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MATURE CALIFORNIAN RABBIT PERFORMANCE AS AFFECTED BY PREBIOTIC OR / AND PROBIOTICS IN DRINKING WATER.

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SUMMARY

A total number of one hundred eighty eight mature Californian (Cal.) rabbits was used in the present study to evaluate the effects of water administering prebiotic (Lactomannan®) or / and probiotic (effective microorganisms-EM_1-) on their productive and reproductive performance. The present study was carried out on 152 nonparous does and 36 sexual mature bucks of Cal rabbits aged 9 months. All animals were divided into four equal comparable experimental groups 9 bucks and 38 does in two sequence parities in each group). The first group was kept untreated (as a control group), while the other three groups (treated groups) were treated with 1ml Lactomannan; 0.5 ml EM_1 or combination of Lactomannan + EM_1 / 1 liter drinking water / 3 continues days weekly, respectively, during the experimental period, which lasted for 4 months.

The results obtained revealed that nutrients digestibility was arranged significantly ($P \leq 0.05$) in a descending order due to combination of Lactomannan + EM_1; EM_1; Lactomannan in drinking water and then by control group, respectively. Supplementing Lactomannan or/and EM_1 to drinking water of Cal rabbit bucks improved significantly ($P \leq 0.05$) their reproductive capability represented by libido and physical semen characteristics (semen-ejaculate volume; advanced-sperm motility; live and normal spermatozoa; acrosome status and sperm-cell concentration per ml and per ejaculate); gonads and pituitary gland weight; scrotal circumference and testicular index. Californian rabbit bucks drank water supplemented with Lactomannan or/ and EM_1 recorded significantly ($P \leq 0.05$) higher testosterone concentration and mating activity than those of control group. Californian rabbit does drank water contained Lactomannan or/ and EM_1 and mated naturally by using bucks drank the same treated water recorded kindling rate; litter size and weight at birth; milk yield and pre-weaning mortality rate significantly ($P \leq 0.05$) better than those of received untreated water (control group). Drinking water contained combination of Lactomannan and EM_1 showed significantly ($P \leq 0.05$) superior parameters compared to those obtained when using each alone. Generally, it can be concluded that supplementing 1ml Lactomannan and 0.5 ml EM_1/ liter to of drinking water showed a great role in improving growth performance and reproductive performance, of Cal rabbits.

Keywords: *mature rabbits; prebiotic; probiotic; digestibility; semen; fertility.*

INTRODUCTION

Developing countries like Egypt are often characterized by animal protein deficiency. This is not only due to the small number of existing farm animals as compared to rapid growth of human population, but also due to the low productive and reproductive capabilities of these animals (Seleem, 2003).

The increase in animal protein production may come from short-life cycle animals kept by the small holder farmers such as rabbits (Galal and Khalil, 1994). Rabbit farming is encouraged to minimize the gab

between demand and supply of animal protein (F.A.O. 1987). So, rabbits had gradually increased attention in the last decade in Egypt for meat production (Rashwan and Marai, 2001 and Seleem, 2003).

Rabbit production in Egypt is currently facing hard time owing to high cost incurred on feed. This problem has limited establishing new Rabbitaries and expansion of that kind of project resulted a decrease in animal protein. Several investigations have carried out to reduce the high cost of rabbit feed. The efforts included various feed additives such vitamins; enzymes; minerals; antibiotics; natural herbs; etc. (Boulous *et al*., 1992; Seleem *et al*., 2006; 2007a& b; El-Kholy *et. al*., 2008; Hanna *et. al*., 2008 and Seleem *et al*., 2008a& b). But, several other types of products now available especially after the ban on using antibiotic growth promoter (Marzo, 2001). Some of these have been developed for use with antibiotic–free or organic production. Others aimed at improving health and digestion. Unlike probiotics, which are defined living microorganisms, prebiotics are carbohydrates that can not be digested by the mono-gastric but can be fermented by microbes in the gut. They enhance beneficial bacteria population in the gut like bifidobacteria and lactobacilli (Marteau and Boutron-Ruault, 2002; Van Loo, 2004; and Seleem *et. al*., 2007c). Bifidobacteria produce acetic acid which has a bactericidal action. The so-called prebiotics are an attractive development because they are non-viable.

Several attempts have been carried out to promote the rabbit production and reproduction using probiotics (Osman, 2005 and Seleem *et al*., 2007a). Probiotics are non-nutritional additives containing beneficial microbial cultures and/or ingredients that enhance the growth of desirable gastrointestinal microbes of the host animal (Marionnet and Lebas, 1990). This may be due to its ability to stimulate the digestion process and/or to contribute to the microbial equilibrium of the gut in order to prevent digestive disorders.

The concept of prebiotics in feed is fairly recent. Some of the prebiotics, which are currently used in animal feed, are Mannan-oligosaccharides (MOS). Mannan-oligosaccharides are mainly obtained from cell walls of yeast *Saccharomyces cerivisae*. Some brand names are: Bio-Mos, SAF-Mannan, Y-MOS, Celmanax, Lactomannan. Mannan-oligosaccharides (MOS) interferes with the colonization of the pathogens. Cell surface carbohydrates are primarily responsible for cell recognition. Bacteria have lectins (glycoprotein) on the cell surface that recognize specific sugars and allow the cell to attach to that sugar. Binding of *Salmonella, E.coli* and *Colostridia* sp. is shown to be mediated by a mannose specific lectin (receptor) like substance present on the bacterial cell surface. So, MOS exhibits an anti-adhesive effect where it binds to *E. coli* and *Salmonella* instead of binding to mucosal receptor and flushes them from the digestive tract, before the pathogens cause problems by anchoring themselves to the colon wall and improve intestinal health in other species (Fairchild *et al*., 2001; and Fernandez *et al*., 2003).

