

## **IMPACT OF MACA ADMINISTRATION ON THE CONCEPTION RATE AND REPRODUCTIVE PERFORMANCE OF RABBIT DOES OF DIFFERENT BREEDS.**

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### **SUMMARY**

This work aimed to study the impact of Maca capsules administration on the conception rate and hormonal estimates of rabbit Does. Thirty six rabbit does, (12 V-line, 12 New Zealand white and 12 Bouscat), were divided equally into two equal groups 6 does per each. In the 1<sup>st</sup> group, rabbits were fed a commercial breeder ration without any supplementation; while the 2<sup>nd</sup> group was fed the commercial breeder ration and daily orally administered with 500mg Maca capsule/doe for one week before mating. All does in the treated group were re-administered with the same dose after three days from parturition (day per day) for one week, then re-mated directly during the 2<sup>nd</sup> and 3<sup>rd</sup> parties, respectively. The number of mating per conception (NMPC), Conception rate (CR %), Gestation length (Gl), luteinizing hormone (LH), follicle stimulating hormone (FSH), Estrogen and Progesterone hormone concentrations of rabbit does were measured. The obtained results indicated that there were no significant effect of Maca administration on the NMPC, CR, GL, LH, FSH and progesterone (P4) hormone concentrations in the different rabbit breeds. While the mean estrogen hormone concentration was significantly ( $P \leq 0.001$ ) higher in NZW Does, followed by V-line. lower value was observed in Bouscat rabbit Does. Also, the estrogen hormone concentration of treated rabbit does was insignificantly higher, while no significant effect was found at the interaction between rabbit breed and maca treatment on NMPC, CR, GL, LH, FSH, estrogen and progesterone hormone concentrations. From the obtained findings, it could be concluded that the oral administration of rabbit does with maca capsules insignificantly influenced NMPC, CR, GL, LH, FSH, estrogen and progesterone hormone concentrations.

**Keywords:** *rabbit does Maca administration, conception rate, and hormonal estimates*

### **INTRODUCTION**

Maca root is an adaptogenic herb that has been shown in studies to improve fertility in both men and women. It contains about 31 different minerals and 60 different phytonutrients, Maca is a nourishing food for the endocrine system, aiding the pituitary, adrenal, and thyroid glands. Maca has the ability to affect key hormones in both women and men without containing hormones itself Hethir Rodriguez (2007).

Maca has been scientifically researched for the use of increasing fertility since 1961 and has been shown to contain specific compounds called glucosinolates which can affect fertility for both men and women. These alkaloids are responsible for Maca's ability to support hormonal balance.

Yoshida *et al.*, (2017) indicated that the Maca play an important role to promotes optimal functioning for both hypothalamus and pituitary, throughout the balance effects on FSH, estradiol and progesterone of women.

Studies have shown that men who use Maca may experience an increased libido and an increase in sperm health. In one study, maca was given to female and male rats and it was found that the females had multiple egg follicle maturation (important for ovulation), and the males had significantly higher sperm production and motility rates. Hethir Rodriguez (2007)

Hethir Rodriguez, (2007) found that in female rats taking maca, multiple egg follicles were able to successfully mature, which is important for ovulation and reproductive health. Maca improves sexual

performance without changing reproductive hormone levels (Gonzales *et al.*, 2005). They added that Maca's had beneficial effects for sexual function due to its high concentration of proteins and vital nutrients. Chaco'n de popovicio *et al.*, (1997) stated that, maca contains a chemical called p-methoxybenzyl isothiocyanates, which reputedly has aphrodisiac properties

Maca increased blood levels of progesterone in female mice because it contains saponins which play a very important role in sex hormones Saponins have been shown to normalize hormone secretion and have been used to treat sexual dysfunction (Arletti *et al.*, 1999). Due to these actions, saponins are called adaptogens (Kropotov *et al.*, 2001 and Kelly 2001). However, the mechanism of action for adaptogens has not been clarified (Kropotov *et al.*, 2001). Therefore, the current study was conducted to evaluate the impact of treating rabbit Does with Maca in capsulated form on reproductive performance of rabbits, milk yield and hormonal secretion.

