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GENETIC EVALUATION OF MILK PRODUCTION AND LITTER WEIGHT TRAITS IN GABALI, NEW ZEALAND WHITE RABBITS AND THEIR CROSSES IN A NEWLY RECLAIMED AREA OF EGYPT

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A crossbreeding study was carried out in Maryout Experimental Station, Desert Research Center using Gabali (Gab) as a local breed and New Zealand White (NZW) rabbits as an exotic one in addition to their two reciprocal crosses to study direct heterosis, maternal additive and direct additive effects in addition to some non-genetic factors on milk production and litter weight traits up to weaning. Means of total milk production from kindling up to 21 days and up to weaning at 35 days were 1330.92±23.29 and 1941.93±33.67 gm, respectively. Litter milk efficiency up to 21 and 35 days were 0.85 and 1.02, respectively. Season of kindling contributed significantly to litter milk efficiency traits. Summer kindling does tended to produce the heaviest milk production litter weight at different ages. Milk production and litter weight traits were not affected significantly by mating group. Crossbreeding between NZW and Gab rabbits though non-significant resulted in persistent heterotic effects on milk and litter weight traits studied. Most of doe milk production and litter weight traits were in favour of litters damed by local Gab does as compared to those damed by NZW ones. Direct additive effect on milk production traits was in favour of the crossbred litters sired by NZW bucks.

Key words: Milk production, litter weight, Heterotic effect, direct additive effect, maternal additive effect.

Crossbreeding has an advantage over the synthesis of breeds in utilizing the breed differences due to the expected segregation along with the recombination (Dickerson, 1969). Crossbreeding among standard and local breeds of rabbits has been widely used in Egypt in order to get genetic and economic potential benefits in terms of improvement in different productive traits (Afifi and Emara, 1991; Afifi and Khalil, 1989 & 1992; Oudah,1990; El-Desoki.1991 Afifi *et al* ,1991 Khalil *et al*, 1995; Nayera Bedier *et al* ,1999; Khalil and Afifi, 2000). New Zealand White (NZW) breed was found to exhibit outstanding maternal abilities in relation to behavior, fecundity and milk production (Ozimba and Lukefahr, 1991). Therefore, crossing of NZW does with bucks of local breeds of Egypt (e.g. Baladi, Baladi Red, Baladi Black... etc) was evident to be associated with the existence of marked heterotic effects on most economic productive traits (Oudah, 1990 ,Afifi *et al*, 1994; Khalil *et al*, 1995;Toson *et al*,1999; Khalil and Afifi, 2000).

Most of crossbreeding studies in Egypt have been carried out under the favorable conditions of the Nile valley. Results of crossbreeding might be changed or modified under other environmental conditions such as those common to newly reclaimed lands or desert. In addition, Gabali rabbits as a local breed of Egypt rabbits received little attention to investigate and quantify its productive potentialities under scientific management. The present study was carried out to evaluate some genetic aspects of crossbreeding (heterotic, maternal additive and direct additive effects) on milk production and litter weight traits in a crossbreeding trial using Gab rabbits as a local breed of Egypt, NZW rabbits as an exotic breed and their two reciprocal crosses, to throw some lights on some productive potentialities of Gab rabbits and to study some non-genetic factors on the traits considered under conditions of a newly reclaimed area in the North coast-belt of the Egyptian western desert.

MATERIALS AND METHODS

The present study was conducted in the rabbitry of Maryout Experimental Station, Desert Research Center, Ministry of Agriculture and Land Reclamation, Egypt. The study lasted for three consecutive production years started in September 1993. The Maryout station is located in a newly reclaimed area, 35km to the southwest of Alexandria near Maryout Lake, (32° N Latitude). This area is characterized by a long-hot dry summer, a relatively cold-wet winter and mild spring and autumn.

