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Seasonal variations in sperm abnormalities in bulls in a tropical climate

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RÉSUMÉ

Variations saisonnières des anomalies du sperme de taureaux en climat tropical

Les éjaculats de 10 taureaux zébus Bororo Akou de la ferme de l'Université d'Ibadan, Nigeria, ont été récoltés chaque semaine, durant une année, en utilisant un vagin artificiel.

Des frottis colorés ont été examinés au microscope pour déceler d'éventuelles anomalies. Celles-ci ont été plus nombreuses en saison sèche qu'en saison des pluies. La cause en est probablement la température ambiante élevée et les carences nutritionnelles.

Une étude plus approfondie de l'influence de l'alimentation sur la morphologie du sperme semble nécessaire.

INTRODUCTION

There are divergence of opinion on the importance of the presence of varying numbers of abnormal spermatozoa in semen preparations (7, 11). There appears to be an agreement that abnormal cells should not be more than 17-20 p. 100 (WILLIAMS and SAVAGE, 1925) and even at this level the fertility is reduced (10). Fertile bovine semen was found to contain 14.2 p. 100 (7) and 11.9 p. 100 (17) abnormal spermatozoa.

HAQ (6) and ROLLINSON (17) believed that the semen of normal fertile bulls should not have more than 3 to 4 p. 100 abnormal tails and 0.5 to 6 p. 100 tailless heads.

Spermatozoa abnormalities can be categorized into (a) primary abnormalities and (b) secondary abnormalities. The primary abnormalities include (i) abnormalities of the head, (ii) tailless sperms and sperms with looped tails, (iii) sperms with coiled tails (iv) proximal and distal protoplasmic droplets in the midpiece. The primary sperm head abnormalities include very small, unduly large, short ; narrow and pear-shaped heads, detachment, loosening or distortion of the acrosome cap ; shrunken, mis-shapened or abnormally staining heads which includes peculiar focal defect of the acrosome reported by TEUNISEEN (19) in Danish Red bulls and HANCOCK (5) in Friesians.

In Nigeria, there are basically two seasons — Wet or rainy and dry seasons.

There are a number of conflicting reports about the fertility of bulls at different seasons. Fertility of bulls had been found to be lowest in winter to gradually improve in spring and reach a peak in summer and Fall (18). Fertility was significantly correlated with length of daylight (14). JOHNSTON and BRANTON (8) showed that as temperature and humidity increased fertility decreased and vice-versa.

Most of the work done on seasonal variation in relation to sperm abnormalities in bulls had been in the temperate and sub-

temperate regions. It was therefore considered necessary to investigate the effect of the seasons of the year on sperm abnormalities in Ibadan, Nigeria which has a tropical climate.

MATERIALS AND METHOD

Ten bulls kept at the University of Ibadan Teaching and Research Farm were used for the project. The animals were kept under semi-intensive management.

Each bull was ejaculated weekly with the artificial vagina for a year. Smears of the semen samples were prepared on slides and stained with Carbon Fuschin (Williams method).

The stained smears were examined under microscope with X40 objective lens. 200 sperms were counted per slide and the abnormalities observed from the sperms were recorded.

Monthly means of each abnormality was calculated.

RESULTS

The monthly means of each abnormality is presented in table I.

There were two definite peaks during the period of the investigation for all primary sperm abnormalities except those with round heads and weak stained head with only one peak each.

There were also two peaks for secondary sperm abnormalities like simple bent tail. Pathological middle piece and coiled tail. Other secondary sperm abnormalities like tail coiled round head ; Pouch formation showed only one peak but the free head abnormality showed four peaks.

Most of the first peaks occurred between the months of April and May while the second peak occurred between September and November.

Higher incidence of sperm abnormalities were observed around April and May than between September and November except for pear-shaped heads broad head at base and tail coiled round head which were higher in the latter period.

The narrow head abnormality was highly negatively correlated with the pathological midpiece abnormality (r = − 1).