## **MATERIALS AND METHODS**

This study was carried out at the research rabbit Farm, Poultry Production Department, Faculty of Agriculture Sohag University during the period from August 2017 to January, 2018, to investigate the effect of Maca administration on the NMPC, CR, GL, LH, FSH, estrogen and progesterone hormone concentrations of rabbit does.

### ***Experimental design:***

A total of 36 rabbit does V-line, New Zealand white and Bouscat, with 12 of each. Rabbits were divided equally into two equal groups; each of them included 6 V-line, 6 Newzeland and 6 Bouscat and with 12 of each. Rabbits were divided equally into two equal groups; each of them included 6 V-line , 6 Newzeland and 6 Bouscat In the 1<sup>st</sup> group, rabbits were fed a commercial breeder ration without any supplementation, while the 2<sup>nd</sup> group were fed the commercial breeder ration and orally administered with 500 mg Maca capsules/doe/day for one week before mating. All does were re-administered with the same dose after three days from parturition for one week (day per day), then re-mated directly for the second and third parties.

### ***Housing the experimental rabbits:***

All does were individually housed in wire galvanized battery cages (50 cm L×50 cm W×40 cm H) in open side house under the same managerial and hygienic conditions. They were daily exposed to All does were individually housed in wire galvanized battery cages (50 cm L×50 cm W×40 cm H) in open side house under the same managerial and hygienic conditions. They were offered *ad-libitum* the feed and fresh tap water during the experimental period.

### ***Experimental diets:***

All does were fed on a basal commercial. . The basal diet contains 16.89% crude protein, 12.67% crude fiber, 2.99% fat, 0.63% Ca and 2799 Kcal/kg digestible energy. Maca contains 10.2% crude protein, 59.0% carbohydrates, 2.20% fat, and 8.5% fibers (Documenta Geigy., 1963).

### ***Climatic conditions:***

The interior ambient temperature (°C) and relative humidity (%) were daily recorded in the rabbitry farm at 9.0AM and 13.0PM by using a thermo-hygrometer.

The temperature humidity index were calculated and recorded by the following equation according to Marai *et al.*, (2002):

$$THI = db^{\circ}C - [(0.31 - 0.31RH/100) \times (db^{\circ}C - 14.4)]$$

THI= Temperature humidity index, db°C= the ambient temperature, RH = the relative humidity (%).

Climatic conditions during the experimental periods are shown in table (1).

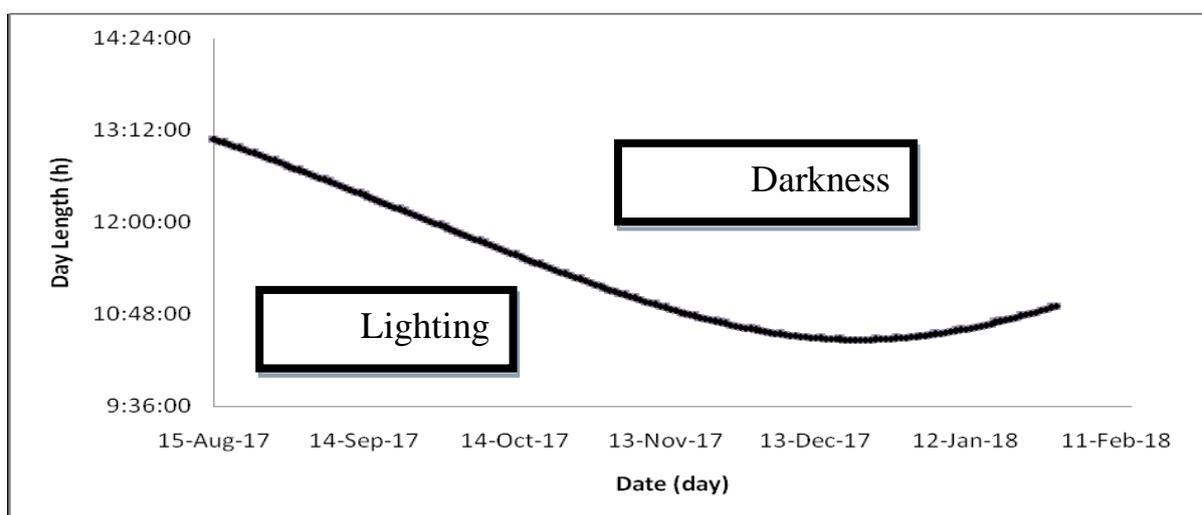
**Table (1). Average of ambient temperature (AT/°C), relative humidity (RH/%) and temperature humidity index (THI/units) during the experimental period**

