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Using Rabbits as a Model: Artificial Insemination as a Tool to Increase Productive and Reproductive Traits

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Abstract **– New Zealand white breed (twenty does and four bucks) and Hyplus breed (twenty does and four bucks) were used to study the effect of diluents and sequence of ejaculation on semen quality; as well as the mating technique effect (natural mating and artificial insemination), breed and parity effect on the Productive and reproductive traits of doe.**

Breed effect on semen evaluation revealed no significant difference for semen volume (SV), color (SC), PH, mass motility (MM), individual motility percent (IM%), live sperm percent (LS%) and total semen abnormalities percent (TSA%); significant difference was reported for sperm cell concentration (SCC). A significant difference was found between different diluents in LS%, SCC, TSA%. Ejaculation sequence reported a significant difference between ejaculates for SV, SC, PH, MM, IM, LS%, SCC and TSA%. Breed effect revealed a non-significant difference in number of service/conception (NSC), gestation period (GP), litter size at birth (LSB), 21 days (LS21), weaning (LSW) and pre-weaning mortalities (PWM); and a significant difference in individual weight at marketing (IWM) and ADG from 21 days old until weaning. AI as mating technique reported significant difference at NSC, LSB, LS21, LSW, LNM, IWM and ADG in both from 21 days old until weaning and from weaning until marketing age. Finally parity effect reported non-significant difference for doe performance for both breeds.

Keywords **– Artificial Insemination, Rabbit, Productive Traits, Reproductive Traits, New Zealand White.**

I. INTRODUCTION

Rural countries are developing Intensive rabbit production system to cover some of the animal protein gap consumption taking into consideration the rabbit meat high quality [1].

Reference [2] reported that New Zealand, California and Senawy bucks SC color was white; the MM on a scale (0-5) was 2.91, 2.88 and 2.71 and normal sperm percentage was 86.17, 84.91 and 85.41 respectively; also reported high significant difference between first and second ejaculate as in the second ejaculate SV decline; increase in color scale, MM, IM, SCC, LS% and normal sperm percentage. In recent studies the second ejaculate recorded an increase in semen PH and a decreased in MM [3]. Reference [4] reported that LS % of high males was 78.1% and TSA was 21.1%.

Reference [5] recorded that New Zealand white buck SV 0.48 ml; PH 7.63; IM% 60.6%; and a decline in SV and semen pH concerning the second ejaculate.

MA24, Tris and glucose mix and skim milk usage as an extender was compared; MA24 gave best results concerning semen quality and NSC, on the other hand, no significant difference was reported in mortality rate, LSB, and LSW [6].

Effect of mating technique on productive and reproductive traits in New Zealand white and Californian breed reported a non-significant difference regarding the breed effect; while a significant difference was found in NSC between the different diluent [7]. Does performance was compared to study the effect of mating technique and reported higher LSB for AI [8].

Several studies were made to identify the breed effect over doe productivity ADG from 49 to 84 days old in Hyplus rabbit breed was 45.10 – 35.10 g/day [9]. NSC of New Zealand rabbit was 1.39 [10]. Reproductive performance of eight rabbits breed was compared and reported a high significant difference between chinchilla breed and Himalayan breed in LSB, average litter weight, PWM and ADG [11]. Hyplus breed reported ADG to be ranged from 38.84 – 29.43 g/day [12]. New Zealand white and Hyplus breed reported a high significant difference for breed effect on GP, LSB, LS 21 days, LW 21 days and ADG (g/day) [13]. Recent studies used New Zealand white breed as a model indicate that NSC (2.4); GP (31.8); LSB (6.6); PWM rate % (34.18%) [14]. Spanish rabbit breed litter size was reported to be 9.07 LSB, 7.79 LSW, and 6.95 LNM [15].

Parity effect on productive and reproductive traits were investigated, a study on three successive parities revealed an increase of GP, LSB, LSW, and PWM with the advanced parities Hassanin 2004. For 2 successive parities an increase in GP, PWM and LWW was reported; while LSB and LSW were decreased [16]. On the other hand [14] reported an increase in LSB, LWB, and LWW from 1st to 6th parity.

