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EFFECT OF DIETARY PROTEIN LEVEL AND FREQUENCY OF EJACULATION ON SEMEN QUALITY OF NZW RABBITS UNDER SUMMER CONDITIONS IN EGYPT

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ABSTRACT

An experiment was carried out to investigate the effects of dietary crude protein level [16 (control), 18 and 20%] and frequency of ejaculation (1, 2, 3 and 7 ejaculates/week) on physical characteristics of semen of New Zealand White (NZW) rabbit bucks under summer conditions in Egypt. Semen quality was assessed by ejaculate volume (EV), sperm concentration (SC), percentages of mass (MM) and progressive motility (PM), percentages of abnormal (AS) and dead sperms (DS), and total output, normal, live and motile sperms. Blood sampling was also performed to determine the concentrations of plasma total protein, albumin, testosterone and creatinine, and, activities of plasma alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

The obtained results revealed that, EV, SC, percentages of MM and PM, and total output, normal, live and motile sperms were significantly increased, while percentages of AS and DS were decreased with elevating the level of dietary CP to 20%. On the other hand, no significant differences were detected in the aforementioned characteristics of rabbit bucks' semen due to increasing the dietary CP level from 16 to 18% except MM and DS were significantly improved. As for the effect of ejaculation frequency, it was observed that, EV, SC, percentages of MM and PM, and total output, normal, live and motile sperms were significantly reduced, while percentage of AS was markedly increased when number of ejaculates reached 7 times per week. Regarding the effect of dietary CP level on blood parameters; no significant differences were found in concentrations of plasma globulin and creatinine, or activities of plasma ALT and AST, whereas values of plasma total protein, albumin, and testosterone were significantly increased with elevating dietary CP level from 16 to 18 or 20%. The effects of dietary CP level and ejaculation frequency on semen quality were not interrelated.

It can be concluded that; under summer conditions in Egypt, NZW rabbit bucks can be used for mating or semen collection 3 times per week with no detrimental effects on semen characteristics, and fed on a 20%-CP diet in order to get semen of a good quality.

Keywords: Rabbits, semen quality, dietary protein and frequency of ejaculation.

INTRODUCTION

The intensive rabbit production is influenced by many environmental factors among which ambient temperature and nutrition play an important part. The domestic rabbit is a homeothermic mammal, and has a high metabolic rate, undeveloped sweat glands and slow heat loss. The thermo-neutral zone for rabbits was reported to be 15 to 18°C (Rafai *et al.,* 1972).

Although rabbits could be well adapted to semi-arid areas, they are very sensitive to high environmental temperatures. The dense fur and lack of sweat glands in rabbits make heat loss very difficult when the ambient temperature exceeds the zone of thermoneutrality (Nichelmann, 1972). Hot weather affects inversely the productive and reproductive performance of rabbits. Therefore under such environmental conditions, the recommended feeding standards regarding the nutrient requirements of rabbits often have no practical value.

However, the published data on the effect of nutrition on the performance of rabbit bucks are limited, the NRC (1977) and Lebas, *et al*. (1986) made no references concerning their nutrient requirements. Practically, rabbit bucks are fed simultaneously on the same diets of their counterparts of rabbit does or growing rabbits under the commercial production systems. However**,** dietary crude protein was estimated to be16 and 17% for growing and lactating rabbits, respectively (NRC, 1977) or 18% for lactating and pregnant rabbits (Lebas, 1980).

Under Egyptian conditions, the optimal dietary crude protein level for rabbit bucks was reported to be 17.5% (Hemid and Tharwat, 1995) and 19% (Abd El-Hady, 2001). The use of diets containing 20 or 22% protein was found to be very effective under Egyptian summer conditions in improving semen characteristics and rabbit bucks fertility (Abd El-Monem and Ayyat, 2002). Furthermore, Ames *et al.* (1980) confirmed that fortification of diets via increasing their content of crude protein corrected the negative nitrogen balance and improved the performance of heat-stressed animals.

The semen characteristics of farm animals appear to vary considerably not only among species but also among individuals within the same species due to differences in level of nutrition, management and diurnal variation (Mann, 1964), season (Igboeli and Rakha, 1971), age (Morstin and Jasiorowski, 1977), sexual preparation (Salisbury *et al*., 1978), and frequency of ejaculation (El-Harrairy, 1981).

A great deal of research work on the effect of frequency of ejaculation on semen characteristics has been focused on large farm animals rather than rabbits and that is why data on rabbits are scarce. The successful use of rabbit bucks for both natural mating and artificial insemination is, to some extent, dependent on their libido and capability to produce semen with sufficient number of viable sperms. Information on the optimal use of rabbit bucks for semen collection or for natural service under Egyptian conditions are rather rare.

The present study aimed to determine the appropriate level of dietary crude protein as well as the optimal frequency of ejaculation for New Zealand White rabbit bucks under summer conditions of Egypt.

MATERIALS AND METHODS

This study was carried out at a private rabbitry (Sadaka village, Dakahlia Governorate) using New Zealand White (NZW) rabbit bucks. A total number of 15 bucks, of 5 months of age with an average body weight of 3650 g were allotted at random to 3 equal experimental groups. The first group was fed on a diet having 16% crude protein (CP) and served as a control, while the 2nd and 3rd groups were fed on diets containing 18 and 20% CP, respectively during an experimental period of 4 months (May up to August, 2004). Composition and chemical analysis of the experimental diets are shown in Table (1).

Table 1: Composition and chemical analysis of the experimental diets.