Period	Date	AT (°C)	RH (%)	THI (units)
1	15 Aug-12 Sep	30.86	63.25	22.53
2	12 Sep -10 Oct	29.18	61.75	21.77
3	10 Oct -7 Nov.	28.92	61.75	21.64
4	7Nov.- 5 Dec.	25.63	57.50	20.15
5	5 Dec. -2Jan.	22.00	58.25	18.27
6	2 Jan.- 30 Jan.	18.63	58.25	16.55

AT= Ambient temperature (AT/°C), RH (%)=Relative humidity (AT/°C), THI (index) = Temperature humidity index, Period= 28 days.

**Lighting programme**

All rabbits exposed to the same lighting programme according the natural day length. According the data in Table (2) which shows the length of every day during the experimental period, so the design light programme curve was as follow: The lighting programme is continues light and dark cycles and is decreasing lighting programme. The light intensity was 5 Lux during the day light.



**Figure (1): The length of every day during the experimental period,**

**Blood constituents:**

Blood samples were collected at 11.0 am from the marginal ear vein per each doe in dry clean centrifuge tubes on the 7<sup>th</sup> day of administration and 14<sup>th</sup> day of kindling. Thereafter, blood serum was separated by centrifugation at 3000rpm for 5 minutes and kept in a deep freezer at (-20°C) until analysis.

**Hormonal assay:**

The serum concentrations of LH, FSH and Estrogen hormones were determined at 7<sup>th</sup> day from administration, while the concentration of progesterone hormone (P4) was determined at 14<sup>th</sup> day from pregnancy. All hormones were determined according to the methods of TOSOH (close system) in smart laboratory.

**Statistical analysis:**

The obtained data were statistically analyzed by using GLM, produced by the statistical analysis systems (SAS, 2004). Duncan's new multiple ranges tests (Duncan, 1955) were used to determine significant differences between treatment means. The following linear model was applied:  $E_{ij} = \mu + B_i + T_j + B_i T_j + e_{ij}$

Where;  $Y_{ij}$ = Observation measured,  $\mu$ = Overall mean,  $B_i$ = Effect of rabbit breed (1, 2 and 3),  $T_j$ = Effect of Maca treatment ( $j = 1$  and  $2$ ),  $BT_{ij}$ = Interaction between rabbit breed and Maca treatment,  $E_{ij}$ = Random error component was normally distributed assumed.

## RESULTS AND DISCUSSIONS

### *Effect of rabbit breeds and maca treatment on NMPC, CR and GL:*

Results in Table (6) showed that the highest value of number of mating per conception (NMPC/times) was recorded in Bouscat rabbits ~~the~~ compared with NZW and V-line. The increased (NMPC/times) in the Bouscat rabbit may be due to the genetic differences between rabbits, therefore the the number of mating times to conceive required for fertilization in V-line rabbit was less than the other two breeds, and this reflects the ability of the high V-line to conceive. These results agree with those of Azoz and El-khaly (2005, 2006) and Gad Allah *et al.*, (2005), who found that the number of services per conception of V-line rabbits was significantly lower than that of Bouscat or Baladi rabbit does .They attributed that the decreased number of services per conception associated with higher values of conception rate.