This study was conducted to argue the effect of diluents used in artificial insemination process, as well as the mating technique effect (natural mating and artificial insemination) on the Productive and reproductive traits of the doe, also the breed effect on parity. the possibility of using artificial insemination as a substitute for natural mating; taking rabbits as a model compared with other livestock animals are characterized with early sexual maturity, high prolificacy, relatively short gestation period, short gestation interval, rapid growth, more efficient feed conversion and low rearing cost.

II. MATERIAL AND METHODS

A. *Animals*

The study took place at the faculty of veterinary medicine, Suez Canal University, during the period from

September 2010 to May 2011. New Zealand White rabbit (20 does and 4 bucks) and Hyplus breed (20 does and 4 bucks) were used; Average body weight of the two breed was 3.5 and 4 kg at six months of age respectively. Does within the breed were divided equally by random selection into 2 groups to test the mating technique effect. Intensive housing system was used with open access to feed and water.

B. *Semen Collection and Examination*

Each buck was conditioned to semen collection technique by training to react to the artificial vagina in a preliminary period of three weeks at 5 months age and Semen samples were collected from each buck by an artificial vagina [3].

After collection, semen samples were preserved in a water bath of 370c until dilution two semen extenders were used to dilute semen during examination and injection: Egg yolk citrate (fresh egg yolk suspended in citrate buffer.) and sodium citrate. (29mg sodium suspended in 100 ml distilled water a product of Oxford laboratory India). To study the effect of the sequence of ejaculation a period of 30 minutes was elapsed between the two consecutive ejaculates. The evaluation was performed within 15 minutes after collection. Semen sample below 0.3 ml was discarded. [17].

Semen evaluation consists of two parts:

I. Gross examination consists of:

1. Color (milky, white, yellowish, and watery).
2. Volume (measured directly from the graduated tube).
3. PH (done by using PH comparative paper ranging from 1 to 14 Macherey – Nagel Gmbh and co. KG dÜren).

II. Microscopical examinations as described by [18] consists of:

1. Mass motility (Rapid progressive motility, Slow or sluggish progressive motility, non-progressive motility, and Immobility).
2. Individual motility (performed on diluted semen sample then observe the progressive forward motility and calculated by the following equation Motility% = No of motile/ Total No of sperm X 100).
3. Sperm-cell concentration (using a haemocytometer to count 5 squares then number x 50 x rate of dilution).
4. Live/dead % (dying the sample with eosin 5% stain and nigrosine stain 10% both product of Oxford laboratory India. Red head means dead, less stained means weakly alive and stainless means alive).
5. Total sperm abnormalities (By using 1% NA carbonate and 1% methyl violet stain (product of Hopkins and Williams LTD England) mixed immediately before the examination to detect the abnormalities).

C. *Induction of Ovulation and Pregnancy Detection*

Induction of ovulation was done by subcutaneous injection of 0.2 ml of Buserelin (Receptal). Pregnancy was diagnosed by abdominal palpation at the 14th days post-copulation. Does which failed to conceive were remated until the pregnancy was successful. All does were remated again after 14th-day post kindling.

D. *Doe Productive and Reproductive Traits Measurement*

Concerning reproductive and productive traits to be studied as mention [19], [20]:

1. Number of services per conception NSC (calculated as the total number of a certain doe mated until conception.).
2. Gestation length GP (period elapsed from conception until parturition).
3. Litter size LS and litter weight LW (were recorded at 21 days after birth LW21, weaning LWW (30 days) and at marketing age LWM (75 days).
4. Pre-weaning mortality PWM = $\frac{ISW-ISB}{LSB} X100$.
5. Average daily weight gain from 21 days till weaning ADG1 = $\frac{LWW-LW21}{9}$.
6. Average daily weight gain from weaning till marketing ADG2 = $\frac{LWM-LWW}{45}$.

E. *Statistical Analysis*

Data obtained were analyzed by analysis of variance (ANOVA) according to [21] using SPSS version 16 for means separation. Duncan's multiple range tests 1995 was used [22]. Probability ≤ 0.01 was considered highly significant.

YIJK = μ + BI + DJ + (BD) IJ + EIJK. Where: μ: overall mean to all observations, BI: effect of primary factor, DJ: effect of the secondary factor, (BD) IJ: interaction between both factors, EIJK: random error.