The advantages of prebiotics are that it can stand high pelletizing temperatures in the feed and also have a long shelf life (Huyghebaert, 2003 and Kembhavi, 2004). Prebiotics can reduce ammonia (NH_3) levels in the cecum, increase cecal volatile fatty acids and decrease cecal pH favorably influencing gut microflora and growth performance (Pinheiro *et al*., 2004 and Seleem *et.al*., 2007b).

Lactomannan® is a commercial product prepared naturally from the cell wall of *Sacchromyces cerevicae* yeast produced by *Ibex, International* and containing mannan, B-vitamins, glucan, antioxidant and nucleic acids. Mannan classified as nostarch polysaccharide. The mode of action of Lactomannan® may be by the B vitamins that play a crucial role in the body's ability to break down and absorb proteins and carbohydrates. B vitamins also assist in preventing free radical damage by oxygen, by assisting the anti-oxidant glutathionine. B vitamin also plays a significant role in the synthesis of certain hormones like somatotrophic hormone (STH) which regulates growth, thyroxin, which regulates metabolic rate, and insulin which regulates energy metabolism (McDowell, 2000). Also, there was a lot of growth promoters in Lactomannan like aspartic and lactic acids, all these are factors well documented as growth promoters through their effects on increasing the activity of metabolic cycles (Parks *et al*., 2000).

Pre-probiotics are natural feed supplements and their function is based upon primary fermentation and supporting the growth of intestinal microflora (Tawfeek and Marai, 1997). Maximum microflora growth expands the digestive capacity as evidenced by increase of volitale fatty acids production and dry matter digestibility (Pet-Ag, 1992). So, the combination between prebiotics and probiotics may be more effective on improving rabbit productive and reproductive performance compared by using each alone.

Therefore, the aim of this study was to detect some reproductive capabilities of mature Californian rabbits as affected by supplementing prebiotic (Lactomannan®) or/ and probiotic (effective microorganisms-EM_1-) to drinking water.

MATERIALS AND METHODS

The present study was conducted in an Industrial Rabbitary (capacity 1500 mothers), Barnacht Village, near El-Ayyat city, 6th October Province, Egypt, during the period from January, 2007 till April, 2008. The study aimed to evaluate some productive and reproductive capabilities of mature rabbits as affected by supplementing prebiotic (Lactomannan®) or/ and probiotic (effective microorganisms-EM_1-) to drinking water.

The present work was *lasted 4 months and was carried out on 152 nonparous does and 36 sexual mature bucks of Cal rabbits aged 9 months.* The experimental animals were divided into four equal comparable experimental groups (9 bucks and 38 does in two sequence parities in each group). The first group was kept untreated (as a control group), *while the other three groups (treated groups) were treated with 1ml Lactomannan; 0.5 ml EM_1 or combination of Lactomannan + EM_1/ 1 liter drinking water/3 continues days weekly, respectively.* The pelleted diets fed to the experimental animals have covered the nutritional requirements of the breeding phase of rabbits according to NRC (1977) recommendations. Composition and calculated analysis of the pelleted diets is shown in Table (1). Animals were individually housed in wired battery cages supplied with feeders and stainless steel nipples for eating and drinking. All batteries were located in a windowed rabbitry with natural ventilation. Fresh tab water was automatically available all the time in each cage. All the experimental animals were healthy and clinically free from internal and external parasites and were kept under the same managerial and hygienic conditions.

A digestibility trial was conducted using 5 male rabbits from each treatment group. The rabbits were individually housed in metabolic cages that permit to collect faeces and urine separately. Digestibility trial lasted 15 days, 9 days as a preliminary period, followed by 6 days to quantify the daily feed intake and faeces output. Samples of daily faeces of each animal were taken and oven dried at 65 °C for 24 hours, then ground and stored in plastic bags until the end of the trial. The composite samples of feed offered and faeces output were chemically analyzed according to A.O.A.C. (1990) for crude protein (CP), crude fibre (CF), ether extract (EE) and nitrogen-free extract (NFE).

Blood samples of rabbit bucks were taken in less than two minutes from the marginal ear vein of five rabbit bucks within each experimental group twice a month. Blood serum testosterone hormone concentration of the rabbit bucks was determined (RIA Kits from Immunotech, A Coulter Co., France) according to the manufacturer information. Libido (sexual desire) was assessed in terms of reaction time in seconds that was estimated just from the time of introducing doe to the buck until the buck start to mount (Daader *et. al.*, 1999a&b and Seleem, 2003). Semen was collected artificially twice a week for up to four weeks by means of an artificial vagina as described by Seleem (1996& 2003). Individual semen samples ejaculated from each rabbit buck were evaluated microscopically and then semen ejaculate volume (ml); advanced sperm motility (%); live spermatozoa (%); morphological normal spermatozoa (%); sperm-cell concentration (N x 10^6/ ml) and total -sperm output (N x 10^6/ ejaculate) were estimated according to Salisbury *et. al.* (1978). Acrosomal damage was determined by using a Giemsa stain procedure as described by Watson (1975). At the end of experiment, four rabbit bucks from each experimental group were randomly chosen and slaughtered. Live body weight and weights of each of pituitary gland and gonads represented by testes; epididymis and sexual accessory glands were evaluated. Scrotal circumference was measured as the method described by Mickelsen *et. al.* (1982). Testicular index (length x width x depth) was calculated in cubic centimeters as recorded by Daader *et. al.* (2003). Mating activity (frequency of mating within 15 minutes) of each buck was determined using sexually receptive doe.

In the fertility traits, 152 Cal. rabbit does in four experimental groups (38 does in each) and received the same treatments of rabbit bucks were naturally mated in two sequence parities using the experimental groups of rabbit bucks. Natural mating was carried out by transferring each doe to the buck's cage to be mated and return back to its cage after mating. Palpation of all rabbit does was carried out 12 days post mating to determine pregnancy. At kindling, kindling rate and litter size and weight at birth values were recorded. Pre

weaning mortality rates and milk yield per doe were estimated also during the suckling period. Milk yield was estimated after deprivation of the pups from suckling their mothers for 24 hours, then the pups and doe were weighed before and after suckling, the increase in pup's and the decrease in doe's weight was used as the doe milk yield.