The highest value ( $P \leq 0.01$ ) of conception rate (CR/%) was recorded in V-line rabbits, while the lowest values were recorded in NZW and Bouscat rabbits. The achieved results disagreed with those of El-Hammady and Abdel-Kareem (2015), they found no significant differences in number of mating per conception (NMPC/times) and conception rate (CR/%) among V-Line, NZW and Bouscat rabbit does. Data in Table (2), illustrated that the gestation length (GL/day) for rabbits was insignificantly affected by rabbit breed, maca treatment and their interaction.

Referring to maca treatment, these data of table (2) showed that the means of NMPC (times), CR (%) and GL (day) of different rabbit breeds were insignificantly influenced by maca treatment. These results are ~~in~~ agreement with Ruiz-Luna *et al.*, (2005), who reported that the gestation length in adult female mice were not influenced by Maca-treatment, which recorded similar results in different groups.

Effect of the interaction, there was no significant effect due to the interaction between rabbit breed and maca treatment on NMPC (times), CR (%) and GL (day) of rabbit does.

**Table (2). Effect of Maca treatment and rabbit breeds on NMPC (times), CR (%) and GL (day) of rabbit does (LSM±SE).**

Items	NMPC (times)	CR (%)	GL (day)
Effect of rabbit breed (B)			
V-line	1.77 <sup>b</sup> ±0.20	70.16 <sup>a</sup> ±6.90	32.16±0.5
NZW	2.21 <sup>ab</sup> ±0.22	54.55 <sup>ab</sup> ±7.34	31.83±0.5
Bouscat	2.39 <sup>a</sup> ±0.20	54.45 <sup>b</sup> ±6.29	32.74±0.5
Effect of maca treatment (T)			
Control	2.12±0.17	57.00±5.67	31.78±0.4
Treatment	2.15±0.17	55.85±5.85	32.70±0.4
Effect of interaction (B×T)			
V-line	Control	1.80±0.30	70.00±10.41
	Treatment	1.75±0.27	70.31±9.47
NZW	Control	2.35±0.32	50.00±10.50
	Treatment	2.06±0.31	59.38±10.43
Bouscat	Control	2.17±0.26	52.78±8.55
	Treatment	2.67±0.30	36.76±9.09
Probability			
Rabbit breed (B)	0.0921	0.0382	0.4286
Maca treatment (T)	0.8214	0.7892	0.1058
Interaction (B×T)	0.3827	0.4146	0.1750

<sup>A, b</sup> Means with different letters within each column are significantly different ( $P \leq 0.05$ ).

Sig = Significant, Ns= Non-significant, C= Control group, T= Treatment group

**Effect of rabbit breeds and maca treatment on FSH and LH hormone concentrations**

Results in Table 3 showed that the concentrations for both FSH and LH hormones were insignificantly influenced by rabbit breed or maca treatment.

The obtained findings indicated that the concentrations both hormones were insignificantly influenced by maca treatment. These findings agree with those of Nicole *et al.*, (2008) who found that Maca did not exert an estrogenic effect in postmenopausal women, as indicated by the lack of change in plasma estradiol, FSH and LH concentrations. In addition to, Meissner *et al.*, (2006b), reported that Maca increased serum levels of FSH for women. These findings are not agreement with Uchiyama *et al.*, (2013), reported that maca supplementation insignificantly enhanced LH serum levels during pulsate phase in female rates. They attributed that the maca supplementation promotes ovulation through pituitary function of the hypothalamus pituitary gonad axis. Also, the results of José *et al.*, (2017) showed that the use of traditional maca play an important role to enhance fertility by enhance luteinizing hormone (LH) concentration levels in women. In addition to , Meissner *et al.*, (2005), found that maca, increased LH hormone serum levels in early postmenopausal women. While the same authors reported that Maca reduced FSH levels after Maca treatment for 12 weeks in a cohort of early postmenopausal women. Contrarily, Yongzhong Zhang *et al.*, (2014) found that long-term treatment with maca modulated hormone levels in ovariectomized rats, through decreasing FSH levels.