Rabbits used in this study represented two different breeds being New Zealand White (NZW), a highly productive standard breed under specific environmental conditions, and Gabali (Gab), a local desert breed that is believed to be adapted to the prevailing environmental conditions..

At the beginning of this study breeding does of each of the two experimental breeds (NZW and Gab) were randomly divided into two categories. Those of the first category of each breed were mated to bucks from the same breed, while those of the second category were mated to bucks from the other breed. Does of each category were grouped at random into groups of four or five does. For each group and according to the breeding scheme, a buck was assigned at random for mating with a restriction of avoiding full sib, half sib and parent-offspring mating. Each breeding buck was allowed to sire all his litters from the same assigned female group. Culled or dead breeding does or bucks were replaced by their substitutes obtained from the same breed. The breeding scheme permitted the simultaneous production of purebred NZW and Gab rabbits in addition to their two reciprocal crosses in each parity.

NZW rabbits were obtained from the rabbitry of Shaco Company, Cairo :hat were descendants of NZW rabbits under the Egyptian conditions. The Gab :abbits were bought from Southern Sinai where Bedouins rear for their own :ood utilization.

Experimental rabbits were raised in a semi-closed rabbitry. Breeding loes and bucks were housed individually in wired cages with standard limensions in vertical metallic batteries (each of four double floors) allocated n two parallel rows along the rabbitry. Each maternity cage was provided with ι metal nest box for kindling and nursing the suckling rabbits by their dams. \ll cages of does and bucks were equipped with feeders made of galvanized teel sheets and automatic drinkers with nipples. Urine and feces dropped down n the batteries were washed and removed every day in the morning.

\ccording to the breeding plan during the breeding time, each doe was ransferred to the cage of the assigned buck to be hand mated to ensure opulation and returned back again to her own cage. On the tenth day after ɿating, each mated doe was palpated to detect pregnancy. Does that were ɔund to be non-pregnant were remated from the same mating buck. Likewise, fter 7 days of kindling, does were mated by the same assigned bucks.

On the 25th day of pregnancy, the nest boxes were supplied with some ce straw to help the doe in preparing a warm comfortable nest for newnates of er litter. Cages and nest boxes were regularly cleaned and disinfected before ach kindling. Within 12 hours after kindling, each litter was checked, recorded ɿd thenafter examined every morning to get rid of the dead individuals from ιe nest. At 5 weeks of age, young rabbits were weaned, ear tagged, sexed and ansferred to standard progeny wired cages in groups of three-four rabbits per ıge.

All years round, rabbits were fed on a standard palleted ration, which as offered ad libitum. Ingredients and composition of the ration, as well as eding and management practices were described in details by Abdel-Aziz 998).

Milk production of each doe was recorded at the seventh (MY7), 14th 1Y14), 21st (MY21) and 35th (MY35) days after kindling, using the weight-ckle-weight technique described by McNitt and Lukefahr (1990). Total milk oduction of the first 21 days of the suckling period (TMY21) was considered seven times of the sum of MY7, MY14 and MY21. Total milk production ɔduced during the suckling period (TMY) was taken as TMY21+ 14(MY35). tter milk efficiency was calculated for two intervals, the first from kindling to 21 days (LME21) and the second from kindling up to weaning at 35 days ME35). Litter milk efficiency for any of these intervals was considered as : gain in litter weight during this interval divided by litter milk intake during the same interval (Lukefaher et al 1983). Milk coefficient up to weaning (MC) was calculated according to Nasr (1994) as [Total milk yield/(doe weight at kindling x lactation period in days)] x 100. Litter weight in grams was recorded at birth (LWB), at 21 days (LW21) and at weaning (LWW). Milk production and litter weight traits were analyzed by using the mixed model least–squares and maximum likelihood program of Harvey (1990). The mixed model included the fixed effects of year of kindling, season of kindling, parity, mating group and all the possible of interactions among the previous factors in addition to the random effects of buck nested within mating group and doe nested within buck within mating group. Crossbreeding genetic effects (purebred differences, direct heterotic effect, maternal effect and direct additive effect) on different traits were estimated according to the genetic model of Dickerson (1992). This genetic model permits deriving a selected set of linear contrasts (Harvey, 1990)