III. Results

Breed effect showed a non-significant difference between both breeds regarding semen quality except for sperm cell concentration (SCC) as Hyplus breed reported higher than New Zealand breed as shown in table (1).

Table (1) the effect of the breed on semen quality traits:

Breed	New Zealand	Hyplus
SV (ml)	$0.72^{a} \pm 0.04$	$0.7^{a} \pm 0.05$
SC	$1.78^{a} \pm 0.14$	$1.84^{a} \pm 0.1$
PH	$6.95^{a} \pm 0.06$	$7.01^{a} \pm 0.06$
MM	$3.84^{a} \pm 0.16$	$3.46^{a} \pm 0.16$
I.M (%)	$69.59^{a} \pm 1.41$	$68.78^{a} \pm 1.62$
LS (%)	$78.56^{a} \pm 1.25$	$75.78^{a} \pm 1.55$
SCC ($x10^{6}$/ml)	$137.73^{a} \pm 7.91$	$188.02^{b} \pm 8.13$
TSA (%)	$19.09^{a} \pm 0.55$	$18.59^{a} \pm 0.65$

Table (2) shows that breed effect combined with diluent effect had a non-significant difference regarding individual motility %. On the other hand, a significant difference was reported for other parameters proving egg yolk to be a better diluent than sodium citrate.

Table (3) shows the findings of breed effect combined with ejaculation sequence effect, a significant difference

was recorded regarding all tested parameters as the second ejaculate showed a decrease in SV, PH, and TSA%; with an increase regarding all the other parameters.

Table (4) reveal the diluent effect combined with ejaculation sequence effect a non-significant difference was recorded regarding IM % and SCC% while a significant difference was reported concerning LS% and TSA% better results were recorded for second ejaculate using egg yolk as diluent.

Parity effect revealed a non-significant difference for productive and reproductive traits for both breeds as showed in Table (6) and (7)

Table (2) the effect of the breed and diluents on semen microscopical characters:

Breed	New Zealand		Hyplus	
Diluents	Egg yolk	Sodium citrate	Egg yolk	Sodium citrate
I.M (%)	$72^{a} \pm 1.9$	$67^{a} \pm 2.1$	$70.06^{a} \pm 2.03$	$67.5^{a} \pm 2.56$
LS (%)	$83^{a} \pm 1.7$	$73.75^{b} \pm 0.76$	$80.5^{a} \pm 1.6$	$71.1^{b} \pm 2.14$
SCC (x10^{6}/ml)	$176^{a} \pm 7.2$	$99.25^{b} \pm 2.99$	$228.71^{a} \pm 4.9$	$147.33^{b} \pm 5.32$
TSA (%)	$16.9^{a} \pm 0.7$	$21.25^{b} \pm 0.5$	$16.25^{a} \pm 0.9$	$20.93^{b} \pm 0.45$

Table (3) the effect of the breed and sequence of ejaculation on semen characters:

Breed	New Zealand		Hyplus	
	First	Second	First	Second
SV (ml)	$0.63^{a} \pm 0.03$	$0.365^{b} \pm 0.02$	$0.66^{a} \pm 0.04$	$0.4^{b} \pm 0.02$
SC	$2.16^{a} \pm 0.08$	$1.59^{b} \pm 0.09$	$1.96^{a} \pm 0.1$	$1.37^{b} \pm 0.08$
PH	$7.03^{a} \pm 0.05$	$6.82^{b} \pm 0.05$	$7.12^{a} \pm 0.05$	$6.87^{b} \pm 0.05$
MM	$3.4^{a} \pm 0.15$	$3.93^{b} \pm 0.12$	$3.40^{a} \pm 0.12$	$4.03^{b} \pm 0.09$
I.M (%)	$69.59^{a} \pm 1.41$	$73.84^{b} \pm 1.31$	$66.78^{a} \pm 1.65$	$75.37^{b} \pm 1.28$
LS (%)	$80.53^{a} \pm 1.17$	$85.53^{b} \pm 1.23$	$81.03^{a} \pm 0.94$	$85.65^{b} \pm 0.97$
SCC (x10^{6}/ml)	$186.42^{a} \pm 3.21$	$209.60^{b} \pm 4.02$	$198.22^{a} \pm 4.22$	$223.12^{b} \pm 5.08$
TSA (%)	$19.78^{a} \pm 0.6$	$15.37^{b} \pm 0.53$	$21.71^{a} \pm 0.67$	$17.09^{b} \pm 0.56$