Effect of the interaction, no significant effect due to the interaction between rabbit breed and maca treatment on luteinizing hormone and follicle stimulating hormone concentrations.

**Effect of rabbit breeds and maca treatment on estrogen and progesterone hormone concentrations:**

The results of Table (3), indicated that the highest significantly ( $P < 0.05$ ) value of estrogen hormone concentration was recorded in NZW Does, followed by V-line, while the lowest one was obtained in Bouscat rabbit Does. Progesterone hormone concentration was insignificantly influenced by rabbit breed. The increased of estrogen concentration could be attributed to improved FSH hormone concentration for NZW compared with V-line rabbit Does.

**Table (3). Hormonal estimates of rabbit does affected by line, treatment and their interaction (LSM±SE).**

Items	LH (MIU/ML)	FSH (MIU/ML)	Estrogen (Pg/ml)	Progesterone (ng/ml)	
Effect of rabbit breed (B)					
V-line	2.10±0.1	1.38±0.1	57.96 <sup>b</sup> ±2.3	10.78±0.7	
NZW	2.03±0.1	1.43±0.1	66.62 <sup>a</sup> ±2.2	10.02±0.7	
Bouscat	2.10±0.1	1.47±0.1	53.19 <sup>b</sup> ±2.3	9.34±0.8	
Effect of maca treatment (T)					
Control	2.12±0.1	1.42±0.1	57.74±1.8	10.36±0.6	
Treatment	2.03±0.1	1.43±0.1	60.78±1.9	9.73±0.6	
Effect of interaction (B×T)					
V-line	C	2.16±0.1	1.36±0.1	57.34±3.3	9.87±1.0
	T	2.04±0.1	1.41±0.1	58.58±3.1	11.69±0.9
NZW	C	2.08±0.1	1.43±0.1	68.26±3.1	11.38±0.9
	T	1.97±0.1	1.44±0.1	64.99±3.2	8.67±1.0
Bouscat	C	2.11±0.1	1.49±0.1	47.62±3.1	9.83±1.1
	T	2.08±0.1	1.36±0.1	57.34±3.3	8.84±1.2
Probability					
Breed (B)	0.7756	0.6987	0.0002	0.4053	
Treatment (T)	0.3199	0.9366	0.2456	0.4586	
Interaction (B×T)	0.9073	0.9058	0.0738	0.0643	

<sup>A, b</sup> Means with different letters within each column are significantly different ( $P \leq 0.05$ ).

LH= Luteinizing hormone (MIU/ML) , FSH= follicle-stimulating hormone (MIU/ML), Ns= Non-significant, C= Control group, T= Treatment group

These results are in agreement with those of Azoz and El-khaly (2005), who found that V-line exceeded Bouscat, does in progesterone concentrate without significant difference. In contrast, the same authors that the estradiol concentration was significantly higher in pregnant Bouscat Does than V-line ones.

The effect of Maca treatment, the obtained findings indicated that the estrogen hormone concentration of treated rabbit Does was numerically higher, while the progesterone hormone concentration was lower than that of the control. These results agreed with (Chacon, 1961), who claimed that alkaloids from Maca increased estrogen levels. Also, Manuel Gasco *et al.*, (2008) suggested that estrogen like activity is not present in the extracts of different varieties of Maca. This is confirmed by the failure to increased uterine weight after treatment with Maca. Also, Hethir Rodriguez, (2007), found no significant effect of Maca on progesterone hormone in rabbits since it decrease progesterone levels compared with the control group. In contrast, Arletti *et al.*, (1999), indicated that Maca increased progesterone levels in female mice because Maca contain Saponins, which play a very important role in sex hormones Saponins have been shown to normalize hormone secretion and have been used to treat sexual dysfunction.

