



Determination of relationship between milk production and the quality of embryo of donor cows

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ABSTRACT

The relationship between milk production in donor cows (74) and quality of embryos was examined in the experiment. According to their milk production, the donors were divided into three groups. In the group 1 there were 18 donors with the milk yield lower than 5000 kg per lactation; in group 2, 32 donors, with milk yield between 5000 kg and 7000 kg, and in group 3, 24 donors with milk production over 7000 kg. Number of total embryos and percentage of transferable embryos in groups were statistically significant. The higher rate of non-transferable embryos was recorded in donors in group 3 with high milk production (48.91%). A positive correlation was recorded between the number of total embryos suitable for transfer decreased in cows with higher milk production ($r = -0.267$), and an important correlation was recorded ($r = -0.070$) between milk production and transferable embryo number.

Key words: Donor cow, Embryo quality, Milk production

Multiple ovulation and embryo transfer (MOET) is of great interest for animal breeding, because of its potential applications in genetic improvement (Lonergan 2007). With the introduction of breeding and conservation MOET nucleus schemes (Nicholas and Smith 1983), particularly in Holstein cattle (Penna *et al.* 1998, Ayasan and Karakozak 2010), these studies became more important. However, MOET results are largely variable and unpredictable.

During the last decades, genetic selection and improved management of herds have dramatically increased milk production of dairy cows, at the same time, the fertility has decreased (Butler 2003). Selection for higher milk production in dairy cattle has changed endocrine profiles of cows so that blood concentrations of bovine somatotropin and prolactin have increased; whereas insulin has decreased (Bonczek *et al.* 1988). Nebel and McGilliard (1993) reported various detrimental results of high milk yield on reproductive performance, primarily delayed ovarian activity and reduced

conception rates.

There is a paucity of information for the relationship between the milk production and the quality of embryos of donor cows. Hence, this study was carried out under the MOET project in Turkey to explore such effects, if any.

MATERIALS AND METHODS

The study was conducted in experimental farm of Cukurova Agricultural Research Institute in Adana, Turkey. The study includes 74 donor Holstein cows aged 5 to 6 years, weighing between 500 and 600 kg. The MOET program was carried out under standardised management conditions. All donors had a regular oestrous cycle and no reproduction diseases and were between days 150 and 210 of lactation. According to milk production, the donors were divided into 3 groups. In the first group, there were 18 donors with the milk yield lower than 5000 kg per lactation; in the second group, 32 donors with the milk yield between 5000 kg and 7000 kg; and in the third group, 24 donors with the milk production over 7000 kg.

Superovulation and luteolysis using decreasing doses of FSH with cloprostenol and embryo collection was done as per standard protocol. Embryos were graded according to the IETS guidelines (Robertson and Nelson 1998). Grade 1 and 2 embryos were defined as viable, and grade 3 and 4 were considered degenerate. Unfertilized ova were

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Table 1. The effect of donor milk production on embryo quality characteristics

Groups	Number of donor cows	Yield of milk (kg/year)	Transferable embryos (X±Sx)	Non transferable Embryos X±Sx	Total embryos X±Sx	Total number of yielded embryos and oocytes	Percentage of transferable embryos	Percentage of non transferable embryos
1	18	<5000	5.89±1.07*	3.06±0.82**	8.94±1.22*	106	68.64**	31.36**
2	32	5000–7000	4.78±0.79	3.19±0.57	7.97±0.98	153	57.46	42.54
3	24	>7000	2.96±0.66	2.54±0.60	5.50±0.72	71	51.09	48.91
	74	Mean	4.54±0.49	2.93±0.37	7.47±0.58	110	59.06	40.94

*Means within row with different superscripts differ significantly ($P<0.05$); ** not significant ($P>0.05$).

designated when there was no sign of cleavage.

For statistical analysis, the data was subjected to analysis of variance using GLM (general linear model) procedure of SPSS (1999), and means were separated using Duncan's multiple range test. The relationship between the milk production and yield and quality of embryos was expressed by means of correlation coefficient r .

RESULTS AND DISCUSSION

The relationship between milk production and embryo quality characteristics is shown in Table 1. In group 1, total recovery was 106 embryos and oocytes, out of which transferable embryos were 5.89 ± 1.07 / donor cow, in group 2, embryos were 153 with transferable embryos 4.78 ± 0.79 / donor cow and in the group 3 there were 71 embryos and oocytes, with 2.96 ± 0.66 transferable embryos / donor cow. The percentage of transferable embryos and not-transferable embryos from donor cows was not significant among the groups ($P>0.05$).

In the study, a decrease was observed in the transferable embryos as donor milk production increased (Table 1). Novotny *et al.* (2005) showed the negative effect of donor cow milk production on embryo production. The percentage of suitable transferable embryos was higher in the cows with the milk production lower than 5000 kg, namely 68.64%, in

comparison to the cows with the milk production between 5000 and 7000 kg (57.46%) and with the cows with the milk production greater than 7000 kg (51.09%).

Mean transferable embryos 4.54 ± 0.49 obtained in this study, was in agreement with the findings of Seidel and Seidel (1981). Yaakub *et al.* (1997) reported that the higher number of bad quality oocytes and degenerated embryos was recorded in cows with high milk production and weak physical condition. Earlier reports indicated the possible harmful effect of high energy nourishment in the milk yielding cows with high production on the quality of embryos both in superovulated and in non-superovulated cows and sheep (Pryce *et al.* 1999, Lozano *et al.* 2000, Washburn *et al.* 2002 and Boland and Lonergan 2003). However, Yaniz *et al.* (2008) reported that fertility was not affected by high milk production.

In our experiment, the regression analysis showed the effect of donor milk yield on the total embryos ($r = -0.267$, $P=0.022$;) and on the transferable embryos ($r = -0.070$, $P=0.023$;) (Fig. 1) and therefore statistically negative correlation between milk production and the number of transferable embryos ($r = -0.070$; $P=0.023$) were obtained. Novotny *et al.* (2005) found also that a slightly negative correlation ($r = -0.350$) was recorded, i.e. the number of embryos suitable for transfer decreased in cows with higher milk production.

The study indicated that milk production affects the number of transferable embryo and total embryo ($P<0.05$). Hence, the selection of donors on the basis of milk yield may be evaluated in the light of the findings of this study.

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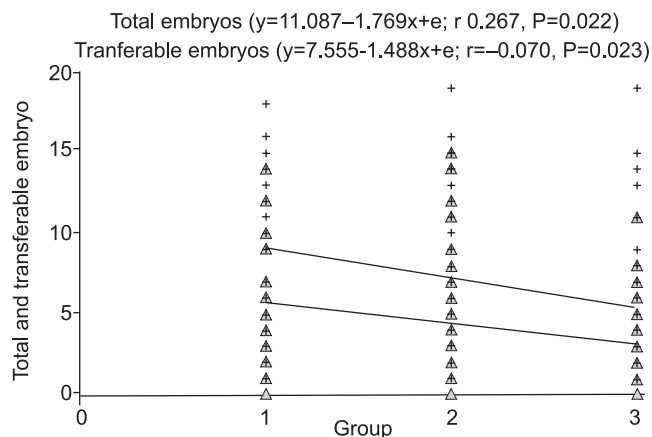


Fig 1. Regression equation between milk yield and tranferable and total embryos.

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