Table (1): Composition and calculated analysis of the pelletd basal diet fed to rabbits, during the experimental period (manufactured by IBEX International Co. L.®.)

Ingredients	%
Clover hay	40.50
Wheat bran	25.00
Yellow corn	14.00
Soybean meal (44%)	11.00
Molasses	3.00
Vinass	3.00
Bone meal	1.75
Limestone	0.70
Sodium chloride	0.55
Vitamins & Mineral Premix *	0.35
DL-Methionine	0.15
Total	100.00
Calculated analysis **	
Crude protein (CP)%	18.00
Ether extract (EE)%	3.00
Crude fiber (CF)%	14.00
Digestible energy (Kcal/Kg)	2720.00

**Vitamins and minerals premix per kilogram contains:*

Item		Item	
Vit.A (IU)	10,000	Biotin (mg)	0.2
Vit.D_3 (IU)	900	Choline (mg)	12000
Vit.E (mg)	5000	Niacine (mg)	50.0
Vit.K (mg)	2.00	Zn. (mg)	70.0
Vit.B_1 (mg)	2.00	Cu. (mg)	0.1
Vit.B_2 (mg)	6.00	Mn. (mg)	85
Vit.B_6 (mg)	2.00	Fe. (mg)	75.0
Vit.B_{12} (mg)	0.01	Folic acid (mg)	5.0
		Pantothenic acid (mg)	20.0

*** Calculated according to NRC (1977) for rabbits.*

Data were subjected to analysis of variance according to Snedecor and Cochran (1982) using the General Linear Model Program of SAS (2001). Percentage values were transformed to Arc. Sin values before being statistically analyzed. Duncan's new multiple range test was used to test the significance of the differences between means (Duncan, 1955). Number of conciered does, kindling rates were analyzed using the Contingency Tables according to Everitt (1977).

RESULTS AND DISCUSSION

Mature rabbit's performance

Reproductive parameter of bucks:

Data presented in Table (2) indicated that, supplementing combination of Lactomannan + EM_1; EM_1 then Lactomannan to drinking water of Cal. rabbit bucks significantly ($P \leq 0.05$) improved in descending order,

respectively their reproductive capability represented by libido (sexual desire) and physical semen characteristics (semen-ejaculate volume; advanced-sperm motility; live and morphological normal spermatozoa; acrosomal damages; sperm-cell concentration and total-sperm output).

Table (2): Libido and physical semen characteristics of Cal. rabbit bucks drank water supplemented with Lactomannan or/ and EM_1.

Variables	Drinking water additives			
	Free additives water (Control)	Lactomannan	EM_1	Lactomannan + EM_1
Libido {sexual desire} (sec.)	32.09±5.16 [a]	25.12±3.17 [b]	24.64±2.32 [b]	21.17±2.49 [c]
Semen-ejaculate volume (ml)	0.44±0.01 [c]	0.61±0.06 [b]	0.66±0.04 [b]	0.83±0.04 [a]
Advanced-sperm motility (%)	53.60±4.12 [c]	62.21±4.75 [b]	65.12±4.51 [b]	72.96±5.12 [a]
Dead spermatozoa (%)	18.75±1.81 [a]	15.92±1.23 [b]	15.08± 1.07 [b]	13.86±0.93 [c]
Sperm abnormalities (%)	16.97± 1.14 [a]	13.45±0.92 [b]	13.20± 0.93 [b]	12.03±0.86 [c]
Acrosomal damages (%)	13.14±0.72 [a]	11.61±0.34 [b]	11.13±0.46 [c]	11.01±0.51 [c]
Sperm-cell concentration ($N \times 10^6$ / ml)	421.7±19.3 [c]	543.4±23.8 [b]	562.6±24.2 [b]	637.9±31.9 [a]
Total-sperm output ($N \times 10^6$ / ejaculate)	185.5 ±13.6[d]	331.5±21.2 [c]	371.3±29.2 [b]	529.5±31.3 [a]

Means within the same row are bearing different letter superscripts (a, b, c & d), differ significantly (P≤0.05).

Tables (3 and 4) showed that, values of each of gonads and pituitary gland weight; scrotal circumference and testicular index; testosterone concentration and mating activity of Cal. rabbit bucks drank water contained combination of Lactomannan + EM_1; EM_1 and Lactomannan recorded significantly (P≤0.05) higher values than those obtained from rabbits drank free prebiotic or/ and probiotic water (control group), respectively.

Table (3): Body, gonads and pituitary gland weights, scrotal circumference and testicular index of Cal. Rabbit bucks drank water supplemented with Lactomannan or/ and EM_1.

Variables	Drinking water additives			
	Free additives water (Control)	Lactomannan	EM_1	Lactomannan + EM_1
Live body weight (gm)	3014.9± 61.2 [d]	3102.6±69.3 [c]	3179.4±71.6 [b]	3214.3±68.5 [a]
Testes weight:				
Absolute (gm)	5.22 ± 0.14 [c]	5.94±0.20 [b]	6.49 ± 0.31 [a]	6.71±0.36 [a]
Relative (%)	0.173 ± 0.02 [d]	0.191±0.02 [c]	0.204 ± 0.01 [bc]	0.209±0.01 [a]
Epididymis weight:				
Absolute (gm)	0.71 ± 0.05 [c]	0.80±0.04 [b]	0.88 ± 0.02 [a]	0.92±0.02 [a]
Relative (%)	0.024 ± 0.01 [d]	0.026±0.01 [c]	0.028 ± 0.01 [b]	0.029±0.00 [a]
Sexual glands weight:				
Absolute (gm)	2.65 ± 0.39 [c]	2.98±0.57 [b]	3.61 ± 0.43 [a]	3.66 ±0.46 [a]
Relative (%)	0.088 ± 0.00 [c]	0.096±0.01 [b]	0.114 ± 0.02 [a]	0.114±0.01 [a]
Pituitary gland weight:				
Absolute (gm)	0.21 ± 0.01 [d]	0.27±0.02 [c]	0.30 ± 0.02 [bc]	0.32±0.01 [a]
Relative (%)	0.007 ± 0.00 [d]	0.009±0.00 [c]	0.009 ± 0.00 [bc]	0.010± 0.02 [a]
Scrotal circumference:				
Absolute (cm)	6.83 ± 0.21 [c]	7.07±0.17 [bc]	7.59 ± 0.32 [a]	7.66±0.36 [a]
Relative (%)	0.227 ± 0.02 [c]	0.228±0.01 [bc]	0.239 ± 0.01 [a]	0.238±0.05 [a]
Testicular index:				
Absolute (cm^3)	5.42 ± 0.44 [b]	6.24±0.42 [ab]	6.46 ± 0.58 [ab]	6.53±0.54 [ab]
Relative (%)	0.180 ± 0.02 [d]	0.201±0.00 [c]	0.203 ± 0.01 [bc]	0.203±0.01 [a]