Ingredients (%)	Experimental diets		
	I	II	III
Yellow corn	15.0	15.0	15.0
Soybean meal (44%)	8.0	14.5	21.0
Wheat bran	32.5	26.0	19.5
Clover hay	40.0	40.0	40.0
Sugar cane molasses	2.0	2.0	2.0
Limestone	1.5	1.5	1.5
Salt	0.5	0.5	0.5
Vit. & Min. Premix*	0.5	0.5	0.5
Chemical analysis % (on air dry basis)			
DM	90.20	89.90	90.10
OM	80.18	79.79	79.92
CP	15.98	17.95	19.91
EE	3.20	2.98	2.73
CF	12.27	11.88	11.50
NFE	48.73	46.98	45.78
Ash	10.02	10.11	10.18
NDF**	37.86	37.60	37.31
Digestible energy (DE) Kcal/g***	2.501	2.514	2.528

*** Each kilogram contains: Vit. A 2000000 IU, Vit. D3 150000 IU, Vit. E 8.33 g, Vit. K 0.33 g, Vit. B1 0.33 g, Vit. B2 1.0 g, Vit. B6 0.33 g, Vit. B12 1.7 mg, Pantothenic acid 3.33 g, Niacin 8.33 g, Biotin 33 mg, Folic acid 0.83 g, Choline chloride 200 g, Zn 11.79 g, Fe 12.5 g, Cu 0.5 g, Co 1.33 mg, Se 16.6 mg, Mg 66.79 mg and Mn 5.0 g.**

**** % NDF = 28.924 + 0.657 (%CF; on DM basis), according to Pagano Toscano *et al*. (1986).**

***** DE; Kcal/g diet) = 4.36-0.0491 (%NDF); according to Fonnesbeck *et al*. (1974).**

Rabbits of all groups were kept at individual battery cages in a naturally ventilated house. The ambient temperature inside the house throughout the experimental period ranged between 22-28^{o}C at night and 30-38 ^{o}C at day, and the relative humidity ranged between 63 and 75%. All rabbits were reared under similar managerial and hygienic conditions.

During a preliminary period elapsed from May to June 2004, rabbit bucks (5-7 months of age) were trained for artificial collection of semen using an artificial vagina (Hiedbrink *et al*.,1980). Whereas, the experimental semen collection was performed during a 7-week period of July and August 2004, as rabbit's bucks advanced from the 7th until the 9th month of age, according to the following schedule:

Weekly intervals	Number of ejaculates/ week
The 1st wk	One ejaculate
The 2nd wk	Rest
The 3rd wk	Two ejaculates
The 4th wk	Rest
The 5th wk	Three ejaculates
The 6th wk	Rest
The 7th wk	Seven ejaculates

Ejaculate volume (EV) was measured in milliliters using calibrated pipette after the removal of the gel mass. For estimation of mass motility (MM) of the sperms, a drop of fresh semen was placed on a warm slide (37°C) and examined under a low magnification. Progressive motility (PM) of sperms was examined by placing a small drop of fresh semen on a warm glass slide, diluted with two drops of warm 0.9%-saline solution and examined under a high power magnification (x 100). Mass and progressive motility were assessed on a percentage score. Percentages of abnormal (AS) and dead sperms (DS) were estimated in a stained smear using eosin-nigrosin dye, and a total of 200 sperms were counted (in duplicate tests) per sample. Sperm cell concentration (SC) was determined by the direct sperm cell count using the Neubaur haemocytometer.

Total sperm output and count of motile, live and normal sperms per ejaculate were calculated as follows:

Total sperm output per ejaculate (A) = ejaculate volume (ml) × sperm cell concentration /ml.

Motile sperm output = A × progressive motility (%).

Live sperm output = A × live sperm (%).

Normal sperm output = A × (100 – abnormal sperms; %).

Blood samples were collected from the marginal veins of the ears of rabbits in heparinized test tubes for the determination of plasma total protein, albumin, creatinine and testosterone as well as activities of plasma transaminases: alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Plasma globulin level was calculated by subtracting the concentration of albumin from that of plasma total protein. All biochemical parameters of blood were determined using commercial kits (Pasteur Lab. Egypt-USA).

Statistical analysis of the data was performed using the Statgraphics Program (Statistical Graphics Corporation, 1991). Multi-factor analysis of variance was used to estimate the significant differences among means for each variable. Differences were considered significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

Effect of dietary crude protein level on semen quality of rabbits:

Data in Table 2 show that all physical characteristics of semen were significantly (P<0.05) improved by increasing the level of CP in diets of bucks. The percent increase in mass motility of sperms reached 5.51 and 10.78 % when dietary CP increased from 16 to 18 or 20 %, respectively, while the corresponding decreases in the percentage of dead sperms were 4.29 and 10.31 %, respectively. It was also observed that, upon increasing the level of dietary CP from 16 to 20 %, ejaculate volume, sperm cell concentration, and percentage of progressive motility increased by 19.08, 6.02 and 9.46 % respectively. On the other hand, percentage of abnormal sperms was decreased by 13.00% when the level of dietary CP was increased from 16 to 20 %.

Table 2: Effect of dietary crude protein level on some physical semen characteristics and sperm output per ejaculate of NZW rabbit bucks.