RESULTS AND DISCUSSIONS

Year of kindling

Year of kindling effect (presented in Table 1) was not able to contributed significantly to the variances of milk production and litter weight traits except litter weight at weaning (LWW) which was affected significantly ($P<0.05$). In disagreement with these results, El-sayaad and Khattab (1990) with Giza White and Bouscat rabbits found that first-, second-, fourth and fifth-week milk yield along with total milk production were significantly ($P<0.05$ or $P<0.01$) influenced by year kindling. Also, Khalil (1993) with Giza White rabbits proved that F-value for the effect of year of kindling on milk yield during the suckling period was significant ($P<0.01$). With respect to litter weight traits, Nayera Bedier *et al* (1999) with Gabali, Californian and their two reciprocal crosses, found that year of kindling did not contribute significantly to the variances of litter weight traits. Yearly changes in litter weight within any rabbit herd would probably be attributed to fluctuation in weather, labour skill, feeding and health conditions (Afifi *et al*, 1989; Youssef, 1992; others). Thus, neglecting the inclusion of year-of-kindling effect in the model of analysis might mask the genetic differences among does or does of different genetic groups.

Season of kindling

Season of kindling did not significantly influence milk production traits of the study except LME21 and ME35, which were significantly ($P<0.05$ or $P<0.01$) affected (Table1). At the same time, all litter weight traits were observed to be significantly ($P<0.05$ or $P<0.01$ or $P<0.001$) affected by season of kindling. In agreement with results in table1, Hassan *et al* (1992) showed that milk yield from kindling to weaning was not significantly influenced by season of kindling. On the contrary, Yamani *et al* (1991) proved that season of kindling exerted significant (P<0.05) effect on milk yield over the period of lactation. Also, Ayyat *et al* (1995) observed that season-of-kindling effect was significant (P<0.01) on milk yield during the first three weeks after kindling and the whole suckling period. In agreement with result in Table 1, Ayyat *et al* (1995) found that season of kindling was a significant (P<0.01) source of variation in LWW. Result in table2 reveals that rabbit does kindled during summer season showed the highest performance for milk production and litter weight traits than those kindled during other seasons of the year. In this respect, Hassan *et al* (1992), Nasr (1994) and Ahmed (1997) in the Nile valley found that milk yield of does kindled during autumn and winter was higher than that of does kindled during spring and summer. The superiority of the performance of summer-kindled does for milk production and litter weight traits over that of those kindled during any other season of the year in the present study might be due to that the climatic conditions in Maryout area (location of the study) during summer was always better than during any other season of year. Seasonal variation in milk production and litter weight traits is deamed to be a reflection of differences in seasonal climatic conditions.

Parity

Parity did not constitute any significant source of variation in all milk production and litter weight traits of the study (Table1). Similarly, El-Sayaad and Khattab (1990), Khalil (1993), Nasr(1994) and Khalil *et al* (1995) with different breed groups of rabbits reported that parity effect on milk yield of the doe either during stages of suckling period or during its whole length was non-significant. Also, Afifi and Khalil (1989), El-Sayaad and Khattab (1990), Afifi *et al* (1992) and Khalil *et al* (1995) found that parity had no or a little contribution to the variances of litter weight traits. On the contrary, parity effect in rabbits was observed to have significant (P<0.05 or P<0.01) effect on milk yield traits of (Askar, 1989;Mcnitt and Lukefahr,1990; Yamni *et al,* 1991; Hassan *et al,*1992; Khalil,1994;Ayyat *et al*, 1995) and litter weight traits (Khalil and Afifi, 1991;Yamani *et al*, 1991).