Means within the same row are bearing different letter superscripts (a, b, c & d), differ significantly (P≤0.05).

These results are closely comparable with those recorded by Metwally *et. al.* (2002) used probiotic and Seleem *et. al.* (2007c) used prebiotic. Dhami and Kodagali (1987) suggested a positive correlation between AST activity in seminal plasma and sperm concentration, live sperm percent, motility, semen volume and fertility rate of semen. They reported also that AST enzyme plays an important role in sperm metabolism through its involvement in the vital cellular process. Seleem *et al.* (2007) suggested that, activity of some essential enzyme may increase due to Lactomannan in rabbit drinking water, which could result in development and maturation of sperm in the testes.

Table (4): Testosterone concentration and mating activity of Cal. rabbit bucks drank water supplemented with Lactomannan or/ and EM_1.

Variables	Drinking water additives			
	Free additives water (Control)	Lactomannan	EM_1	Lactomannan + EM_1
Testosterone concentration (ng/ ml)	4.43 ± 0.47^{c}	4.83 ± 0.55^{bc}	5.86 ± 0.49^{a}	5.97 ± 0.61^{a}
Mating activity (frequency of mating/ 20 minutes)	4.07 ± 0.21^{d}	4.36 ± 0.24^{c}	4.81 ± 0.04^{b}	4.94 ± 0.06^{a}

Means within the same row are bearing different letter superscripts (a, b, c & d), differ significantly (P≤0.05).

Some doe traits:

Data presented in Tables (5 and 6) showed that, Californian rabbit does drank water supplemented with combination of Lactomannan + EM_1; EM_1 and Lactomannan and mated naturally by using bucks drank the same treated water recorded kindling rate; litter size and weight at birth; milk yield and pre-weaning mortality rate significantly (P≤0.05) better and descendingly than of those received untreated water (control group).

Table (5): Some doe traits of Cal. rabbit does naturally mated and drank water supplemented with Lactomannan or/ and EM_1.

Variables	Drinking water additives			
	Free additives water (Control)	Lactomannan	EM_1	Lactomannan + EM_1
Number of mating	38X 2	38X 2	38X 2	38X 2
Number of conceived does	51^{d}	59^{c}	68^{b}	70^{a}
Kindling rate (%)	67.11^{d}	77.63^{c}	89.47^{b}	92.11^{a}
Litter size at birth	5.64 ± 1.07^{c}	7.18 ± 1.14^{b}	7.94 ± 1.42^{ab}	8.87 ± 1.44^{a}
Bunny weight at birth (gm.)	43.74 ± 1.2^{c}	44.74 ± 1.1^{bc}	45.64 ± 1.6^{ab}	46.44 ± 1.7^{a}
Litter weight at birth (gm)	246.7 ± 15.2^{d}	321.2 ± 18.3^{c}	362.4 ± 21.1^{b}	411.9 ± 19.8^{a}

Means within the same row are bearing different letter superscripts (a, b, c & d), differ significantly (P≤0.05).

The same trends were evaluated previously by Metwally *et. al.* (2002) useing probiotic and Seleem *et. al.* (2007c) useing prebiotic. In this respect, Alves *et al.* (2003) and Mourão *et al.* (2004) observed that, the prebiotic additives lead to increase feed efficiency in rabbits. This may lead to increased milk secretion and its yield in treated rabbits. Beside that, the increase in milk production may be due to increase in litter size at birth, where there was a positive correlation between the litter size at birth and milk yield (Lebas *et al.*, 1997

and Rommers *et al.*, 2001). Finally, the improvement in litter traits proved that, the Lactomannan or/ and EM_1 treatments are capable to improve the milking ability of the doe which is reflected in her care and ability to suckle her young till weaning.

Table (6): Milk yield and pre-weaning mortality rate of Cal. rabbit does naturally mated and drank water supplemented with Lactomannan or/ and EM_1.

Variables	Periods (Days)		Drinking water additives			
	From	To	Free additives water (Control)	Lactomannan	EM_1	Lactomannan + EM_1
Milk yield (gm/ doe)	Birth	7	605.3± 21.4 ^{d}	751.8±29.3 ^{c}	803.2±21.2 ^{b}	829.9±22.2 ^{a}
	Birth	14	1208.6 ± 41.3 ^{d}	1478.9±42.2 ^{c}	1570.5±36.7 ^{b}	1624.3±40.0 ^{a}
	Birth	21	2785.9 ± 41.4^{c}	2997.6±44.6 ^{b}	3124.7±45.1 ^{ab}	3162.9±45.2 ^{a}
	Birth	28	3061.4 ± 39.7 ^{c}	3309.7±41.1 ^{b}	3497.3± 40.6 ^{ab}	3526.±42.3 ^{a}
Pre-weaning mortality rate	Birth	7	2.01 ± 0.09 ^{a}	1.66 ± 0.07 ^{b}	1.52 ± 0.08 ^{cd}	1.42 ± 0.09 ^{d}
	Birth	14	3.04 ± 1.00 ^{a}	2.46 ± 0.09 ^{ab}	2.23 ± 0.07 ^{bc}	1.98 ± 0.08 ^{c}
	Birth	21	5.09 ± 1.11 ^{a}	4.59 ± 0.0.9 ^{b}	3.92 ± 0.07 ^{cd}	3.85 ± 0.07 ^{d}
	Birth	28	6.70 ± 1.30 ^{a}	5.84 ± 1.22 ^{b}	5.79 ± 1.14 ^{cd}	5.66 ± 1.12 ^{d}

Means within the same row are bearing different letter superscripts (a, b, c & d), differ significantly (P≤0.05).