Characteristics	Crude protein level		
	16%	18%	20%
Ejaculate volume (ml)	0.870 ± 0.033^{b}	0.937 ± 0.031^{b}	1.036 ± 0.032^{a}
Sperm concentration ($\times10^6$/ml)	254.69 ± 4.86^{b}	262.17 ± 4.57^{ab}	270.02 ± 4.62^{a}
Mass motility (%)	68.83 ± 1.61^{b}	72.62 ± 1.58^{a}	76.25 ± 1.52^{a}
Progressive motility (%)	71.87 ± 1.56^{b}	75.13 ± 1.51^{ab}	78.67 ± 1.45^{a}
Sperm abnormality (%)	22.70 ± 0.44^{a}	21.69 ± 0.44^{a}	19.75 ± 0.41^{b}
Dead sperm (%)	13.29 ± 0.20^{a}	12.72 ± 0.21^{b}	11.92 ± 0.18^{c}
Total out put*	230.77 ± 11.45^{b}	253.27 ± 11.12^{b}	287.99 ± 12.10^{a}
Motile sperm*	176.14 ± 10.34^{b}	199.28 ± 10.62^{b}	236.45 ± 12.12^{a}
Live sperm*	200.78 ± 10.12^{b}	221.56 ± 9.83^{b}	254.25 ± 10.80^{a}
Normal sperm*	180.58 ± 9.44^{b}	200.29 ± 9.31^{b}	233.46 ± 10.36^{a}

$^{a-c}$: Means in the same row having different superscripts are significantly different at P≤0.05.
*** (sperm number × 10^6/ejaculate)**

As for the effect of dietary CP level on sperm production it was observed that total sperm output, and numbers of motile, live and normal sperms were significantly (P<0.05) improved by increasing the dietary CP level from 16 to 20%. On the other hand, increasing the level of CP from 16 to 18% had no significant effect on the aforementioned characteristics of rabbit bucks' semen. This improvement was relevant to the increases in ejaculate volume, sperm concentration and percentage of progressive motility, and the decreases in percentages of abnormal and dead sperms in the semen of the experimental bucks fed 20% dietary CP as compared to their counterparts fed on the 16 %-CP diet.

In accordance with the present results, Abd El-Monem and Ayyat (2002) found that rising dietary protein level from 18 to 22% significantly ($P<0.05$) improved ejaculate volume, mass motility, and advanced motility, and, reduced sperm abnormality in semen of NZW bucks under hot summer conditions in Egypt. Abd El-Hady (2001) observed a significant increase in sperm motility percentage by increasing dietary CP level from 15 to 17% and a significant decrease in dead sperm percentage by increasing dietary CP level from 15 to 19% in rabbit diets. However, ejaculate volume sperm concentration and abnormal sperms were not affected by dietary CP level. Hemid and Tharwat (1995) found that increasing dietary CP level from 15 to 17.5% of diets for NZW rabbits resulted in significant increases in mass motility and sperm concentration, and led to significant decreases in percentages of dead and abnormal sperms; however, ejaculate volume and progressive motility percentage were not affected. In contrast with the present results, Ahmed *et al.* (1991) indicated that increasing the level of dietary protein did not show significant effect on the percentage of sperm motility, abnormal and live sperms, while the average of ejaculate volume of semen and sperm concentration were significantly ($P<0.05$) lower in semen of rabbit bucks fed low protein diet (11.39%) than those of bucks fed high protein diet (16.45%).

It is of interest to note that the significant increase in ejaculate volume in response to increasing dietary protein level may be associated with the effect of dietary CP level on the size of accessory glands, and/or their activity in the production of the seminal fluid. Louis *et al.* (1994) mentioned that a significant increase in ejaculate volume achieved by increasing dietary CP level may be related to increasing activity of the accessory glands; as a result of an increased secretion of testosterone in response to increasing dietary CP level. In the current study, testosterone concentration was increased significantly in the plasma of rabbit bucks when dietary CP increased from 16 to 18 or 20 % (Table 5).

Spermatogenesis is controlled directly by testosterone concentration (Hammond *et al.,* 1983 and Abdel-Khalek *et al*. 2000a) and directly or indirectly by thyroid hormones (Nalbandov, 1970) that decrease by high ambient temperature. El-Sherry *et al.* (1980) confirmed that summer stress retards spermatogenesis in rabbits.

However, the improvement in sperm concentration of semen may be attributed to indirect effect of the dietary CP on increasing the testicular weight and volume, and in turn on number of sperms produced per gram of the testicular mass (Mansour *et al.,* 1989). The marked improvement in sperm concentration by rising level of dietary protein may be due to the rebuilding of degenerated germinal epithelium and spermatogenic cells in the seminiferous tubules occurring in heat-stressed animals (Chou *et al.,* 1974 and El- Sherry *et al.,* 1980). The increase in percentage of dead sperms under high environmental temperature (summer season) in the semen of bucks fed low CP level may be due to the effect of heat stress on the epididymis function which is under the control of testosterone (Davis *et al.,* 1970, Damber *et al.,* 1980 and Chap and Bedrak, 1983) that is affected negatively by heat stress.

The pronounced increase in percentages of mass and progressive motility of sperms by increasing the level of CP may be attributed to marked reduction in the percentages of dead and abnormal sperms and/or to an improvement in the epididymis function and accessory glands activity as a result of increasing dietary CP level (Louis *et al.,* 1994). These authors, (Louis *et al.,* 1994) also demonstrated that increasing dietary CP level exerts an effect on the hypothalamus to produce gonadotrophic releasing hormone, which in turn increase serum concentrations of LH, FSH and testosterone. The change in percentages of dead and abnormal sperms may be due to changes in LH, FSH and testosterone production that interfere with testis and epididymis functions.

Effect of frequency of ejaculation/week on semen quality of rabbits:

Ejaculate volume, sperm cell concentration, and percentages of mass and progressive motility showed gradual reduction by increasing the frequency of ejaculations/week, but these reductions became more pronounced and significant ($P<0.05$) when number of ejaculations exceeded 3 and reached 7/week (Table 3).

