Reproductive Performance of Arabian and Thoroughbred Mares under Subtropical Conditions of Pakistan

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ABSTRACT: Breeding records of 57 Arabian and 66 Thoroughbred mares were analysed to assess their reproductive performance under the subtropical conditions of Pakistan. The Arabian mares showed significantly higher conception rates ($p<0.05$) in second mated oestrus and foal heat mated oestrus compared to Thoroughbred mares. However, conception rates for first lifetime mated oestrus were similar in both breeds of mares. Age at first mating ($1,301\pm40$ vs $1,500\pm32$ days) was significantly ($p<0.05$) less in Arabian compared to Thoroughbred mares. Both breeds of mares showed significantly ($p<0.05$) higher frequencies of oestrous cycles and conception rates during the winter (October to March) compared to summer (June to August) months. Age of mares affected the conception rates, as mares at ages 3 to 7 and 8 to 12 years of ages had significantly higher conception rates ($p<0.05$) than those ≥18 years old in both breeds. This study demonstrates that i) reproductive performance in Arabians is better than Thoroughbred mares under the subtropical conditions of Pakistan, ii) mares remain cyclic throughout the year and iii) conception rates were higher in mares bred during winter compared to summer months. (**Key Words:** Mare, Reproductive Performance, Conception Rate, Pakistan)

INTRODUCTION

Limited information is available on the reproductive efficiency of Arabian and Thoroughbred mares (Demirci, 1987) from countries located in subtropical conditions. Retrospective studies on fertility across the world have revealed per cycle pregnancy rates ranging from 54% to 64% in Thoroughbred (Bruck et al., 1993) and 84% in Arabian mares (Benhajali et al., 2009). While there are a few reports of higher foaling rates, these perhaps are the result of better selection criteria and more intensive management of the mares (Morris and Allen, 2002). There are reports from Australia (Bruck et al., 1993), Sweden (Hemberg et al., 2004), India (Sharma et al., 2009), and the UK (Sanderson and Allen, 1987) showing varied conception rates. Yet to our knowledge, no scientific studies have been reported on the reproductive performance of Arabian and Thoroughbred mares under subtropical conditions in Pakistan.

British cavalry imported Arabian and Thoroughbred breeds to improve the native breeds of the subcontinent which did not meet their standards back in eighteenth and nineteenth centuries.

Remount Veterinary and Farm Corps (RVFC) at Mona, Pakistan is one of the places established for horse breeding. Presently, it maintains more than 5,000 equines (horses, mules, donkeys) with accurate and reliable reproductive records. This stud started horse breeding in 1902, and it is enlisted as a full member of the World Arabian Horse Organisation.

The present study was designed to investigate various reproductive parameters of Arabian and Thoroughbred mares maintained at Mona. The aim was to investigate the reproductive performance of Arabian and Thoroughbred

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mares under subtropical conditions in Pakistan. Data generated from these studies will provide valuable information on the reproductive efficiency of mares in the subtropics and help to devise better strategies for equine breeding programs in a subtropical environment.

MATERIALS AND METHODS

Database

Breeding records of Arabian (n = 57) and Thoroughbred mares (n = 66) for ten consecutive (2000 to 2010) breeding seasons were reviewed at Mona, Pakistan (latitude 32°24N; longitude 73°06E). Average temperature, humidity and rain fall during the period of data collection is shown in (Table 1). A survey form was developed and the data characterising reproductive performance was recorded and analysed. These data included mare's age, reproductive status, pregnancy status, twining, abortion and foaling outcome. Conception rate (CR) is defined as the number of mares that are diagnosed pregnant between 30 to 45 days post-ovulation compared with the total number of mares bred. Seasonal (or cumulative) CR signifies the proportion of mares that conceive during the course of the breeding season compared to the number of mares bred or exposed to the stallion. To maintain the farm confidentiality, all mares were identified by numerical codes.