Regarding mortality rate, Fonseca *et al.* (2004) and Hooge *et al.* (2004a & b) reported that, the prebiotics reduced mortality with about 50% reduction compared with the control. In addition, Lactomannan as prebiotic may be had a role in reduced mortality rate by its role in modify pH of rabbit digestive tract promoting useful bacteria and inhibit the harmful ones (Pinheiro *et al.*, 2004). It is, however, claimed that the mannan oligosaccharides from yeast cell wall work by providing specific binding sites (D-mannose) to enteric pathogens, thus reducing their chances to attach to the intestinal tract (Finucane *et al.*, 1999). Since mannan oligosaccharides are not digested by the endogenous enzymes, they pass through the gut with the pathogens attached. There is also a "cleaning up" effect, i.e., they detach pathogens already attached to the gut (Newman, 1994). Furthermore, the possible antimicrobial activity of the prebiotics may be accounted for by their growth-promoting effects on *bifidobacteria* and *lactobacilli*. These bacteria can reinforce the barrier function of the intestinal mucosa, helping in the prevention of the attachment of pathogenic bacteria, essentially by crowding them out. These bacteria may also produce antimicrobial substances and stimulate antigen specific and nonspecific immune responses (Macfarlane and Cummings, 1999 and Roberfroid, 2000). On the other hand, the milk available per kit may also have a pronounced effect on the mortality of young rabbits (Rommers *et al.*, 2001 and Szendro et al., 2002). The lowest and pronounced decrease of mortality percentage in offspring's treated rabbit does may be discussed from the view which demonstrated by Fortun-Lamothe and Boullier (2004) who showed that in the young rabbit a passive immunity occurs due to mother's immuno-globulins transmission by the colostrum and to a lesser extent by the milk. So, this is sufficient to provide protection against infections. The concept of using prebiotics to reduce ammonia (NH_3) levels in the cecum as shown by (Mourão *et al.*, 2004; and Pinheiro *et al.*, 2004) may be responsible in decrease ammonia in confinement housing to improve air quality and consequently health and performance.

It is interested to note that, drinking water contained combination of Lactomannan and EM_1 showed significantly ($P\leq0.05$) superior parameters than using EM_1 or Lactomannan, each alone.

Conclusively, it could be concluded that, supplementation 1ml Lactomannan and 0.5 ml EM_1/ liter drinking water showed a great improvement productivity and reproductively performance of mature Cal. rabbits.

Digestibility coefficient of nutrients:

Data presented in Table (7) showed that, digestibility of crude protein (CP), crude fibre (CF), ether extract (EE), nitrogen-free extract (NFE) as well as total digestible nutrients (TDN) values of Cal. rabbits male were arranged significantly ($P\leq0.05$) in descending order due to combination of Lactomannan + EM_1; EM_1;

Lactomannan in drinking water then control group, respectively. These findings were comparable with those obtained by Metwally *et. al.* (2002) useing probiotic and Alves *et al.* (2003) and Seleem *et. al.* (2007c) useing prebiotic. The addition of Lactomannan could selectively stimulates the activity of intestinal bacteria associated with health and well-being (Gibson, 1999 and Seleem *et. al.*, 2007c) which improved nutrient utilization by: 1) Competing with pathogenic bacteria for colonization sites on the surface of the intestine (Spring *et al.*, 2000; Fairchild *et al.*, 2001 and Fernandez *et al.*, 2003); 2) Lowering intestine pH, further, limiting the growth of pathogens (Ismail *et al.*, 1996 and Pinheiro *et al.*, 2004); 3) Increasing cecal levels of volatile fatty acids (VFA) and decreasing cecal ammonia, further, favorably influencing gut microflora (Ismail *et al.*, 1996 and Mourão *et al.*, 2004) and 3) Helping to replenish the normal intestinal population of which can be diminished by periodic stress.

Table (7): Digestibility of nutrients by male rabbits drank water supplemented with Lactomannan or/ and EM1.

Item	Drinking water additives							
	Free additives water (Control)		Lactomannan		EM_1		Lactomannan + EM_1	
Digestibility coefficients (%)								
CP	63.57	± 1.19^{d}	66.36	± 1.22^{c}	68.08	±1.35^{b}	72.49	± 1.99^{a}
CF	38.35	± 0.55^{d}	41.65	± 0.57^{c}	43.09	±0.61^{b}	44.85	± 0.64^{a}
EE	70.09	± 1.16^{d}	74.19	± 1.24^{c}	76.04	±1.49^{b}	78.73	± 1.30^{a}
NFE	75.25	± 1.90^{d}	77.59	± 1.41^{c}	79.51	±1.44^{b}	82.11	± 1.91^{a}

Means within the same row are bearing different letter superscripts (a, b, c & d), differ significantly (P≤0.05)

REFERENCES

A. O. A. C. (1990). Association of Official Analytical Chemists, "Official Methods of Analysis". 13th edition Published by the A. O. A .C., Benjamen Franklin Station, Washington, D. C.