It is of interest to note that abnormal sperms showed insignificant increase by increasing the frequency of ejaculation from one to two and from two to three ejaculates/week, but increased significantly ($P<0.05$)when number of ejaculations reached 7/week. However, the percentage of dead sperm slightly increased by increasing frequency of ejaculation but significant difference ($P<0.05$) was observed only between 1 and 7 ejaculates/week in this respect (Table 3).

Table 3: Effect of frequency of ejaculation on some physical semen characteristics and sperm output per ejaculate of NZW rabbit bucks.

Semen characteristics	Frequency of ejaculation			
	1/week	**2/week**	**3/week**	**7/week**
Ejaculate volume (ml)	1.14 ± 0.03^{a}	1.13 ± 0.03^{a}	1.09 ± 0.02^{a}	0.81 ± 0.03^{b}
Sperm concentration ($x10^{6}$/ml)	286.6 ± 4.3^{a}	286.7 ± 3.0^{a}	283.0 ± 2.1^{a}	243.0 ± 4.0^{b}
Mass motility (%)	80.93 ± 0.98^{a}	80.97 ± 0.65^{a}	78.82 ± 0.64^{a}	66.26 ± 1.43^{b}
Progressive motility (%)	82.73 ± 0.98^{a}	83.30 ± 0.89^{a}	81.29 ± 0.60^{a}	69.26 ± 1.38^{b}
Sperm abnormality (%)	18.13 ± 0.69^{c}	19.38 ± 0.56^{bc}	20.51 ± 0.46^{b}	22.79 ± 0.34^{a}
Dead sperm (%)	12.00 ± 0.43^{b}	12.20 ± 0.43^{ab}	12.30 ± 0.22^{ab}	13.00 ± 0.15^{a}
Total sperm out put*	327.64 ± 9.5^{a}	323.71 ± 8.3^{a}	309.68 ± 6.9^{a}	205.91 ± 9.5^{b}
Motile sperms*	271.74 ± 9.9^{a}	270.53 ± 8.5^{a}	252.75 ± 6.9^{a}	154.34 ± 9.1^{b}
Live sperms*	288.37 ± 8.7^{a}	284.14 ± 7.3^{a}	271.72 ± 6.3^{a}	180.01 ± 8.5^{b}
Normal sperms*	268.38 ± 8.5^{a}	261.16 ± 7.2^{a}	246.98 ± 6.5^{a}	161.45 ± 7.9^{b}

a-c: Means in the same row having different superscripts are significantly different at $P\leq0.05$.;

* **(sperm number x 10^{6}/ejaculate)**

The effect of frequency of ejaculation was more pronounced when semen quality was expressed in terms of total sperm output and numbers of motile, live and normal sperms, where counts of different types of sperms gradually decreased by increasing the ejaculation frequency from one to seven times per week. But, the significant differences ($P<0.05$) were observed only when ejaculate frequency increased to seven times per week (Table 3).

In agreement with the present results, El-Harairy (1981) found significant decreases in ejaculate volume, sperm motility, sperm concentration, and a significant increase in sperm abnormality percentage in semen of Baladi and Buscat bucks by increasing the frequency of ejaculation from one up to 3/week. However, the percentage of dead sperms was not significantly affected by the frequency of ejaculation. Nizza *et al*. (2003) found significant decreases in semen volume/ejaculate and sperms concentration/ml in semen of the crossbreed Hyla rabbit bucks due to increasing collection frequency. However, these authors (Nizza *et al*., 2003) reported that semen pH, motility, percentage of live sperms and sperm abnormalities were not significantly affected by the frequency of ejaculation.

Generally, in the present study all semen characteristics were slightly affected by increasing the frequency of ejaculation from one up to three ejaculates/week. On the other hand, the effect of increasing the frequency of ejaculation from 3 to 7/week was more pronounced on all semen characteristics. Amann (1966) concluded that; in order to achieve the best results from rabbit bucks, an ejaculation frequency of two ejaculates every 48 h would be recommended. Miros and Vakulenko (1979) suggested an optimal regimen of mating rabbits in which each buck would be mated with two does every three days.

Effect of interaction of dietary protein level by frequency of ejaculation/week on semen quality of rabbits:

Analysis of variance revealed that the interactive effect of the frequency of ejaculation by dietary CP level on all semen physical characteristics and sperm output was not significant. Ejaculate volume, sperm cell concentration and percentages of mass and progressive motility were almost higher in bucks fed 20% CP, followed by those fed 18% CP. Meanwhile, bucks fed 16% CP level showed the lowest values with all ejaculate frequencies.

However, percentages of dead and abnormal sperms showed the opposite trend (Table 4 and Fig. 1). Total sperm output and number of motile, live and normal sperms gradually decreased by increasing the frequency of ejaculation from 1 to 3 times/week and sharply decreased when it was 7 times/week (Table 4 and Fig. 2).