The changes of the does performance for milk yield and litter weight traits with advance of parity were not able to show any consistent pattern of effect on either milk production or litter weight traits (Table2). A lot of the cited literature revealed that parity showed a curvilinear pattern of effect on milk yield (Lukefahr *et al*,1983; Mcnitt and Lukefahr,1990; El-Sayaad and Khattab (1990); Hassan *et al*,1992 Khalil 1993 & 1994;Ayaat *et al* 1995) and litter weight traits (El-Sayaad and Khattab, 1990;Khalil, 1993), but the peak was reached at different parities. However, Abo El-Ezz et al (1981), Holdas and Szendro (1982), Abo El-Ezz *et al* (1988), Mcnitt and Lukefahr (1990) Yamani *et al* (1991) and El- Maghawry *et al* (1993) observed that milk yield increased as parity advanced. Also, it was found by Yamani *et al* (1991) that beginning with the second parity, litter weight traits increased gradually as parity advanced till the fifth one. The pattern of change in milk yield due to parity might be related to changes in the physiological efficiency of the doe which occur with advance of parity especially those related to the udder capacity and doe's ability to nurse her young (Abo-El-Ezz *et al*, 1981) and that mammary gland cells increase in size and number with advance of parity till reaching the maximum at the parity in which the maximum milk yield is produced (El-Sayaad and Khattab, 1990). The pattern of change in litter weight traits (LWB, LW21 and LWW) seems to follow that of milk yield of the doe up to 21 days and weaning. Results of Khalil (1993&1994) proved the existence of positive significant (P<0.001) residual correlation between LWB, LW21 and LWW and each of milk yield up to 21 days and up to weaning.

Interactions

Among all the interactions of the study, only the interaction between mating groups and season of kindling on each of TMY21, TMY and MC was significance (P<0.05).

Mating group

All milk production and litter weight traits did not differ significantly among the four mating groups of the study (Table 1). Likewise, Afifi and Emara (1984), Oudah (1990) and Nayera Bedier et al (1999) found that mating group effect on most litter traits studied was not significant. Mating Gab bucks with NZW does produced more TMY21 and TMY than other mating groups of the study and weaned heavier litters than purebred matings of either Gab and NZW rabbits (Table 3). The best performance for litter weight traits was shown by litters sired by NZW buck and damed by Gab does.

Purebred differences

Differences between both Gab and NZW purebred for all milk production traits were not significant (Table 1) and in favour of NZW ones for TMY, LME35 and MC. These results might indicate that NZW does were more persistent lactating up to later stage of suckling period as compared to Gab ones. Similarly, Oudah (1990) and El-Desoki (1991) reported that milking ability of exotic breeds of rabbits was better than that of local breeds. However, linear contrasts of Gab and NZW rabbits in this work showed that differences between the two breeds were in favour of Gab rabbits for LWB, LW21 and LWW and significant only for LWB (Table 3). Youssef (1992) found that linear contrast of NZW and Baladi Red rabbits were significant (P<0.01 or P<0.001) for LWB, LW21 and LWW and in favour of NZW rabbits. In this respect, Nayera Bedeir *et al* (1999) with Gab and Californian (Cal) rabbits and their two reciprocal crosses revealed that purebred differences were in favour of Gab rabbits for LWW and in favour of Cal rabbits for litter weight at earlier ages (LWB and LW21). On the contrary, results of Khalil and Afifi (2000) indicated that NZW rabbits surpassed Gab ones for both milk yield (TM21 and TMP) and litter weight (LWB and LWW) traits. This might be due to its better mothering and milking abilities of NZW rabbits than Gab ones.

Table 1 F–ratios of the least-squares analyses of variance of different factors affecting milk production and litter weight traits .