Alves, A.; V. Pinheiro; J.L. Mourão; J. Oliveira; A. Gama; A. Pereira; J. Eouzan and M. Madureira (2003). Effect of diets supplemented with promoters of digestive flora and alimentary tract development on performances and morphometry of ileal mucosa of growing rabbits. COST Action 848. Scientific Meeting Nutrition and Pathology (WG 4) and Meat quality (WG 5), September 25, Prague, Czech Republic, pp. 25.

Boulos, N.Z.; Shalash, M.A. EL-Skeikh; H.M. Abdella and N.A. Hattaba (1992). Effect of the biogenic enhancer Ascogenr on laying hen performance. Egyptian Poultry Science,12 :679-695.

Daader, A.H.; H.A. Gabr and T.S.T. Seelem. (1999a). Reproductive performance of Californian rabbits as affected by season of the year and oxytocin or adrenaline. 1st International Conference on Indigenous Versus Acclimatized Rabbits, 7-9 Sept., El-Arish, North-Sinai, Egypt, 299-311.

Daader, A.H.; H.A. Gabr and T.S.T. Seleem (1999b). Productive and reproductive performance of New-Zealand White and Californian rabbit bucks as affected by supplementing vitamin "A" to the diet, during summer and winter seasons. 7th Science Conference on Animal Nutrition, 19-21 Octob., El-Arish, North-Sinai, Egypt, 551-564.

Daader, A.H.; H.A. Gabr; A.M.F. Khadr and T.S.T. Seleem (2003). Some nutritional and physiological aspects of heat-stressed rabbits as affected by diuretics and/or GnRH. 9th Conf. on Animal Nutrition (Ruminants, Poultry, Rabbit and Fish Nutrition), 14-17 October, 2003, Hurghada, Egypt, pp. 245-252.

Dhami, A. J. and S. B. Kodagali, (1987). Correlation between biochemical and enzymatic constituents of semen of Suerti buffalo bulls. J. Anim. Sci., 57:1283-1286.

Duncan, D.B. (1955). Multiple Range and Multiple (F-test). Biometrics, 11: 1-42.

El-Kholy, K.H.; T.S.T. Seleem; T.A. El-Aasar and Hanaa, A. Abdelharith (2008). Effect of dietary addition of Arak (Salvadora Persica) on growth and reproductive performance in Black Baladi rabbit males. World Rabbit Sci., 16: 21 – 27.

Everitt, B. S. (1977). The Analysis of Contingency Tables. Monographs of Applied Probability and Statistics. pp, 38-66 London, Chopman Hall.

F.A.O. (1987). Ralbbit production. 12th Session of the F.A.O. Regional Animal Production and Health commission for Asia and Pacific (APHCA) Held In Islamabad, Pakistan from 5th to 10th Octob.

Fairchild, A.S.; J.L. Grimes; F.T. Jones M.J. Wineland; F.W. Edens and Sefton, A. E. (2001). Effects of hen age, Bio-Mos, and Flavomycin on poult susceptibility to oral Escherichia coli challenge. Poultry Sci. 80, 562-571.

Fernandez, F.; M. Hinton and B. V. Gils (2003). Dietary mannan-oligosaccharides and their effect on chickes caecal microflore in relation to salmonella enteritidis colonization. Avian Pathology, 31:49.

Finucane, M.; P. Spring and K.E. Newman (1999). Poster S179, Southern Poultry Science, Jan 18-21, Atlanta.

Fonseca, A. P.; L. Falcão; A. Kocher; and P. Spring (2004). Effects of dietary mannan oligosaccharide in comparison to oxytetracyclin on performance of growing rabbits. 8th World Rabbit Congress, Puebla, Mexic.

Fortun-Lamothe, L. and S. Boullier (2004). Interactions between gut microflora and digestive mucosal immunity, and strategies to improve digestive health in young rabbits. 8th World Rabbit Congress, Puebla, Mexic.

Galal, E.S.E. and M.H. Khalil (1994). Development of rabbit industry in Egypt. 1st Inter-Conf. on Rabb. Prod. in Hot Climates, 6-8 Sept., Cairo, Egypt., 43-56.

Gibson, G. R. (1999). Dietary modulation of the human gut microflora using the prebiotics oligofructose and inulin. Am. Socity Nutr. Sci., 129:1438-1441.

Hanna, M.F.S.; Samia Z. Meshreky and A.A.A. El-Zaiat (2008). Effect of some supplementation medicinal plant on growth performance, carcass traits and economical efficiency of growing rabbits. 1st Egyptian Conf. on Rabbit Science, Department of Animal Production, Faculity of Agriculture, Cairo University, Giza, Egypt, 29-30October: 167-181.

Hooge, D. (2004a). Meta-analysis of Broiler Chicken Pen Trials Evaluating Dietary Mannan Oligosaccharide, 1993-2003. Int. J. Poult. Sci. 3: 163-174.

Hooge, D. (2004b). Turkey Pen Trials with Dietary Mannan Oligosaccharide: Meta-analysis, 1993-2003. Int. J. Poult. Sci. 3, 179-188.

Huyghebaert, G. (2003). Replacement of antibiotics in poultry. Eastern Nutrition Conference, Québec, Canada, pp. 55-78.

Ismail, A. M.; A. Al-Bar; K. M. Mansour; and P. R. Cheeke (1996). Evaluation of some probiotic growth promoters on rabbit performance. 6th Conf. Agric. Dev. Res. Ain Shams Univ., Cairo, Dec. 17-19, 1996, pp. 71-79.

Kembhavi, A. (2004). Feed additives. In: Biotechnology Application for the Indian Animal Feed Industry: Prospects for Growth. Food and Agriculture Organization of the United Nations, FAO, Rome, Italy.

Lebas, F.; P. Coudert; H. De. Rochambeau; and R. G. Thébault (1997). The Rabbit Husbandry, Health and Production. Food and Agriculture Organization of the United Nations, FAO, Rome, Italy.

Macfarlane, G. T. and J.H. Cummings (1999). Probiotics and prebiotics: can regulating the activities of intestinal bacteria benefit health. West. J. Med., 171:187-191.