Table (4) the effect of the sequence of ejaculation and the diluent on semen Microscopical characters:

Ejaculation sequence	first		second	
Diluents	Egg yolk	Sodium citrate	Egg yolk	Sodium citrate
I.M (%)	$66.81^{a} \pm 1.71$	$67.28^{a} \pm 1.41$	$74.62^{a} \pm 1.33$	$74.59^{a} \pm 1.29$
LS (%)	$81.65^{a} \pm 0.98$	$79.9^{b} \pm 1.13$	$87.96^{a} \pm 0.94$	$83.21^{b} \pm 1.1$
SCC (x10^{6}/ml)	$193.08^{a} \pm 3.93$	$191.55^{a} \pm 3.86$	$218.79^{a} \pm 4.35$	$213.93^{a} \pm 5.06$
TSA (%)	$18.09^{a} \pm 0.92$	$23.4^{b} \pm 0.79$	$14.4^{a} \pm 1.14$	$18.06^{b} \pm 1.19$

Table (5) Correlation coefficients among different semen quality traits:

Item	SV	SC	PH	MM	IM%	LS%	SCC x 10^{6}/ml	TSA%
SV		0.49**	0.20*	-0.47**	-0.52**	-0.54**	-0.22*	0.47**
SC			0.10	-0.66**	-0.57**	-0.56**	-0.18*	0.23**
PH				-0.08	-0.11	-0.14	-0.16	0.28**
MM					0.84**	0.79**	0.15	-0.15
IM%						0.84**	0.175*	-0.23**
LS%							0.18*	-0.32**
SCC x 10^{6}/ml								-0.28**
TSA%								

*Correlation is significant at the level (0.05)
** Correlation is significant at the level (0.01)

Table (6) the effect of the breed and parity on productive and reproductive traits for New Zealand breed:

	New Zealand			
	first	second	third	fourth
NSC	1.5[a] ± 0.13	1.55[a] ± 0.13	1.65[a] ± 0.15	1.4[a] ± 0.11
GP(days)	30.33[a] ± 0.09	30.3[a] ± 0.16	30.65[a] ± 0.14	30.35[a] ± 0.14
LSB	7.5[a] ± 0.53	8.4[a] ± 0.37	8.15[a] ± 0.44	7.25[a] ± 0.55
LS21	5.8[a] ± 0.39	6.4[a] ± 0.31	6.55[a] ± 0.35	6.25[a] ± 0.45
LSW	5.63[a] ± 0.38	6.3[a] ± 0.34	6.1[a] ± 0.34	5.9[a] ± 0.55
LNM	5.63[a] ± 0.38	6.25[a] ± 0.34	6.1[a] ± 0.34	6.2[a] ± 0.55
PWM	21.47[a] ± 1.08	24.35[a] ± 1.60	22.48[a] ± 1.18	17.05[a] ± 1.21
LW21(g)	439.65[a] ± 19.84	452.71[a] ± 14.84	415.53[a] ± 10.58	433.94[a] ± 12.76
LWW(g)	604.32[a] ± 25.63	644.23[a] ± 26.88	604.26[a] ± 16.49	613.94[a] ± 15.74
IWM(g)	2036.1[a] ± 74.73	2202.6[a] ± 59.64	2162.7[a] ± 42.98	2057.6[a] ± 58.08
ADG[1](g/day)	18.29 [a] ± 4.08	21.28 [a] ± 3.28	20.97 [a] ± 4.54	20.01 [a] ± 5.58
ADG[2](g/day)	31.81 [a] ± 1.27	34.63 [a] ± 0.96	34.6 [a] ± 0.73	32.09 [a] ± 1.02

Table (7) the effect of the breed and parity on productive and reproductive traits for the Hyplus breed:

	Hyplus			
	first	second	third	fourth
NSC	1.6[a] ± 0.15	1.5[a] ± 0.13	1.6[a] ± 0.16	1.4[a] ± 0.11
GP(days)	30.35[a] ± 0.14	30.4[a] ± 0.19	30.45[a] ± 0.15	30.65[a] ± 0.15
LSB	7.5[a] ± 0.65	8.5[a] ± 0.46	8.2[a] ± 0.51	7.75[a] ± 0.57
LS21	5.95[a] ± 0.46	6.9[a] ± 0.38	6.5[a] ± 0.46	6.05[a] ± 0.53
LSW	5.85[a] ± 0.46	6.5[a] ± 0.37	6.4[a] ± 0.43	5.75[a] ± 0.46
LNM	5.75[a] ± 0.46	6.4[a] ± 0.36	6.4[a] ± 0.43	5.7[a] ± 0.46
PWM	19.38[a] ± 1.87	22.2 [a] ± 1.01	21.1 [a] ± 0.86	25.03[a] ± 1.22
LW21(g)	429.22 [a] ± 24.52	396.49 [a] ± 14.3	440.05 [a] ± 22.2	466.45 [a] ± 21.32
LWW(g)	637.52 [a] ± 28.12	603.29 [a] ± 17.59	667.4 [a] ± 24.22	623.86 [a] ± 28.33
IWM(g)	2213.8 [a] ± 87.25	2218.6 [a] ± 67.99	2346.8 [a] ± 54.24	2189.7 [a] ± 48.5
ADG[1](g/day)	23.15 [a] ± 3.62	22.99 [a] ± 3.57	25.25 [a] ± 3.44	23.32 [a] ± 3.5
ADG[2](g/day)	35.03 [a] ± 1.4	35.9 [a] ± 1.26	37.3 [a] ± 0.96	34.81 [a] ± 0.62

Table (8): breed effect combined with mating technique effect on productive and reproductive traits:

	New Zealand		Hyplus	
	Natural	Artificial	Natural	Artificial
NSC	1.32[a]±0.07	1.77 [b] ±0.1	1.43 [a] ±0.09	1.63 [b] ±0.10
GP(days)	30.44 [a] ±0.09	30.35 [a] ±0.09	30.5 [a] ±0.1	30.43 [a] ±0.1
LSB	6.72 [a] ±0.25	9.15[b] ±0.38	7.13 [a] ±0.3	8.85[b]±0.42
LS21	5.58 [a] ±0.21	7.03[b] ±0.31	5.7 [a] ±0.29	7[b] ±0.326
LSW	5.26 [a] ±0.19	6.8[b] ±0.35	5.45 [a] ±0.26	6.8[b]±0.31
LNM	5.24 [a] ±0.19	6.95[b] ±0.31	5.575 [a] ±0.26	6.55[b] ±0.36
PWM	19.02 [a] ±2.59	24.26 [a] ±3.7	22.61 [a] ±2.2	21.25 [a] ±2.6
LW21(g)	434.35 [a] ±11.29	437.88 [a] ±12.2	424.66 [a] ±14.39	441.44 [a] ±15.77
LWW(g)	619.41 [a] ±16.55	610.18 [a] ±15.88	652.74 [a] ±14.16	613.29 [a] ±20.34
IWM(g)	2117.58 [a] ±51.03	2091.6 [b] 2±37.91	2340.24 [a] ±40.43	2144.32 [b] ±48.34
ADG[1](g/day)	20.56 [a] ±0.88	19.14 [b]±0.9	25.34 [a] ±0.79	21.9 [b]±0.98
ADG[2](g/day)	33.29 [a] ±0.86	32.92[b]±0.68	37.51 [a] ±0.71	34.02[b]±0.78

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Effect of mating technique combined with breed effect results were shown in table (8) non-significant was recorded concerning gestation period (GP), litter weight at 21days (LW21), weaning (LWW) and pre-weaning mortalities (PWM). While a significant difference was reported for other parameters showing increase in number of service/conception (NSC), litter size at birth (LSB), 21 days (LS21), weaning (LSW) and litter size at marketing (LSM); and decrease in individual marketing weight (IWM), average daily weight gain (ADG) in both from 21 days old until weaning and from weaning until marketing age for artificial insemination compared with natural mating.