The findings of Masami Oshima *et al.*, (2003) indicated that maca treatment increased progesterone levels in female mice, which insignificantly on the embryo implantation rate in female mice.

Effect of the interaction, no significant effect due to the interaction between rabbit breed and maca treatment on estrogen and progesterone hormone concentrations.

## CONCLUSION

The results of the NMPC (times), CR (%) and GL (day) in different rabbit breed were not affected. NZW rabbit does have the highest value of estrogen hormone concentration, while the lowest value was recorded in Bouscat rabbit does.

Maca capsules on means of NMPC (times), CR (%), GL (day) as well as LH, FSH and progesterone (P4) hormone concentrations. Estrogen hormone concentration was numerically increased. The progesterone hormone concentration in treated group was lower than the control, but not significantly different

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### تأثير التجريع بكبسولات الماكا على معدل الامساك والاداء التناسلى لامهات الارانب

طلعت مصطفى الشيخ<sup>1</sup> و احمد عبد الكريم ابو غابة<sup>1</sup> و كوثر عبد الرحمن غالى<sup>2</sup> و ماريان خيرى وديع<sup>3</sup>

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هدفت هذه التجربة الى دراسة تأثير تجريع امهات الأرناب بكبسولات الماكا على معدلات الامساك وعدد مرات التلقيح وبعض التقديرات الهرمونية. اشتملت هذه الدراسة علي عدد 36 من امهات ارانب الفى-لاين و النيوزيلاندى والبوسكات بواقع 12 ام لكل سلالة، قسمت كلا منها الى مجموعتين متساويتين بواقع 6 امهات بكل مجموعة. اعتبرت المجموعة الاولى مجموعة المقارنة (كنترول)، بينما تم تجريع امهات الارانب المجموعة الثانية بكبسولات الماكا بتركيز 500 ملجم / ام ( اسبوع قبل التلقيح واسبوع بعد الولادة ) بواقع يوم بعد يوم خلال الفترة المذكورة لمدة ثلاث بطون متعاقبة. تم تغذية جميع الامهات المستخدمة فى الدراسة على عليقة تجارية. خلال هذه الدراسة

تم تقدير عدد مرات التلقيح اللازم للأخصاب، معدل الإمساك، طول مدة الحمل، وبعض الهرمونات مثل هرمون التيبويض، الهرمون المنبه لنمو الحويصلات المبيضية وهرمون الاستروجين وهرمون البروجسترون بجميع امهات الارانب تحت الدراسة.

اوضحت النتائج المتحصل عليها عدم وجود أي تأثير معنوي بعدد مرات التلقيح ومعدل الإمساك وطول مدة الحمل، بالإضافة الى هرمون التيبويض، الهرمون المنبه لنمو الحويصلات المبيضية هرمون التيبويض، وهرمون البروجسترون بين السلالات المختلفة. سجلت اعلى القيم بهرمون الاستروجين بامهات ارانب النيوزيلاندى بينما سجلت اقل القيم بارانب البوسكات .

ولقد اوضحت النتائج عدم وجود تأثير معنوي للمعالجة بكبسولات الماكا على عدد مرات التلقيح، معدل الإمساك، طول مدة الحمل، وهرمون التيبويض، الهرمون المنبه لنمو الحويصلات المبيضية وهرمون الاستروجين وهرمون البروجسترون. كذلك لم يكن للتداخل بين نوع الارانب والمعاملة بالماكا تأثير معنوي على كافة الصفات تحت الدراسة.

وخلصت نتائج الدراسة الى أن كبسولات الماكا المستخدمة لم يكن لها تأثير معنوي ملحوظ على الصفات المدروسة، ولم يكن لاستخدامها تأثير معنوي ملحوظ على الهرمونات بالأرانب المعاملة خلال فترة التجربة.

**الكلمات الدالة:** امهات الارنب، الماكا ، معدل الإمساك ، التقديرات الهرمونية