McDowell, L.R. (2000). Vitamin B12. In: Vitamins in Animal and Human Nutrition, 2nd edn. Iowa State University Press, Ames, IA, pp. 523–563.

Marionnet, D. and F. Lebas (1990). What is a probiotic? Cuniculture, Lipmpdes, Paris, 96:225.

Marteau, P. and M.C. Boutron-Ruault (2002). Nutritional advantages of probiotics and prebiotics. British J. Nutr., 87, Suppl. 2:153-157.

Marzo, I. (2001). New strategies in rabbit feed: Additives and alternatives to antibiotic use. 26th Symp. ASESCU, Aveiro, (Portugal), 51-68.

Metwally, A.M.; S.A. Mahmoud; M. El-Fateh; I.A. Hammouda and M.A. Abo Warda (2002). Reproductive performance and blood constituents of buck and doe rabbits fed diets supplemented with some probiotic and herbal additives. 3rd Science Conference on Rabbit Production in Hot Climates, 8-10 October, Hurghada, Egypt, 693-704.

Mickelsen, W. D.; L. G. Paisley and J. J. Dahmen (1982). The relationship of libido and serving capacity test score in rams on conception and lambing percentage in the ewe. Theriogenology, 18: 79.

Mourão, J. L.; A. Alves; and V. Pinheiro (2004). Effects of fructo-oligosaccharides on performances of growing rabbits. 8th World Rabbit Congress, Puebla, Mexic.

Newman, K. (1994). Mannan-oligosaccharides: Natural polymers with significant impact on the gastrointestinal microflora and the immune system. In: Biotechnology in the Feed Industry. Lyons, T. P. A. J., K.A. (ed.) Nottingham University Press, Nicholasville, Kentucky, pp. 167-180.

NRC (1977). Nutrient Requirements of Rabbits. National Academy of Science, Washington, DC. USA.

Osman, Noha, A. M. (2005). Influence of supplemental probiotc on immunological, hematological and productive performance in growing rabbits. M. Sc. Thesis, Agric. Fac., Cairo Univ., Egypt.

Parks, C.W.; J.L. Grimes; P.R. Ferket and A.S. Fairchild (2000). The case for man nanoligosaccharides in poultry diets: An alternative to growth promotant antibiotics. In: Biotechnology in the Feed Industry. Proc. Alltech's 6th Annual Symposium, Nottingham, Leics, UK, pp. 45-59.

Pet-Ag. Inc (1992). Fermacto Nutritional Supplement for Poultry. 30W 432, Route 20, Elgin, IIIinois 60120, USA.

Pinheiro, V.; A. Alves; J.L. Mourão; C.M. Guedes; L. Pinto; P. Spring and A. Kocher (2004). Effect of mannan oligosaccharides on the ileal morphometry and cecal fermentation of growing rabbits. 8th World Rabbit Congress, Publa, Mexic.

Rashwan, A.A. and I.F.M. Marai (2001). Mortality in rabbits : causes and its control. 2nd Inter. Conf. on Anim. Prod. and Health in Semi-Arid Areas, 4-6 Sept., El-Arish, North-sinai, Egypt, 41-56.

Roberfroid, M. B. (2000). Prebiotics and probiotics: are they functional foods?. Am. J. Clin. Nutr., 71:1682-1687.

Rommers, J. M.; R. Meijerhof; J.P.T.M. Noordhuizen and B. Kemp (2001). Effect of different feeding levels during rearing and age at first insemination on body development, body composition and puberty characteristics of rabbit does. World Rabbit Science, 9:101-108.

Salisbury, G. W.; N. L. Van Demark; and J. R. Lodge (1978). Physiology of Reproduction and Artificial Insemination of Cattle. W.H. Freeman and Company, San Francisco, USA.

SAS (2001). Statistical Analysis System, User's Guide Version 8.2, Cary NC. USA. Savage, T. F. and Zakrzewska, E. I. (1995). Performance of male turkeys to 8 weeks of age when fed an oligosaccharide derived from yeast cells. Poult. Sci., 74:158.

Seleem, T.S.T. (1996). Studies on some reproductive characteristics in rabbits. M. Sci., Thesis, Faculty of Agricuture, Zagazig Universty, Zagazig, Egypt.

Seleem, T.S.T. (2003). Studies on productive and physiological characteristics of rabbits under different managerial conditions. Ph.D. Thesis, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.

Seleem, T.S.T.; A. E. M. Abd El-Motaa; I.M.M. Assaf; A.M.A. Torkia and Leila B. Bahgat (2007b). Some productive and reproductive performance of rabbits as affected by supplementing Nigella Sativa to the diet. The 5th Inter. Con. on Rabbit Prod. in Hot Clim., Hurghada, Egypt, 273 - 286.

Seleem, T.S.T.; A. E. M. Abd El-Motaal and K. H. El-Kholy (2006). Effect of L-carnitine preparation in drinking water on some productive and reproductive performance of NZW rabbits. The 1st Conference. on Clean Environment and Safety Food, December, Ain Shams University, Egypt.

Seleem, T.S.T.; H.M. Fayek; K. H. El-Kholy and S.M. Afifi, (2007c). Rabbit productivity and reproductivity as influenced by prebiotics in drinking water. 4th World Poultry Conference 27- 30 March, Sharm El-Sheikh, Egypt, 603-625.