Management

Mares were fed a daily ration according to their reproductive status. This usually consisted Lucerne hay and paddock grass *ad libitum* plus approximately 4 kg of concentrate divided twice or thrice/d. All mares were regularly assessed for various reproductive diseases by speculum examination of the vaginal vault, endometrial culture and cytology. Mares having the history or evidence of reproductive disorders (repeat breeders, uterine infections, anatomical defects) have been excluded from the data of the current study. Oestrus was monitored daily by teasing with a stallion in the early morning. Two veterinarians examined mares by palpation per rectum and by ultrasonography to verify the ovarian follicular status and uterine oedema (Bergfelt and Adams, 2007). Mares in oestrus were mated by natural service using a stallion in-hand with known fertility. The mares were bred again 48 h later. The same two veterinarians performed pregnancy detection by ultrasonography (Falco Vet 100; Pie Med; Holland) or by transrectal palpation at 30 days post-breeding.

Statistical analysis

Chi-squared analysis was used to determine if there was an overall effect of each variable on the outcome of interest (Kranzler and Moursund, 1999) and, if the effect was significant ($p < 0.05$). Multiple comparisons were made and each comparison was considered significant only after the Bonferroni adjustment. Age at first mating between Arab and Thoroughbred mares were analysed using a paired t-test. $p < 0.05$ was regarded as significant. For part of the analysis, mares were categorised into breed or age groups. Age categories were 3 to 7 years; 8 to 12 years; 13 to 17 years and 18 years or older.

RESULTS

Arabian mares showed significantly higher conception rates ($p < 0.05$) compared to Thoroughbred mares in the second mated oestrous cycle and foal heat mated oestrus Table 2. However, conception rates for the first lifetime mated oestrus were similar in both breeds of mares. Age at first mating (1,301±40 vs 1,500±32 days) was significantly ($p < 0.05$) less in Arabian as compared to Thoroughbred mares. Various reproductive traits like twining, abortion, still born and foal sex ratio are presented in Table 3. Both breeds of mares showed significantly ($p < 0.05$) higher

Table 1. Average means of temperature, humidity and rain fall during the period of survey at Mona equine breeding farm in Pakistan

Months	Temperature (℃)		Humidity (%)		Rain fall (mm)
	Maximum	Minimum	Morning	Evening	
January	18.27±3.64	5.62±3.28	87.41±10.91	52.00±17.12	0.95±3.78
February	22.74±4.45	9.61±2.93	83.26±13.45	56.91±18.79	3.11±8.96
March	28.25±4.34	14.45±2.48	79.52±10.14	51.61±13.76	1.28±5.74
April	35.06±4.21	19.47±3.1	55.98±15.08	33.69±15.02	0.65±3.28
May	38.69±3.54	24.04±2.57	50.73±12.39	32.06±9.52	1.68±11.58
June	38.69±3.99	25.29±2.65	60.57±17.96	45.36±18.17	3.14±10.21
July	35.41±3.31	27.39±17.07	79.45±11.75	65.58±10.97	6.83±19.91
August	34.23±3.73	25.85±2.19	85.85±6.83	68.80±10.77	5.41±15.22
September	34.19±2.32	23.62±2.54	87.37±5.55	62.41±11.03	1.39±4.96
October	32.26±2.36	18.59±2.96	84.32±7.30	55.27±9.74	0.12±0.76
November	25.48±2.70	12.12±2.8	89.60±7.15	63.57±11.37	0.26±1.07
December	20.40±2.37	6.25±2.25	89.07±3.73	56.29±16.43	1.14±8.71

Table 2. Conception rate in first, second and foal heat mated mares under subtropical conditions of Pakistan

Breed	First mated oestrus*		Second mated oestrus**		Foal heat mated oestrus		Conception rate (%)
	No. of mares	Conception rate (%)	No. of mares	Conception rate (%)	No. of mares	No. of mating	
Arabian	57	75	53	45[a]	67	242	52[a]
Thoroughbred	66	62	64	22[b]	57	240	33[b]

Values in the same column with different superscripts are different ($p < 0.05$).
* Conception rate at first lifetime breeding.
** Conception rate at second oestrus cycle breeding (includes mares consecutively breeding second lifetime).

