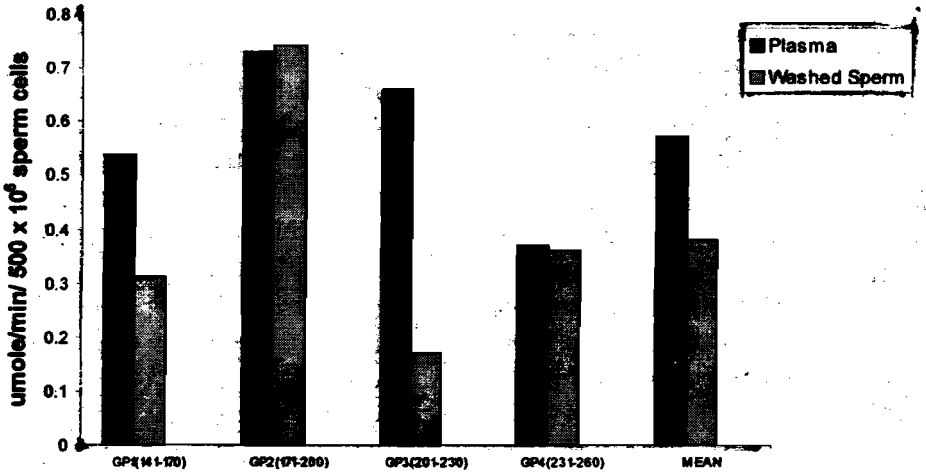

Fig.1 Lactate Dehydrogenase activity in WS and plasma from testes of White Fulani bulls of liveweight range 141-260kg

0.17 ± 0.01 imole/min in 500 x 10^6 sperm cells for testicular plasma and WS respectively. The corresponding values in the other groups, without any significant but only marginal difference between plasma and WS in LDH activity were 0.54 ± 0.04 and 0.31 ± 0.05; 0.73 ± 0.19 and 0.74 ± 0.09; 0.37 ± 0.07 and 0.36 ± 0.06 imole/min in 500 x 10^6 for plasma and WS of groups 1, 2 and 4 respectively. The LDH activity in the testicular washed sperm cells of group 2 bulls was significantly higher than in the washed sperm from the testes of all the other groups, while there was no significant difference between the LDH activity of the testicular plasma from the different live-weight groups.

The calcium contents of testicular plasma and washed sperm are shown in Figure 2. The overall mean calcium contents in plasma and WS of mature WF bulls involved in the study were 0.81 ± 0.15 and 0.73 ± 0.11 mg/500x10^6 sperm cell respectively. The calcium content of the testicular WS cells did not differ significantly between the different live weight groups nor did the contents in plasma as shown in figure 2. The calcium content of testicular plasma was generally higher than that of the WS cells in all the different live-weight groups as shown in figure 2, with the testicular plasma and WS values of 1.01 ± 0.35 and 0.57 ± 0.13; 0.47 ± 0.09 and 0.78 ± 0.20; 0.76 ± 0.15 and 0.63 ± 0.18 and 1,12 ± 0.22 and 1.13 ± 0.02 mg/500 x 10^6 sperm cells for groups 1, 2, 3, and 4 respectively.

