Chromosomal aberrations or abnormal karyotypes could be one reason for reproductive failure in breeding bulls. The objective of the study was to detect chromosomal abnormalities and their relation with fertility problem in cattle and water buffalo breeding bulls. Blood samples were collected from 30 buffalo bulls and 23 Holstein or Holstein-Friesian cross bred bulls for lymphocyte culture. No gross chromosomal abnormality was detected. However, a few samples exhibited polyploidy, premature centromeric division, chromosomal fragmentation, aneuploid cells, fragile site, chromatid gaps or breaks. These aberrations were not consistent feature in a particular animal; therefore, the aberrations may not have obvious effects on fertility. However, such aberrations should be scored in regular screening as a high percentage of such abnormalities can be associated with reduced fertility. (Bangl. vet. 2012. Vol. 29, No. 1, 17 – 21)

Introduction

Most of the developments in domestic animal cytogenetics were achieved from human cytogenetics. Animal cytogenetics has several applications in animal improvement and one of these is to diagnose genetic abnormalities especially chromosomal aberrations that are usually associated with subfertility, infertility, embryonic losses and still births. Chromosomal abnormalities account for substantial loss in animal production and some pedigree bulls selected for breeding are subfertile or infertile (Alam and Hurtado, 1982). Many countries now screen bulls for chromosomal aberrations (Kovacs and Szepeshelyi, 1987; Patel, 2000). The most common effect of unbalanced karyotype is early embryonic mortality. Where artificial insemination (AI) is used, chromosomal aberration can be transmitted to large populations and it can cause repeat breeding in females because of embryonic losses, and poor semen quality in bulls. Cytogenetics in domestic animals was started in the early sixties and various abnormalities have been reported in Indian cattle (Prakash et al., 1995; Patel et al., 1997a; Patel, 1999a; Patel and Patel, 2000; Yadav, 2000; Patel, 2002 Patel, 2003; Muralidharan et al., 2011) and in buffaloes (Balakrishnan and Yadav 1984; Balakrishnan et al., 1985; Yadav et al., 1987; Yadav et al., 1990; Prakash et al., 1992; Prakash et al., 1994; Vijh et al., 1994; Patel et al., 1997; Patel and Khoda, 1998; Patel, 1999b; Patel et al., 2006; Chauhan et al., 2009; Prakash and Singh, 2009).
Materials and Methods

A total of 53 heparinized blood samples were collected from 23 phenotypically normal Holstein-Friesian (HF) and HF Crossbred bulls and 30 Murrah buffalo bulls stationed at sperm stations of Gujarat State, India. Chromosomal preparations were performed using standard whole blood culture in RPMI-1640 medium supplemented with antibiotics, 15% fetal calf serum and 1% pokeweed mitogen (Patel et al., 1995). The culture was incubated at 37°C for 72 hours. To increase the relative frequency of prometaphase chromosomes, Ethidium bromide (Sigma, India) 10 µg/mL was added for two hours and to arrest somatic cell division at metaphase stage, colchicine (Sigma, India) 2 µg/mL was added for one hour. The cells were harvested by centrifugation at 1000 rpm for five minutes followed by hypotonic treatment with 0.56% KCl for 20 minutes at 37°C and fixed in 3 : 1 ratio of methanol and glacial acetic acid. Finally, cell suspension was dropped on slides and air dried. Slides were stained with Giemsa stain for screening under the Nikon (Japan) compound microscope with photographic system.

Results and Discussion

Cattle (*Bos taurus*) normally possess 60 (2n) chromosomes, 29 pairs of autosomes and one pair of sex chromosomes. All the autosomes are acrocentric and sex chromosomes (XY) are submetacentric. The water buffalo (*Bubalus bubalis*) possesses 50 (diploid) chromosomes, 24 pairs of autosomes and one pair of sex chromosomes. The first five pairs of autosomes are submetacentric, whereas all others including sex chromosomes are acrocentric. The X chromosome is largest acrocentric, and can be easily identified even without GTG banding. The Y chromosome is among the smaller acrocentric chromosomes (Kumar and Yadav, 1991) and can be identified by conventional G and C-bandings.

In most samples, approximately 30 metaphase chromosome fields were screened. No breeding bull exhibited gross abnormalities except for some sporadic chromosomal aberrations like polyploidy (Fig. 1), premature centromeric division (PCD; Fig. 2), chromosomal fragmentation (Fig. 3), aneuploid cells (Fig. 4), fragile site (Fig. 5), chromatid gaps or breaks. These low degrees of aberrations were not consistent for a particular sample, therefore, may not have obvious effects on fertility. However, such aberrations should be scored, as a high percentage of such abnormalities can be associated with reduced fertility (Prasanthi et al., 2004; Sangamitra et al., 2004; Patel et al., 2011), which is generally not noticed as fertility of bulls is not regularly monitored in many countries.
Fig. 1. Polyploid cell of Buffalo

Fig. 2. PCD in cattle chromosomes

Fig. 3. Chromosomal fragmentation in cattle

Fig. 4. Aneuploid cell (61, XXY) of cattle. Large arrows indicate X chromosome and small arrow indicates Y chromosome

Fig. 5. Arrow indicates fragile chromosome in buffalo
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Reference