DISCUSSION

The proportion of sperm abnormalities in semen varies not only with the reproductive

TABLE 1 : Monthly mean sperm abnormality

	Narrow heads	Narrow at base (head)	Pear shaped head	Giant head	Round head	Broad head at base	Weak stained head	Abaxiel midpiece	Pathological midpiece	Free heads	Simple bent tail	Pouch formation	Tail coiled below	Tail coiled round head
January	4	2	0	0	0	0	0	3	50	0.67	15	0	0	0
February	2	2	0	0	0	0	0	0	25	0	13.5	0	0	0
March	10	1	0	9.5	0	1.8	0	3.5	50	35	16	0.67	1.6	1.0
April	52	5	0	0	0	4.6	0	18	265	33	37.5	0	7.6	0
May	76	24	0	33	0	0	135	73	290	58	135	0	0	0
June	15	7	2	0	0.5	0	0	4	130	20	30	0	0	0
July	5	3	3.3	0	0	0	0	0	70	51	70	0	0.67	2.5
August	4	5	0	0	0	0	0	2	20	36	67.5	0	0	2.0
September	18	4	0	8	0	0	0	33	70	60	75	0	2.3	22
October	17	16	0	7.6	0	0	0	44	50	33	100	0	2.0	6
November	18	14	4.6	17.5	0	7.6	0	32	80	88	35	0	0	0
Décember	8	2	0	0	0	0	0	4	100	36.6	30	0	0	0

health of the male but as influenced by infections or other disease (10, 2) and at some latitudes, also by season of the year (1, 4, 15, 13).

The two peaks of sperm abnormalities were observed in the periods preceeding the rains and at the end of the rainy season. The ambient temperature is generally low between December and February due to harmattan. The heavy rains between late May and early September probably lowers the ambient temperature when compared with late September to November and March to June. Reproductive efficiency is depressed during periods of high temperatures of F 80° and over (9, 16). This probably explains the high incidence of sperm abnormalities between April and May and also from September to November. CASADY *et al.* (3) showed that spermatogenesis was impaired at temperatures of F 85° maintained for 5 weeks.

JOHNSTON and BRANTON (8) observed that as temperature and humidity increased, fertility decreased and vice-versa. As temperature increases between March and May, humidity also increases. Effect of nutrition on fertility should also be considered. In the adult male, testis hypofunction, atrophy, loss of Leydig cell function followed by cessation of spermatogenesis which may earlier manifest as sperm abnormalities have been associated with nutrition (18). Studies involving acute and chromic starvation showed that gonadal hypofunction during inanition was primarily due to diminished levels of gonadotropins (12). During the dry season in Nigeria, there is a decrease in both the quantity and quality of pasture available to animals.

The increased sperm abnormalities observed during the dry season might have been as a result of the combination of the effects of high ambient temperature and nutritional deficiencies.

A more detailed study on the nutritional effect is necessary.

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SUMMARY

Ten white Fulani (Zebu) bulls from the University farm at the University of Ibadan, Nigeria were ejaculated weekly, using artificial vagina, for a year. The stained smears of the ejaculates were examined under microscope for sperm abnormalities.

There were more abnormalities during the dry season than the wet season. The increase in sperm abnormalities during the dry season is probably due to high ambient temperature and nutritional deficiency.

More detailed study of the nutritional effect on semen morphology is considered necessary.

RESUMEN

Variaciones estacionales de las anomalías del espermo de toros en clima tropical

Se provocó la eyaculación de 10 toros Bororo Aku (Cebú) de la granja de la Universidad de Ibadan, Nigeria, cada día, durante un año, mediante una vagina artificial.

Se examinaron los frotis colorados con el microscopio para determinar anomalías eventuales. Las dichas se encuentran más numerosas durante la estación seca que durante la estación de las lluvias, lo que es probablemente causado por la temperatura ambiente elevada y las carencias nutricionales.