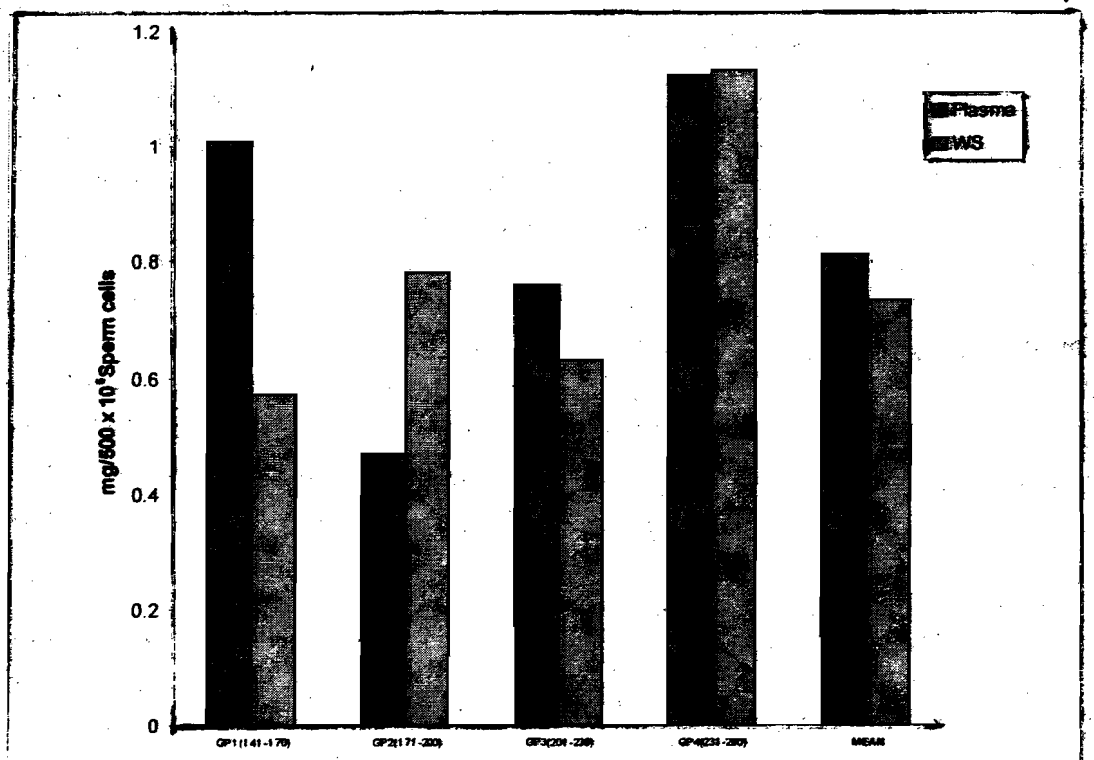

Fig. 2 Occurence of Calcium in WS and plasma from testes of White Fulani bulls of liveweight range 141-260kg

DISCUSSION

The generally non-significant ($P>0.05$) difference between the different live-weight groups in both LDH activity and calcium contents of both plasma and WS from the testis indicated some stability in the physiology of the testes of these animals. Such stability would be consistent with the assumption that this body-weight range coincided with the mature weight of WF bulls in Ibadan. This result is in agreement with Bostedt et al (1976) that age has a significant effect on enzyme activity. The extensive system of management, to which these bulls were exposed, without feed supplementation could also have largely downplayed some of the individual variations, which could have affected the final physiological responses of the testes as it was observed in this study.

The higher values recorded for LDH activity in the testicular plasma over the WS could be an indication of loss of LDH from the immature testis sperm into the surrounding medium as a result of damage to the acrosome. This is due to the adverse conditions to which the sperm cells were exposed during the storage period, when the testes were frozen before homogenization. This is in agreement with Upreti et al (1996), and Patel et al (2000). In adjusting to the new environment,

sperm cells would increase metabolic activities. Dave (1975) and Dube et al (1982) had reported that LDH activity was associated with sperm metabolism. The leakage from sperm would account for the increase in plasma value (Pursel et al., 1971), with a corresponding reduction in the fertility due to the adverse effect on the quality of spermatozoa (Stamatiadis et al., 1984). Dhami and Kodagali (1990) had reported that motility and fertility of post-thawed sperm were negatively correlated with LDH activity of seminal plasma, which was positively correlated with Glutamic Oxalate Transaminase (GOT) and Alkaline Phosphatase (ALP) activities. Thus the leakage of LDH from sperm into plasma, observed in this study indicated a loss in the quality of sperm. LDH could thus be used as an enzyme, whose level in the plasma could reflect the quality of spermatozoa in stored semen. This is in line with the observation of Pursel et al (1971) that the loss of LDH in sperm resulted in a concomitant increase in the seminal plasma, having been established that LDH activity is related to metabolic process in spermatozoa (Dave, 1975; Dube et al., 1982; Patel et al., 2000). Such information would therefore be relevant in the development of semen processing protocols and semen diluents as earlier suggested by Upreti et al (1996).

The higher calcium content of testicular plasma over the washed sperm cell is a Pointer to the need for calcium by developing sperm cells in the testis. Higher calcium content than normal in seminal plasma has been implicated with sperm abnormality (Bostedt et al., 1976), poor sperm motility (Leonhard-Marek, 2000) and testicular degeneration (Pedroso et al., 1978). The results of this study therefore, implied that the testis environment on its own carries some level of calcium, which has been implicated with the enhancement of spermatogenesis and fertility. This is of importance to farms, where the breeding efficiency is paramount in their management procedures. In view of the emphasis on breeding efficiency, diets given to breeding males are often supplemented in order to improve the semen quality of their males. Sometimes, some of the extensively managed bulls find their way into breeding herds of private farmers, who might be tempted to utilize dietary supplementation with calcium as a mineral, for the enhancement of their spermatogenic potential and fertility. Under this circumstance, such farmers should be cautious in order to avoid the partial toxicity of calcium (Leonhard-Marek 2000) due to the implications itemized, above.

CONCLUSION

It could be concluded from this study that when spermatozoa are exposed to adverse conditions, the leakage of LDH from sperm acrosome occurs. This leakage often accounts for the increased LDH activity in the surrounding plasma

Medium. The testis environment contains a level of calcium, which is required for spermatogenesis. Such level Should be determined before the utilization of dietary calcium as a means of enhancing fertility in extensively managed bulls.

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