Table (9): breed effect combined with diluent used in AI effect on productive and reproductive traits:

	New Zealand		Hyplus	
	Egg yolk	Sodium citrate	Egg yolk	Sodium citrate
NSC	1.4^{a} ±0.11	2.15^{b} ±0.13	1.5^{a} ±0.13	1.75^{b} ±0.16
GP(days)	30.35^{a} ±0.1	30.35^{a} ±0.1	30.55^{a} ±0.16	30.3^{a} ±0.12
LSB	9.65^{a} ±0.46	8.65^{a} ±0.59	8.9^{a} ±0.58	8.8^{a} ±0.61
LS21	7.05^{a} ±0.54	7^{a} ±0.31	7.2^{a} ±0.47	6.8^{a} ±0.45
LSW	7^{a} ±0.55	6.6^{a} ±0.46	7^{a} ±0.45	6.6^{a} ±0.44
LNM	7^{a} ±0.55	6.9^{a} ±0.31	6.9^{a} ±0.46	6.2^{a} ±0.56
PWM	27.8^{a} ±1.47	20.7^{a} ±1.07	19.42^{a} ±1.26	23.09^{a} ±1.53
LW21(g)	441.68^{a} ±21.0	434.08^{a} ±12.9	422.27^{a} ±21.3	460.62^{a} ±22.96
LWW(g)	612.24^{a} ±28.16	608.13^{a} ±15.54	626.92^{a} ±26.40	599.66^{a} ±31.347
IWM(g)	2104.85^{a} ±59	2078.41^{a} ±49.02	2189.18^{a} ±64.79	2099.47^{a} ±72.001
ADG^{1}(g/day)	18.95^{a} ±4.50	19.34^{a} ±5.96	22.73^{a}±3.51	20.93^{a} ±4.06
ADG^{2}(g/day)	33.17^{a} ±0.97	32.69^{a} ±0.98	34.72^{a} ±1.1	33.33^{a} ±1.12

Means of the same column of each category bearing the same superscripts are of a non-significant difference (P > 0.05).
Means of the same column of each category bearing different superscripts are of a significant difference (P ≤0.01).

As shown in table (9) effect of diluent used in artificial insemination technique combined with breed effect were non-significant concerning all studied traits except for number of service/conception (NSC) was lowered significantly when egg yolk citrate was used as a diluent.

Table (10): Correlation coefficients among different productive and reproductive traits:

Item	SC	GP	LSB	LS21	LSW	LNM	PWM	LW21	LWW	IWM	ADG^{1}	ADG^{2}
SC		-0.14	0.145	0.161^{*}	0.208^{**}	0.131	0.116	-0.109	-0.108	-0.06	-0.02	-0.03
GP			-0.109^{**}	-0.051	-0.072	-0.067	-0.042	0.036	-0.064	0.007	-0.05	0.04
LSB				0.756^{**}	0.705^{**}	0.703^{**}	0.341^{**}	-0.321^{**}	-0.272^{**}	-0.1	0.02	0.01
LS21					0.895^{**}	0.904^{**}	-0.18^{*}	-0.494^{**}	-0.841^{**}	-0.24^{**}	-0.1	-0.09
LSW						0.898^{**}	-0.392^{**}	-0.508^{**}	-0.452^{**}	-0.23^{**}	-0.01	-0.09
LNM							-0.25^{**}	-0.5^{**}	-0.447^{**}	-0.23^{**}	-0.01	-0.09
PWM								0.263^{**}	0.246^{**}	0.21^{**}	0.1	0.15^{*}
LW21									0.769^{**}	0.46^{**}	0.11	0.25^{**}
LWW										0.74^{**}	0.61^{**}	0.5^{**}
IWM											0.67^{**}	0.95^{**}
ADG^{1}												0.59^{**}
ADG^{2}												

* Correlation is significant at the level (0.05)
** Correlation is significant at the level (0.01

IV. Discussion

Effect of the breed, ejaculation sequence and dilution on semen quality:

Breed effect only reported significant difference for SCC% was higher in Hyplus breed.