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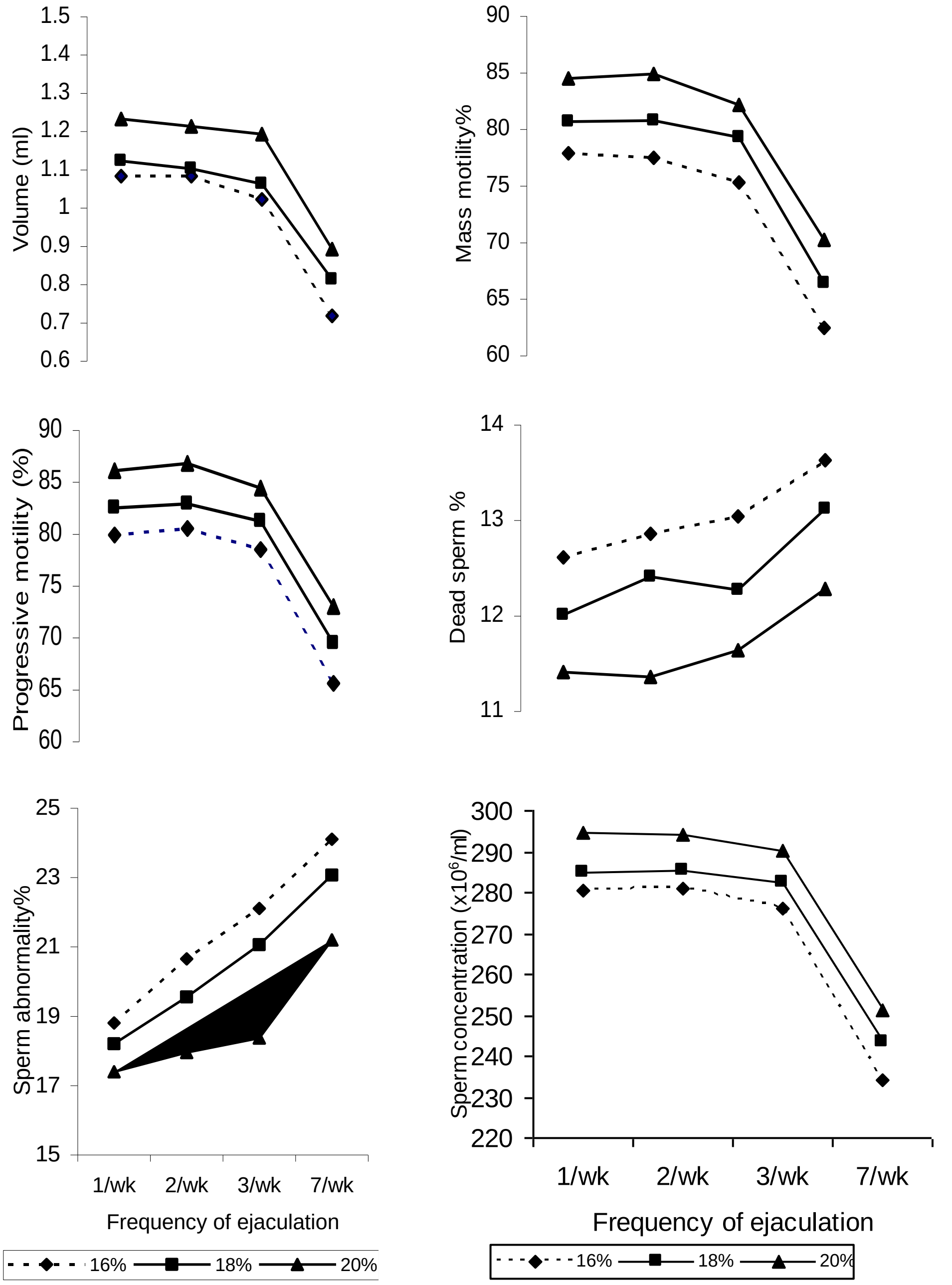

Figure 1: Effect of frequency of ejaculation and dietary crude protein level on some semen characteristics of rabbit bucks.

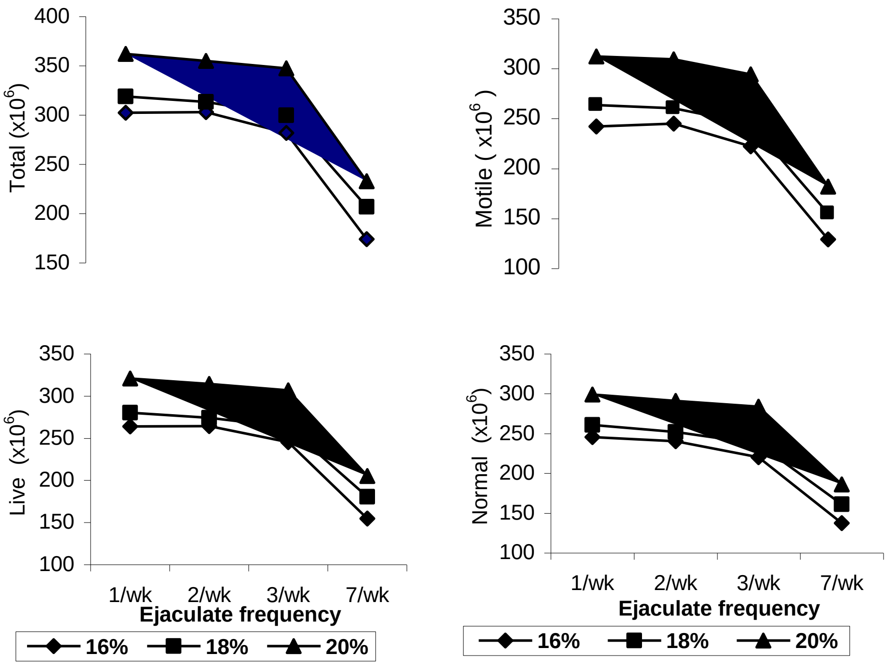

Figure 2: Effect of frequency of ejaculation and dietary crude protein level on sperm counts per ejaculate of NZW rabbit bucks.