Seleem, T.S.T.; M.A. Elsawy, W.A.A. Ali and H.E. Radwan (2008b). Rabbit productivity and reproductivity as affected by Fenugreek in diets.1st Egyptian Conf. on Rabbit Science, Department of Animal Production, Faculity of Agriculture, Cairo University, Giza, Egypt, 29-30 October: 142-154

Seleem, T.S.T.; M.F.S. Hanna; H.E. Radwan and Kh.A.A. Ali (2008a). Some productive and reproductive aspects of rabbits as influenced by Anise (Yansoon) seeds in diets. 1st Egyptian Conf. on Rabbit Science, Department of Animal Production, Faculity of Agriculture, Cairo University, Giza, Egypt, 29-30 October: 155-166

Seleem, T.S.T; H. Ibrahim; A.M. Ali ; A.M. Abd-Elmotaal and A. E.B. Zeidan (2007a). Rabbit performance as affected by Origanum Majorana in diets. The 5th Inter. Con. on Rabbit Prod. in Hot Clim., Hurghada, Egypt, 495 - 508

Snedecor, G.W. and W.G. Cochran (1982). Statistical Methods. 2nd Ed. Iowa University, Press Ames, Iowa.

Spring, P.; C. Wenk; K.A. Dawson and K.E. Newman (2000). The effects of dietary mannanoligosaccharides on cecal parameters and the concentrations of enteric bacteria in the ceca of Salmonella-challenged broiler chicks. Poult. Sci., 79: 205-211.

Szendro, zs.; I. Randai; E. Birone-Nemeth; R. Romvari and G. Milists (2002). Effect of live weight on the carcass traits of pennon white rabbits. 3rd Int. Symp. "Animal Science Days", Sept. 26-29, 1995, Bled, Slovenia.

Tawfeek, M.I. and I.F. Marai (1997). Use of probiotics in small animal production. International Conf. on Animal, Poultry and Rabbit Prod. And Health, 2-4 September, Dokki, Egypt. 71-90.

Van Loo, J. (2004). The specificity of the interaction with intestinal bacterial fermentation by prebiotics determines their physiological efficacy. Nutr. Res. Rev., 17: 89-98.

Watson, P. F. (1975). Use of Giemsa stain to detect changes in acrosomes of frozen ram spermatozoa. Veter. Research, 97: 12-15.

تأثير إضافة البريبيوتيك أو/ و البروبيوتيك في مياه الشرب على معدلات أداء الأرانب الناضجة

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استخدم فى هذه الدراسة 188 أرنب كاليفورنيا لتقييم تأثير إضافة البريبيوتيك (لاكتومنان) أو/ و البروبيوتيك (الكائنات النشطة - EM_1) في ماء الشرب على بعض معدلات الأداء الإنتاجي والتناسلي للأرانب الناضجة. استغرقت التجربة أربعة أشهر و أجريت على 36 ذكر ناضج جنسيا، و 152 أم ولدت مرة واحدة على عمر 9 أشهر من أرانب الكاليفورنيا. قسمت كل الأرانب إلى أربعة مجموعات تجريبية متساوية لتضم كل مجموعة (9 ذكر ناضج جنسيا، 38 أم في بطنين متتاليين). حفظت المجموعة الأولى بدون معاملة (مجموعة ضابطة)، بينما أضيف لماء شرب مجموعات المعاملات الثلاثة 1 مل لاكتومنان ، 0.5 مل EM_1 أو خليط من اللاكتومنان + EM_1 لكل لتر ماء شرب ولمدة ثلاثة أيام متتالية إسبوعيا خلال فترة التجربة.

أوضحت النتائج المتحصل عليها من هذه الدراسة أن قيم كل من النسب المئوية لمعاملات الهضم والقيم الغذائية لأرانب الكاليفورنيا الناضجة كانت أعلى معنويا (عند مستوى 5%) وفى ترتيب تنازلى كنتيجة لإضافة مخلوط اللاكتومنان + EM_1 ، اللاكتومنان لمياه الشرب ثم المجموعة الضابطة، على الترتيب.

إضافة اللاكتومنان أو/ و EM_1 لماء شرب ذكور أرانب الكاليفورنيا الناضجة جنسيا أدى إلى تحسين معنوي (عند مستوى 5%) فى مقدرتها التناسلية متمثلة فى رغبتها الجنسية والخصائص الطبيعية للسائل المنوى (حجم قذفة السائل المنوى ونسب كل من الحركة التقدمية للحيوانات المنوية ، الحيوانات المنوية الحية والسليمة مورفولوجيا، حالة الأكروسوم وكذلك تركيز الحيوانات المنوية فى المل وفى القذفة)، بالإضافة إلى أوزان الغدة النخامية والأعضاء الجنسية، ومحيط كيس الصفن والدليل الخصوى. سجلت ذكور أرانب الكاليفورنيا المضاف إلى ماء شربها اللاكتومنان أو/ و EM_1 قيم لكل من تركيز الهرمون الذكرى التستيسترون والنشاط التزاوجى (عدد مرات التلقيح فى 15 دقيقة) أعلى معنوياً (عند مستوى 5%) عن تلك التى قدم إليه ماء شرب خالى من اللاكتومنان أو/ و EM_1.

إناث أرانب الكاليفورنيا المقدم إليها ماء شرب محتوي على اللاكتومنان أو/ و EM_1 والملقحة طبيعياً من ذكور معاملة بنفس المعاملة سجلت قيم لكل من معدل ولادات، وعدد ووزن خلفات عند الميلاد ، وكمية اللبن لكل أم وكذلك معدلات نفوق الخلفات قبل الفطام أفضل معنوياً (عند مستوى 5%) مقارنة بتلك التى سجلتها الأرانب التى لم يضاف اللاكتومنان أو/ و EM_1 لماء شربها (المجموعة الضابطة).

أظهرت النتائج أن إضافة خليط من اللاكتومنان +EM_1 إلى ماء شرب الأرانب أدى إلى تحسن معنوى (عند مستوى 5%) عن إضافة EM_1 أو اللاكتومنان فقط على الترتيب، فيما يتعلق بكل الصفات التى تم دراستها. ومما سبق فإن الدراسة أوضحت فى مجملها أن إضافة 1 مل لاكتومنان + 0.5 مل EM_1 إلى ماء شرب أرانب الكاليفورنيا الناضجة جنسياً لعب دوراً هاماً فى تحسين معدلات النمو ومعدلات الأداء التناسلية.