Source of variation	Df	TM21	TMY	LME21	LME35	MC	LWB	LW21	LWW
Mating group	3	0.12	0.12	2.16	0.42	0.06	1.56	1.56	0.26
Buck/mating group	32	0.97	1.15	0.73	0.98	1.22	1.30	0.87	1.20
Doe/mating group/buck	63	1.82**	1.43*	1.79**	1.10	1.33	1.39*	1.87***	0.99
Year of kindling	2	0.83	0.61	2.47	2.79	0.74	1.11	0.69	2.40*
Season of kindling	3	0.76	1.21	3.85*	9.26***	0.80	3.98*	5.56**	7.68***
Parity	5	0.38	0.32	2.08	1.67	0.17	1.47	0.78	1.30
Mating group x season	9	2.48*	2.31*	1.37	1.03	2.13*	0.99	1.31	0.26
Season x Parity	15	1.07	1.18	1.29	1.33	1.46	0.79	0.90	1.14
Mating group x parity	15	1.06	0.80	0.36	0.90	0.99	1.19	0.74	1.02
Remainder df	183						183	183	297
Remainder mean squares		50524.95	25.05	0.06	0.082	0.12	3252.66	142337.4	465248.5

TMY21= Total milk yield up to 21 days . TMY= total milk yield during the suckling period. LME21= litter milk efficiency up to 21 days. LME35= litter milk efficiency up to 35 days and MC= milk coefficient. LWB=Litter weight at birth. LW21=Litter weight at 21 days. LWW=Litter weight at weaning. +=Buck breed listed first. * =P<0.05. ** =P<0.01. *** =P<0.001

Table 2. Least -squares means of season and parity effect on milk production and litter weight traits.

Source of variation	TMY21	TMY	LME21	LME35	MC	LWB	LW21	LWW
	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Season of kindling								
Autumn	1272.91±50.26	1842.80±75.78	0.83±0.05	1.05±0.06	1.79±0.08	356.60±12.80	1446.82±84.69	1924.18±114.72
Winter	1319.13±42.19	1912.60±62.29	0.88±0.04	0.89±0.05	1.87±0.06	324.86±10.77	1338.39±71.21	1848.52±101.71
Spring	1340.76±3820	1948.52±56.50	0.92±0.04	1.06±0.04	1.88±0.06	354.35±09.76	1580.97±64.57	2008.05±093.21
Summer	1390.89±46.82	2062.79±70.53	0.97±0.05	1.29±0.06	1.97±0.07	373.40±11.93	1782.96±78.94	2520.86±111.87
Parity								
1st	1231.33±88.65	1847.89±133.96	0.93±0.10	1.32±0.11	1.84±0.14	309.63±22.52	1652.94±146.99	2365.21±198.45
2nd	1304.35±59.99	1936.19±090.93	0.95±0.06	1.15±0.07	1.90±0.09	336.40±15.26	1590.65±100.97	4444.57±135.69
3rd	1350.10±49.74	1968.53±075.08	0.91±0.05	1.13±0.06	1.92±0.08	368.04±12.67	1613.39±083.82	2264.38±116.22
4th	1347.07±43.05	1983.99±064.64	0.81±0.05	0.99±0.05	1.89±0.06	355.99±10.98	1439.74±072.65	1906.10±108.62
5th	1364.92±57.24	1949.03±086.60	0.91±0.10	1.02±0.07	1.87±0.09	370.37±14.57	1532.67±096.37	1977.76±140.00
≥6th	1387.77±90.10	1965.92±137.02	0.97±0.10	0.83±0.11	1.86±0.14	373.38±22.89	1394.35±151.41	1716.41±214.15

TMY21= Total milk yield up to 21 days TMP Total milk yield , LME21=Litter milk efficiency up to 21 days, LME35= Litter milk efficiency up to 35 days and MC= Milk coefficient LWB=Litter weight at birth, LW21=Litter weight at 21 days LWW Litter weight at weaning

* =P<0.05, ** =P<0.01, *** =P<0.001

Table 3. Estimates of mating group means, purebred differences, heterosis (H^I), maternal additive effect (G^m) and direct additive effect (G^I) of milk production and litter weight traits traits.