Change of ejaculate volume has been attributed mainly to the changes in the quantities of fluids secreted by the epididymis and principally by the accessory glands is influenced by sequence of ejaculation it decreases within the second ejaculate causing increase in SC, MM, IM%, SCC and LS% as shown in correlation table (5) this comes in agreement with [2], [5]. Semen color depends mainly on semen concentration as SCC increase the intensity of SC increase. The results were consistent with [14]. Semen PH tends to be alkaline acts as an indication to the normal status of the accessory secretion and the livability of spermatozoa, Semen extenders used should act as a buffer against excessive acidity or alkalinity; usage of egg yolk citrate gave better results concerning LS%, SCC% and TSA% the findings were in agreement with [23], [3]. Semen motility is expressed as the percentage of sperms that are motile under their own power. A progressively motile sperm is one that is moving from one point to another in a more or less straight line. Ejaculate may show other types of motility including both circular and reverse movement due to tail abnormality and vibrating or rocking movement often associated with aging. The results comes in agreement with [2], [14]. Sperm cell concentration determines the dilution rate and dose of insemination. For ejaculation effect, SCC of the first ejaculate acts as a stimulant for the second one the obtained high values may be attributed to good management and nutrition; the study findings comes along with that of [2], [5]. Percentage of life sperm is highly related to high conception rate. Study findings were in agreement with [23]. Abnormal sperms are produced by faulty spermatogenesis or faulty spermiogenesis. This is caused by inheritance, diseases, faulty nutrition and other environmental factors. Egg yolk as a diluent was proven better than sodium citrate in order to protect the sperm against thermal shock. It is believed that its action is due to the presence of the low-density lipoproteins (LDL), which adhere to the cellular membrane during the cryopreservation process, thereby preserving the sperm membrane this comes in agreement with [24].

Effect of the breed, parity, and mating technique on doe productive and reproductive traits:

Doe reproduction is regulated by a complex hormonal system in which hypothalamus and pituitary gland play a leading role in the secretion of gonadotrophin releasing hormone produced by hypothalamus level can stimulate both the synthesis and release of two Gonadotrophin: Follicle stimulating hormone and luteinizing hormone at the anterior pituitary level. These hormones act on the ovaries. Follicle stimulating hormone is mainly responsible for follicular growth and luteinizing hormone controlling the final follicular maturation and inducing ovulation of preovulatory follicles in order to solve poor fertility of the doe rabbits the systemic use of Gonadotrophin hormones is widespread in rabbit farms AI results comes in consistant with that of [10]. Suckling had significant effects on mating rate Studies on doe reproductive performance usually show a high fertility rate in nulliparous does a lower fertility in primiparous does and intermediate values in multiparous does. The body energy deficit of primiparous does and the negative interactions between lactation and fertility have been considered the main reasons for parity results which came in consistent with [14]. Litter size at birth depends on ova shed at ovulation and controlled by genetic and non-genetic factors can be increased as shown in the results with the use of gonadotrophin-releasing hormone (GnRH) analogue, which lead to increasing the number of the released follicles leading to significant increase in litter size this was also reported by [8]. Litter size at weaning is the basal measure of economic productive efficiency, it is governed by many factors such as mothering ability and efficiency of milk secretion which are the major factors reflected by breed and parity the results were in consistent with [25]. The environmental conditions also plays a significant role in this aspect. On the other hand, the management system particularly mating system has clear interference in that economic trait; Mortality or viability of the growing rabbits is a determinant characteristic trait influenced by genetic and non-genetic factors as diseases; litter size, season, feeding, and management play a considerable role. These findings were in agreement with [26], [27]. Litter weight at weaning reflects the contribution of fertility, maternal behavior, milk production, growth rate and survivability; it was stimulated by the higher milk production of does in their second and third lactation than of primiparous does. Parity findings were in agreement with [16].

V. Conclusion

The use of artificial insemination technique in rabbits with recommendation of using second ejaculate semen sample and egg yolk citrate as diluent leads to significant increase in litter size and decrease in number of service/conception but on the other hand it affects the daily weight gain which is a disadvantage can be avoided by fostering. The artificial insemination technique proved to be an efficient way to increase farm animal production.

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