Table 3. Various reproductive traits in mares under subtropical conditions of Pakistan

Breed	No. of mares	Age at first mating (d)	Twining rate %*	Abortion rate %	Dead born rate %	Foal sex ratio Filly:colt
Arabian	57	1,301±40[a]	-	3	3	54:46
Thoroughbred	64	1,500±32[b]	3	8	7	49:51

Values in the same column with different superscripts are different ($p < 0.05$).
* Termination in abortion.

frequencies of oestrous cycles and conception rates during the winter (October to March) months Figure 1 and 2. Age of mares affected the conception rates, as mares at ages 3 to 7 and 8 to 12 years of ages had significantly higher conception rates ($p < 0.05$) than those ≥18 years old in both breeds Figure 3.

DISCUSSION

To the best of our knowledge, this is the first report on reproductive performance of Arabian and Thoroughbred mares under subtropical conditions of Pakistan. The present study demonstrates higher conception rates in Arabian (45% and 52%) compared to Thoroughbred (22% and 33%) mares bred during second mated oestrus and foal heat mated oestrus, respectively. The higher conception rate in Arabian mares may be due to a genetic trait of adaptability in warmer climates.

The first lifetime mated oestrus conception rates found in this study (75% and 62%) were comparable to 80% and 66% reported by Demirci (1987) for Arabian and Thoroughbred mares (Hemberg et al., 2004), respectively. Therefore, it suggests that overall reproductive efficiency for both breeds did not differ in the present facility compared to other parts of the world. The aetiology of the CR discrepancy between Arabian and Thoroughbred mares may be multifactorial. In other species such as cattle, there are precedents where selective breeding for non-reproductive traits have lead to reduced fertility (Lucy, 2001). In Thoroughbred mares there have been many years of selective breeding for athletic ability, coupled with widespread use of reproductive technologies to assist subfertile mares to produce foals. The effect of these factors on fertility in Thoroughbred mares remains to be investigated.

In the present study, age of the mare is a major factor influencing conception rates in Arabian and Thoroughbred mares which is in agreement with several other studies
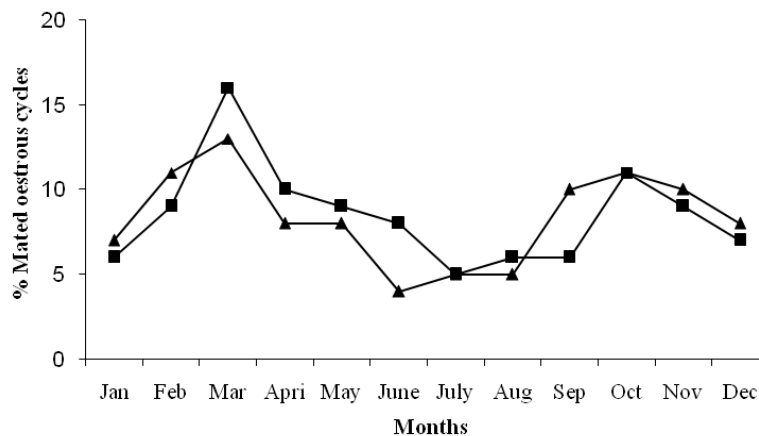
Figure 1. Distribution of mares mated during the whole year. Shown are the % of mares mated oestrous cycles ($n = 697$) of Arabian (▲) and ($n = 1,110$) of Thoroughbred (■) mares under subtropical conditions of Pakistan.
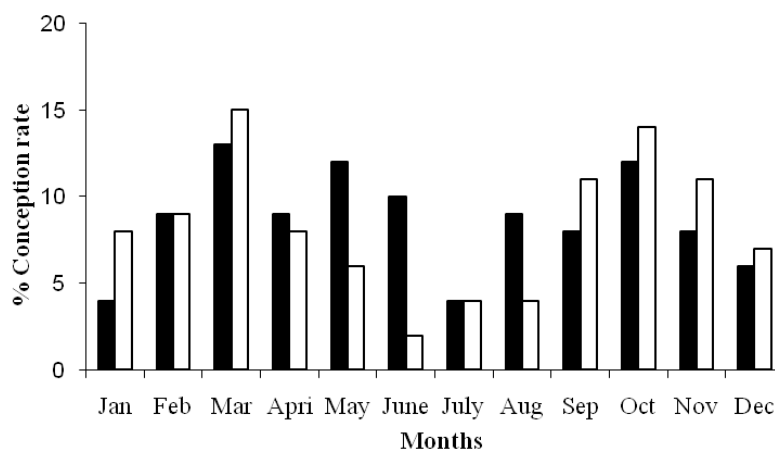
Figure 2. Observed pattern of conception rate during different months. Shown are the % of conception rates (n = 308) of Arabian (□) and (n = 336) of Thoroughbred (■) mares under subtropical conditions in Pakistan.