	TMY21	TMY	LME21	LME35	MC	LWB	LW21	LWW
Items	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Mating group+								
Gab x Gab	1333.90±39.38	1915.60±55.71	0.88±0.04	1.08±0.04	1.87±0.06	354.92±9.91	1526.88±67.30	2062.71±81.46
NZW x NZW	1324.69±38.88	1937.95±57.05	0.86±0.04	1.09±0.04	1.87±0.06	336.34±10.43	1441.54±66.41	2029.82±79.89
Gab x NZW	1348.37±49.73	1963.80±71.72	0.87±0.05	1.03±0.05	1.90±0.07	354.31±12.87	1564.77±84.93	2088.72±101.78
NZW x Gab	1316.73±45.24	1950.35±64.24	0.97±0.05	1.09±0.04	1.88±0.07	363.64±11.55	1615.96±77.40	2120.36±97.72
	ns	ns	ns	ns	ns	ns	ns	ns
Purebred differences [(G'NZW + G'''NZW) - (G'Gab + G'''Gab)]	-9.21±36.88	24.18±55.98	-0.02±0.04	0.01±0.05	0.01±0.05	-18.59±9.36*	-85.00±61.91	-32.88±92.15
Heterosis contrast H'NZW x Gab								
Units	1.62±14.79	21.27±22.33	0.02±0.01	-0.01±0.01	0.01±0.02	13.34±7.51	106.16±50.18*	58.26±73.87
Percentage	0.12%	1.10%	2.45%	-1.37%	0.01%	3.86%	7.15%	2.79%
Maternal effect (G''' NZW – G'''Gab)	31.64±42.61	-0.24±64.03	-10.00±0.05*	-0.06±0.05	0.02±0.06	-9.33±10.81	51.19±71.31	-31.64±16.72
Direct sire effect (G'NZW) – G'Gab)	-20.42±28.34	12.21±42.87	0.04±0.03	0.03±0.04	-0.001±0.04	-4.62±7.19	-17.07±46.07	-0.62±6.97

TMY21 = Total milk yield up to 21 days TMY=Total milk yield during the suckling period. LME21=Litter milk efficiency up to 21 days. LME35= Litter milk efficiency up to 35 days and MC = milk coefficient. LWB=Litter weight at birth. LW21=Litter weight at 21 days. LWW=Litter weight at weaning. + Buck breed listed first

* =P<0.05, ** =P<0.01, *** =P<0.001

Heterotic effect

Results of crossbreeding between Gab and NZW rabbits, given in Table 3, evidenced the presence of positive non-significant heterotic effect on most milk production traits (TMY21, TMY, LME21 and MC) and most litter weight traits (LWB and LWW). Percentages of heterosis ranged from 0.12 to 2.45% for milk production traits and from 2.79 to 7.15% for litter weight traits. Heterotic effect on litter weight was lower at birth than at weaning (13.34 vs 58.56gm). This is expected since effect of milking and maternal abilities decreased with advance of litter's age and consequently the non-additive genetic effects could express themselves later at weaning age more than earlier at kindling. These findings would indicate that crossing between Gab and NZW in this work caused some improvement in most milk production and all litter weight traits from kindling to weaning. Khalil (1996) and Afifi (1997) reported that crossing between Gab and NZW rabbits was associated with negative non-significant direct heterotic effect on milk production, but with positive significant ($P<0.05$ or $P<0.01$) direct heterosis, which caused some superiority over mid parents for litter weight at birth and at weaning. Khalil and Afifi (2000) indicated that crossing between Gab and NZW rabbits was associated with negative low non-significant heterotic effect on milk yield during the first 21 days of suckling period and during the whole of that period but positive and significant ($P<0.05$ or $P<0.01$) heterotic effect on litter weight at birth and weaning. Heterosis percent was found by same authors to be 17.5% at birth and 15.6% at weaning. In this respect, Afifi (2002) reviewing the literature noted that crossing between Gab and NZW rabbits caused the presence of positive direct heterosis in milk production traits (milk yield during the suckling period, litter milk efficiency and milk coefficient) and litter weight. However, Nayera Bedier et al (1999) proved that direct heterotic effect on litter weight traits (LWB, LW21 and LWW) was negative and non-significant when crossing was performed between Gab and Californian rabbits.

