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1/29 Robertsonian translocation in *Blonde d'Aquitaine* bulls: frequency and effects on semen characteristics

F Gary, D Concordet, HM Berland, X Berthelot, R Darré

Ecole Nationale Vétérinaire de Toulouse,
Département des Productions Animales, Laboratoire INRA de Cytogénétique,
23, chemin des Capelles, F-31076 Toulouse Cedex, France

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INTRODUCTION

In cattle, Robertsonian translocations are known to affect fertility of carrier breeders. In the *Blonde d'Aquitaine* breed, an earlier study (Frebling *et al*, 1987) showed that 14.2% of the females from selection herds were translocated. These results justified further investigations to determine the frequency of the 1/29 centric fusion in *Blonde d'Aquitaine* bulls and its effects upon semen characteristics.

MATERIALS AND METHOD

Study of the frequency of the 1/29 translocation in bulls used for natural breeding
In 1986–87, cytogenetic analyses were carried out on 157 *Blonde d'Aquitaine* bulls used for natural breeding, representing 80% of the natural breeding bulls in selection herds. Karyotypic analyses were performed using conventional staining methods (de Grouchy *et al*, 1964).

Semen characteristics from translocated bulls
Semen samples from 23 bulls, 15–18 months old, were analyzed at the Laboratoire National de Contrôle des Reproducteurs, Maisons-Alfort, to evaluate their sexual functions. 5 bulls carried the 1/29 translocation and 18 were normal. The parameters investigated were: volume, wave motility (scored from 1 to 5), concentration of spermatozoa, abnormal spermatozoa (frequency and distribution of the abnormalities) in fresh ejaculates; percentage of normal and dead spermatozoa after deep-freezing.

For the statistical analysis, we considered that the effects of the 1/29 centric fusion were identical for all bulls. The lack of a bull effect was controlled by analysis

of variance on the seminal characteristics in groups of translocated or normal bulls. Mean values and standard deviations of seminal characteristics were calculated and Student's t test was performed. The overall significant level was 0.05.

RESULTS

Frequency of the 1/29 translocation in bulls used for natural breeding

Among the 157 natural breeding bulls karyotyped, 34 (22%) were carriers of the 1/29 translocation and one was a homozygous carrier. 47% of these translocated bulls and 24% of the normal bulls had a translocated AI bull as their father or one of their grandfathers. 41% of the translocated bulls and 24% of the normal bulls were descended from a father or a grandfather used for natural breeding.

Semen characteristics of translocated bulls

The mean values for the seminal characteristics of translocated and normal bulls were not different (table I), except for a lower concentration of spermatozoa in translocated bulls' ejaculates ($P < 0.05$). There was no significant bull effect on sperm concentration in either carrier or non-carrier groups. The distribution of spermatozoan abnormalities, observed by light microscopy (abnormalities of the head, neck, middle piece and tail, cytoplasmic drop), did not differ between the two groups.

Table I. Mean values ± standard deviation (SD) of semen characteristics according to karyotype.

Semen characteristics	*19 ejaculates from 5 translocated bulls* ($m \pm SD$)	*57 ejaculates from 18 normal bulls* ($m \pm SD$)	*Significance of the difference*
Fresh semen			
volume (ml)	4.0 ± 1.2	3.6 ± 1.1	NS
wave motility	3.8 ± 0.3	3.9 ± 0.3	NS
concentration (10 000/ml)	153.2 ± 51.5	184.3 ± 48.9	$P < 0.05$
% abnormal spermatozoa	18.2 ± 8.5	21.8 ± 8.1	NS
% acrosomal abnormalities	0.4 ± 0.6	1.2 ± 2.7	NS
% head abnormalities	4.6 ± 3.3	6.8 ± 4.9	NS
% neck abnormalities	5.2 ± 3.4	7.8 ± 4.5	NS
% middle piece and tail abnormalities	5.0 ± 4.0	4.6 ± 3.1	NS
% cytoplasmic drops	2.9 ± 4.8	1.6 ± 1.5	NS
After freezing			
% dead spermatozoa	32.6 ± 3.5	30.8 ± 0.36	NS
% normal spermatozoa	34.7 ± 10.2	37.9 ± 9.8	NS

DISCUSSION

The frequency of the 1/29 translocation was higher in natural breeding bulls than in 2000 heifers from selection herds (14.2%) (Frebling *et al*, 1987). There were more AI translocated bulls and natural mating sires with unknown chromosomal status among ancestors of translocated bulls than of normal bulls. To improve eradication efficiency, we recommend that farmers buy only breeders that have been tested for the 1/29 translocation.

Our results, obtained from a limited number of young bulls not preselected for their sexual function, confirmed the absence of a deleterious effect of the 1/29 translocation upon semen quality and freezability in heterozygous bulls (Dyrendhal and Gustavsson, 1979; Bétancourt, 1983; Moustafa *et al*, 1983). In concordance with our results, some researchers observed a drop in sperm concentration in translocated bulls (Queinnec *et al*, 1974; Dyrendhal and Gustavsson, 1979), although this was not confirmed by others (Bétancourt, 1983; Moustafa *et al*, 1983). Only Morelli *et al* (1985) detected more spermatozoan abnormalities in translocated bulls.

Since semen quality and freezability were not affected by the translocation, the selection based on seminal characteristics does not enable us to eliminate carrier bulls. Such results justify karyotypic analyses in bulls selected for artificial insemination or natural breeding. Further investigations are needed in the *Blonde d'Aquitaine* breed to confirm the effects of 1/29 centric fusion upon male fertility observed in Swedish cattle (Dyrendhal and Gustavsson, 1979).

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