Effect of dietary crude protein level on blood parameters:

Data in Table (5) revealed that concentrations of total protein, albumin as well as albumin to globulin ratio were significantly (P<0.05) increased in blood plasma of rabbit bucks fed the higher-CP diets (18 or 20% CP) in comparison with their control group fed on 16%-CP diet.

However, concentrations of globulin, creatinine and activity of AST and ALT were not significantly affected by dietary CP level. In general, means of all blood parameters obtained were within the normal physiological range reported for NZW rabbits, as mentioned by Ismail (1999), Abd El- Khalek et al. (2000b) and Ashour (2001), independently of the effect of dietary treatments.

The obtained results showed that, the treatments did not affect the functions of liver and kidneys of rabbits; as evidenced by the absence of significant variations in the activities of plasma ALT and AST, or in the level of plasma creatinine among the experimental groups of rabbit bucks (Table 5).

Concerning the concentration of plasma testosterone, there was a significant (P<0.05) increase in its concentration with increasing dietary CP level in diets of bucks. It increased by 30.36 and 88.86% with increasing the level of dietary CP from 16 to18 or 20%, respectively (Table 5).

Table 5: Effect of dietary crude protein level on some blood parameters of NZW rabbit bucks.

Parameter	**Dietary crude protein level**		
	16%	**18%**	**20%**
Total proteins, g/dl	7.12 ± 0.13^{c}	7.54 ± 0.03^{b}	7.96 ± 0.14^{a}
Albumin (AL) , g/dl	3.71 ± 0.09^{c}	4.20 ± 0.03^{b}	4.59 ± 0.03^{a}
Globulin (GL) , g/dl	3.41 ± 0.08	3.34 ± 0.03	3.37 ± 0.15
AL/GL ratio	1.09 ± 0.04^{c}	1.26 ± 0.02^{b}	1.36 ± 0.05^{a}
Creatinine, g/dl	1.76 ± 0.007	1.75 ± 0.009	1.73 ± 0.014
AST, U/dl	62.13 ± 0.08	62.07 ± 0.09	61.92 ± 0.19
ALT, U/dl	28.83 ± 0.04	28.75 ± 0.09	28.85 ± 0.01
Testosterone, ng/ml	3.59 ± 0.18^{c}	4.68 ± 0.17^{b}	6.78 ± 0.15^{a}

$^{a-c}$: Means in the same row having different superscripts are significantly different at $P\leq0.05$.

Regardless of the effect of dietary treatments, testosterone concentrations obtained in this study are in agreement with those reported on NZW rabbits by El-Gaafary (1994); Tawfeek *et al.* (1994) and Castro *et al.* (2002). It is of interest to note that the improvement in quality and volume of semen as affected by increasing the level of dietary CP was connected with increased secretion of testosterone. The impact of increasing dietary CP level on growth in general (Omole, 1982 and Ismail, 1999), and in turn on growth of the internal organs may led to an increased secretion of testosterone. In this respect, Boiti *et al.* (1992) found a positive correlation between weights of body, testis and seminal vesicles in rabbits. Testosterone may increase the steroidogenic activity of the interstitial cells which may improve semen quality (Schanbacher and Lunstra, 1977 and Echternkamp and Lunstra, 1984)

CONCLUSION

It can be concluded that; under summer conditions in Egypt, NZW rabbit bucks can be used for mating or semen collection 3 times per week with no detrimental effects on semen characteristics, and fed on a 20%-CP diet in order to get semen of a good quality.

REFERENCES

Abd El-Hady; Salwa B. (2001). Effect of dietary protein level on the productive and reproductive performance of rabbits. Egyptian Journal of Rabbit Science, 11 (2): 167 – 177.

Abd El-Khalek, A.E.; S.A. Darwish; A.F. Mehrez and M.B. Aboul- Ela (2000a). Relationships between sexual desire and testicular, scrotal and penile morpho-histometrics in Egyptian buffalo bulls. J. Agric. Sci., Mansoura Univ., 25 (8):4913-4923.

Abd El-Khalek, A.E.; A.I. Abd El-Ghani; S.A. El-Ayouty and M.A. Shatifa (2000b). Some blood constituents and characteristics of gastrointestinal tract in rabbits as affected by feeding silage. Egyptian Journal of Animal Production, 37(2):1-13.

Abd El-Monem, U. M. and M. S. Ayyat (2002). Effect of dietary protein level on growing and mature rabbits performance, under summer conditions of Egypt. In: Proceedings of the 3rd Scientific Conference on Rabbit Production in Hot Climates, 8-11 Oct Hurghada, Egypt : 481-494.

Ahmed, Soad, S.; M. I. Abd El-Rahim and Hoda F. Salem (1991). Semen characteristics, blood constituents, testicular histology of buck and reproductive performance of does of NZW rabbits fed barley grains as substitute for the pelleted complete ration. Egyptian Journal of Rabbit Science, 1 (1) : 73 – 86.

Amann, R. P. (1966). Effects of ejaculation frequency and breed on semen characteristics and sperm output of rabbits. J. Reprod. Fert.(11): 291.

Ames, D. R.; D. R. Brink and C. D. Williams (1980). Adjusted protein in feedlot ration during thermal stress. Journal of Animal Science, (50): 1-11.

Ashour, G. (2001). Blood metabolites, minerals and hormones in relation to growth of rabbits. Egyptian Journal of Rabbit Science, 11(1): 73-91.

Boiti, C.; G.M. Chiericato; U. Filotto and C. Canali (1992). Effects of high environmental temperature on plasma testosterone, cortisol, T3 and T4 levels in the growing rabbit. Journal Applied Rabbit Research, (15): 447-455.