Maternal additive effect

Maternal additive (doe breed) effect was found to be of limited values and non-significant for most milk production traits (4 out of 5) and all litter weight traits (Table 3). Similarly, Afifi and Khalil (1989), Oudah (1990), Khalil *et al* (1995), Khalil (1996), Afifi (1997) and Nayera Bedier *et al* (1999) noted that differences in litter weight and /or milk production traits due to maternal additive effect were not significant. On the contrary, Khalil and Afifi (2000) crossing Gab with NZW rabbits, proved the presence of significant ($P<0.05$) maternal additive effect on LWB, LWW, TMY21(milk yield of the doe up to 21 days post-kindling) and TMY (milk yield during the suckling period). Orthogonal contrasts in table3 show the superiority of Gab over NZW rabbits in maternal additive effect for TMY, LME21, LME35, LWB and LWW while the reverse was shown for TMY21, MC and LW21. Estimates of maternal additive effect obtained by Khalil and Afifi (2000) were in favour of NZW rabbits for TMY21, TMY and LWW but in favour of Gab ones for LWB, They added that this evidenced the superiority of exotic breeds in their maternity (in terms of milk production, maternal behavior and care for young). Maternal superiority of NZW for most pre-weaning litter traits has been demonstrated by Rouvier and Brun (1990), Ozimba and Lukefahr (1991) and others. Mating NZW bucks with Gab does gave heavier litters from birth till weaning and lower milk yield up to 21 days post-kindling and up to weaning at 35 days along with smaller coefficient than the reciprocal mating (Table3) but the differences were small and non-significant as stated before. All these findings would lead to indicate that Gab does might be comparable to those of NZW ones in their maternity.

Direct additive effect

Results in Table 3 indicate that direct additive (buck breed) effect was not able to influence milk production and litter traits significantly. Also, these results reveal that the differences between the two breeds, in this respect, were of relatively limited magnitude. The linear contrasts in that table evidenced the superiority of Gab direct additive effect over that of NZW rabbits for TMY21, MC, LWB, LW21 and LWW but the reverse i.e. the superiority of NZW direct additive effect over that of Gab rabbits for TMY, LME21 and LME35 was proved. Accordingly, Gab as a buck breed generally produced milk up to 21 days post-kindling, heavier litter weight from kindling up to weaning and recorded more milk coefficient than NZW as a buck breed, while NZW a buck breed gave more milk during the suckling period and recorded higher litter milk efficiency up to 21 days and weaning. In consistent with the present results, Khalil et al (1995) with Baladi Red, NZW rabbits and their crosses, observed that linear contrasts of direct additive effect on most litter weight traits (LW21 and LWW) were not significance and that the differences between the two parental breeds in direct additive effect were relatively limited. Similarly, Nayera Bedier et al (1999) found that linear contrasts of direct additive was not significant for LWB, LW21 and LWW, i.e. little contribution of direct additive effect to the variance of litter weight traits, Also, Khalil (1996) and Afifi (1997) reported that direct additive effect on LWB, LWW, TMY were not significant. They added that effect of Gab rabbits, as a buck breed was nearly similar to that of NZW ones as a buck breed. Thus it is possible to use Gab rabbits as a terminal buck breed in crossbreeding programs when using Gab and NZW rabbits under the Egyptian desert conditions to improve rabbits productivity. Afifi (2002) came to the same conclusion.

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