(Samper et al., 2002; Davies Morel et al., 2005; Allen et al., 2007; Benhajali et al., 2009; Sharma et al., 2009). Most likely, the decline in fertility with age could be due to anatomic changes in perineal conformation and the physical barriers to uterine contamination leading to predisposition to pneumovagina, and urine pooling (Roberts, 1986); progressive degenerative changes in the endometrium; and susceptibility to endometrial infection that has been observed in older mares (Bracher et al., 1996). However, more studies are needed to determine if there is a definable point at which age should be considered when predicting foaling probabilities in mares within each endometrial category.

The present study clearly indicates that Arabian and Thoroughbred mares remain cyclic throughout the year in subtropical regions of Pakistan. In contrast to more temperate climates, frequencies of oestrous cycles and conception rates were significantly higher during the winter months. Most likely, higher frequencies of oestrous cycles and conception rates during winter compared to summer in

this study could be due to a higher level of protein and energy in winter fodder compared to summer fodder (Khan et al., 2006). Furthermore, due to high temperature and humidity during the summer months, there is limited breeding of mares during June to August at the present facility.

CONCLUSION

This study demonstrates that under subtropical conditions of Pakistan i) reproductive performance in Arabians is better than Thoroughbred mares; ii) mares remain cyclic throughout the year; and iii) conception rates were higher in mares bred during winter compared to summer months.

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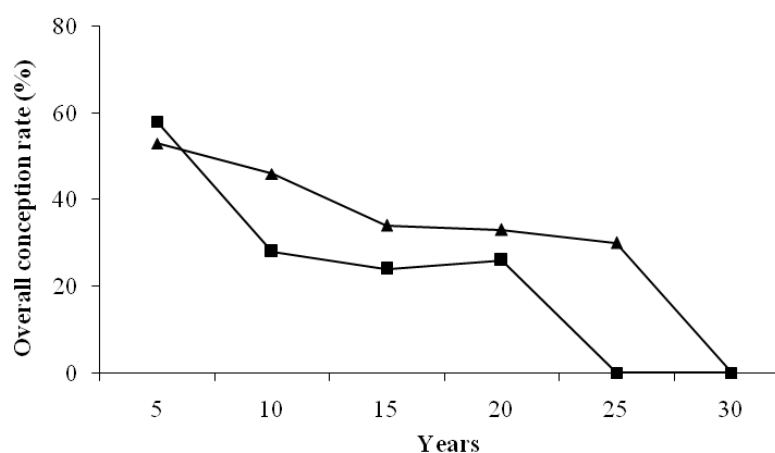
Figure 3. Overall conception rate (number of pregnant mares/number of mated mares) according to the mare's age. Shown are the % of conception rates of Arabian (n = 19) (▲) and Thoroughbred (n = 26) (■) mares.

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