Castro, A.C.S.; W.E. Berndtson and F.M. Cardoso (2002). Plasma and testicular testosterone levels, volume density and number of leydig cells and spermatogenic efficiency of rabbits. Brazilian Journal of Medical and Biological Research (35): 493-498.

Chap, Z. and E. Bedrak (1983). Interrelationship between pituitary- testicular axis activity and raised environmental temperature in the rat. Journal of Endocrinology, (97): 193-197.

Cheeke, P. R. (1987). Rabbit Feeding and Nutrition, Academic Press, Inc.,Orlando, Florida, U.S.A.

Chou, J. P.; L. Y. Chuan and C. Hen-Chao (1974). Effect of heating on rabbits spermatogenesis. Chinese Medical Journal, (6):365.

Damber, J. E.; A. Bergh and P. 0. Janson (1980). Leydig cell function and morphology in the rat testis after exposure to heat. Andrologia, (12): 12- 16.

Davis, J. R.; G. A. Langford and P. J. Kirby (1970). The Testicular Capsule in the Testis. Academic press, New York, pp 307.

Echternkamp, S.E. and D.D. Lunstra (1984). Relationship between LH and testicular development in progesterone-implanted prepubertal ram lambs. Journal of Animal Science, (59): 441-453.

El-Sherry, M. I.; S. M. Nassar and S. M. El-Naggar (1980). Experimental study of summer stress in rabbits. 1. The description and qualification of the spermatogenic cell cycle in normal Baladi rabbit. Assiut Veterinary Medical Journal, (7):2-11.

El-Gaafary, M.N. (1994). The effects of Gonadotropin releasing hormone on reproductive performance of low fertility male rabbits. In: Proceedings of the1st Scientific Conference on Rabbit Production in Hot Climates, 8-9 Sept. Cairo, Egypt, pp. 313-320.

El-Harrairy, M. A. (1981). Studies on the sexual behaviour of farm animals: semen characteristics and testes histological structure in two breeds of rabbits. M.Sc. Thesis, Mansoura University, Mansoura, Egypt.

Fonnesbeck, P.V. ; L.E. Harris and L.C. Kearl (1974). Digestion of plant cell walls by animals. J. Anim. Sci., 39:182-188.

Hammond J.; J. C. Bowman and J. J. Robinson (1983). Hammond's Farm Animals. .5th Edition, Bother and Tanner Ltd, Great Britain.

Hemid, A. A. and E. E. Tharwat (1995). Effect of dietary protein level on semen characteristics and fertility of New Zealand White rabbit bucks. Egyptian Journal of Rabbit Science, 5 (2):117-123.

Hiedbrink, G.; H. L. Enos and G. E. Seideljr (1980). Artificial insemination in commercial rabbit production. Colorado State Univ, Bulletin, 5735, 1-6.
Igboeli, G. and A. M. Rakha (1971). Major cations in the semen of Angoni (Short-Horn Zebu) bulls. J. Reprod. Fert.; 24: 377.
Ismail, F.S.A. (1999). Is there any beneficial effect to increase dietary protein for growing rabbits under high temperature conditions? Egyptian Journal of Rabbit Science, 9(1): 87-103.
Lebas, F. (1980). Les recherches sur l' alimentation du lapin; Evolution au cours des 20 dernieres annees et perspectives d' avenir. In: Proceedings of the 2nd World Rabbits Congress, vol.2, April 15-18, p. 17.
Lebas, F.; P. Coudert; R. Rouvier and H. De Rochambeau (1986). The Rabbit Husbandry, Health and Production. Food and Agriculture Organization of the United Nation, Rome, Animal Production and Health Series No. 21.
Louis, G. F.; A. J. Lewis; W. C. Weldon; P. S. Miller; R.J. Kittok and W. W. Stroup, (1994). The effect of protein intake on boar libido, semen characteristics and plasma hormone concentration. Journal of Animal Science, 72: 2051-2060.
Mann, T., (1964). In: The Biochemistry of Semen and of the Male Reproductive Tract. Methuen and Co. Ltd., London.
Mansour, H. ; A. Hazzaa; A. Abdel-Raheim and A. Eidaroos (1989). Reproductive capacity of buffalo bulls 1. Scrotal measurements and their relation to age, libido and semen characteristics in sexually mature buffalo bulls. In: Proceedings of the First Annual Congress, pp. 74–83, ESARF and Fac. Vet., Alex. Univ., Edfina, 24-26 Juanuary.
Miros, V. V. and I. S. Vakulenko (1979). Mating regime of male rabbit on commercial farms. Animal Breeding Abstracts, 48: 321.
Morstin, J. and T. Jasiorowski (1977). Characters of testes, epididymes and semen obtained by electroejaculation as criteria of evaluating bulls, and selecting sires for fertility. Animal Breeding Abstracts, 45: 1871.
Nalbandov, A. V. (1970). Reproductive Physiology. "2nd Edition" Taraporovala Sons and Company Private Ltd., Bombay.
National Research Council; NRC (1977). Nutrient Requirements of Rabbits.2nd revised ed., National Academy of Sciences, DC, USA.
Nichelmann, M. (1972). Besonderheiten der physikalischen temperaturregulation beim kaninchen. Archiv Fûr Exp. Veterinãrmedizin, (27): 782-789.
Nizza, A.; C. Di Meo and S. Taranto (2003). Effect of collection rhythms and season on rabbit semen production. Reprod. Domest. Anim., 38 (6) 436-439.
Omole, T.A. (1977). Influence of levels of dietary protein and supplementary copper on the performance of growing rabbits. British Veterinary Journal, 133:593-599.
Omole, T.A. (1982). The effect of level of dietary protein on growth and reproductive performance in rabbits. Journal Applied Rabbit Research,5:83-88.
Pagano Toscano, G.; G. Benatti and I. Zoccarato (1986). Comparison of crude fiber and the Van Soest detergent methods for fiber determination in rabbit feeds. J. Appl. Rabbit Res., 9:69-75.
Rafai P.; Z. Papp and K. Széchy (1972).ل Tenyész és ◌̊jsz◌̊l◌́tt hybrid ny◌̊lak oxygén fogyasztلsلnak vizsgلlata. *Baromfiipar,* 19 (9): 392- 399.
Salisbury, G. W.; N. L. Van Demark and J. R. Lodge (1978). In: Physiology of Reproduction and Artificial Insemenation of Cattle. Freeman, and Co., San Franc.