Un estudio más detenido de la influencia de la alimentación sobre la morfologia del espermo parece necesario.

REFERENCES

1. ANDERSON (J.). Seasonal variation in the reproductive capacity of dairy bulls. *J. agric. Sci.*, 1946, **35** : 184-196.
2. BLOM (E.). Om bedommolsen af tyresperma specielt med henblik pa anvendelsen ved den kunstige saedverforing. (The evaluation of bull semen with special reference to its use in artificial insemination.) Copenhagen ; (A/S Carl. Fr. Mortensen, 1945, 225).
3. CASADY (R. B.), MYERS (R. M.), LEGATES (J. E.). The effect of exposure in high ambient temperature on spermatogenesis in the dairy bull. *J. dairy Sci.*, 1953, **36** : 14-23.
4. ERB (R. E.), ANDREWS (F. W.), HILTON (J. H.). Seasonal variation in semen quality of the dairy Bull. *J. dairy Sci.*, 1942, **25** : 815-826.
5. HANCOCK (J. L.). Evidence of an inherited seminal character association with infertility of Friesian bulls. *Vet. Rec.*, 1949, **61** : 308-309.
6. HAQ (I.). Causes of sterility in bulls in southern England. *Brit. vet. J.*, 1949, **105** : 114-126 ; 200-206.
7. HERMAN (H. A.), SWANSON (E. W.). Variations in dairy bull semen with respect to its use in artifical insemination. *Res. Bull. No. agric. exp. Stn.*, 1941 : No. **326** : 82.
8. JOHSTON (J.), BRANTON (C.). Effects of seasonal climatic changes on certain physiological reactions, semen production and fertility of dairy bulls. *J. dairy Sci.*, 1953, **36** : 934-942.
9. KELLY (J. W.), HURST (V.). The effect of season on fertility of the dairy cow. *J. am. vet. med. Ass.*, 1963, **143** : 40-43.
10. LAGERLOF (N.). Morphologische Untersuchungen uber Veranderungen im spermabild und in den Hoden bei Bullen mit verminderter oder aufgehobener Fertilat. *Acta path. microbiol. scand.*, 1934, Suppl. **19** : 254. Abstract *in* : *Vet. Bull.*, 1934, **4** : 780.
11. LAING (J. A.). Observations on the characteristics of the semen in relation to fertility in the bull. *J. agric. Sci.*, 1945, **35** : 1-24.
12. LEATHEM (J.). Nutritional effects on hormone production. *J. anim. Sci.*, 1966, **25** : 68-82.
13. MERCIER (E.), SALISBURY (G.). The effects of season on the spermatogenic activity and fertility of dairy bulls used in artificial insemination. *Cornell Vet.*, 1946, **36** : 301-311.
14. MERCIER (E.), SALISBURY (G.). Seasonal variation in hours of daylight associated with fertility level of cattle under natural breeding conditions. *J. dairy Sci.*, 1947, **30** : 747-756.
15. PHILLIPS (R. W.), KNAPP (B.), HEEMSTRA (L. C.), EATON (O. N.). Seasonal variations in the semen of bulls. *Am. J. vet. Res.*, 1943, **4** : 115-119.
16. RHYNES (W. E.), EWING (L. L.). Testicular endocrine function in Hereford bulls exposed to high ambient temperature. *Endocrinology*, 1973, **95** : 509.
17. ROLLINSON (D. H. L.). Studies on the abnormal spermatozoa of bull semen. *Brit. vet. J.*, 1951, **107** : 203-214 ; 258-273 ; 451-468.
18. SALISBURY (G.), VANDEMARK (N.). Physiology of reproduction and artificial insemination of cattle. London and San Francisco, Freeman and Co., 1961.
19. TEUNISEEN (G. H. B.). Een afwijking van het acrosoom (Kopkap) bij de spermatozoiden van een stier. (An abnormality of the acrosome in the spermatozoa of a bull.) *Tijdschr. Diergeneesk*, 1946, **71** : 292-303.