Schanabacher, B.D. and D.D. Lunstra (1977). Acute and chronic effects of gonadotropin releasing hormone on reproductive characteristics of rams during the non breeding season. Journal of Animal Science, (44): 650-655.

Statistical Graphics Corporation (1991). Statgraphics Program, Version 5.0 Reference Manual. Rockville, M.D.: Statistical Graphics Corporation.

Tawfeek, M.I.; M.N. El-Gaafary and M.Y. Abdel- Hamid (1994). Effect of testosterone injection on pre- and post-sexual maturity in male rabbits. In: Proceedings of the 1st Scientific Conference on Rabbit Production in Hot Climates, 8-9 Sept. Cairo, Egypt,pp. 367-375.

تأثير مستوى بروتين الغذاء وعدد مرات الجمع على جودة السائل المنوي لذكور أرانب النيوزيلندي الأبيض تحت ظروف فصل الصيف في جمهورية مصر العربية

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أجريت هذه الدراسة لبحث تأثير مستوى بروتين الغذاء (١٦أو١٨أو٢٠%) وعدد مرات الجمع (١أو٢أو٣أو٧مرات أسبوعيا) على الصفات الطبيعية للسائل المنوي لذكور أرانب النيوزيلندي الأبيض خلال فصل الصيف في جمهورية مصر العربية. تم تقييم جودة السائل المنوي باستخدام حجم القذفة وتركيز الحيوانات المنوية والنسب المئوية لكل من الحركة الكلية والتقدمية لها وكذلك النسب المئوية لكل من الحيوانات المنوية الشاذة والميتة وتم حساب أعداد كل من الحيوانات المنوية الكلية والطبيعية والحية والمتحركة. تم تقدير محتويات بلازما الدم من كل من البروتين الكلي والألبيومين وهرمون التستوستيرون والكرياتنين وكذلك نشاط إنزيمي ألانين أمينوترانسفيريز وأسبارتيت أمينوترانسفيريز كما تم حساب نسبة الجلوبيولين ونسبة الألبيومين:الجلوبيولين.

أوضحت النتائج المتحصل عليها ارتفاعا معنويا في حجم القذفة وتركيز الحيوانات المنوية وفي النسب المئوية لكل من الحركة الكلية والتقدمية لها وكذلك في أعداد كل من الحيوانات المنوية الكلية والطبيعية والحية والمتحركة بينما انخفضت النسب المئوية لكل من الحيوانات المنوية الشاذة والميتة نتيجة رفع مستوى بروتين الغذاء حتى ٢٠%. أدى رفع مستوى بروتين الغذاء من ١٦ إلى ١٨% إلى حدوث زيادة معنوية في النسبة المئوية للحركة الكلية وانخفاضا معنويا في النسبة المئوية للحيوانات المنوية الميتة بينما لم تتأثر باقي الصفات الطبيعية للسائل المنوي معنوياً. وفيما يتعلق بتأثير عدد مرات جمع السائل المنوي لوحظ انخفاضا معنويا في كل من حجم القذفة وتركيز الحيوانات المنوية وفي النسب المئوية لكل من الحركة الكلية والتقدمية لها وكذلك في أعداد كل من الحيوانات المنوية الكلية والطبيعية والحية والمتحركة بينما ازدادت النسبة المئوية للحيوانات المنوية الشاذة زيادة معنوية عندما تم جمع السائل المنوي ٧مرات أسبوعيا. وبالنسبة لتأثير مستوى بروتين الغذاء على قياسات الدم لم يكن هناك فروقا معنوية في تركيزات كل من الجلوبيولين والكرياتنين أو نشاط إنزيمي ألانين أمينوترانسفيريز وأسبارتيت أمينوترانسفيريز بينما لوحظ ارتفاعا معنويا في محتوى بلازما الدم من كل من البروتين الكلي والألبيومين وهرمون التستوستيرون عند رفع مستوى بروتين الغذاء من ١٦ الى١٨أو٢٠%. كان التفاعل بين مستوى بروتين الغذاء وعدد مرات جمع السائل المنوي غي معنويا بالنسبة لكل الصفات المدروسة.

مما سبق يمكن استنتاج أنه تحت ظروف فصل الصيف في جمهورية مصر العربية يمكن استخدام ذكور أرانب النيوزيلندي الأبيض للتزاوج الطبيعي أو لجمع السائل المنوي ثلاث مرات أسبوعيا دون حدوث تأثيرات ضارة على خصائص السائل المنوي مع تغذيتها على عليقة تحتوي على ٢٠% بروتين للحصول على سائل منوي ذو جودة عالية.

Table 4: Effect of interaction of dietary protein level by frequency of ejaculation per week on semen quality of rabbits

Ejaculates/ wk	Semen characteristics									
	Ejaculate volume (ml)	Sperm concentration ($\times 10^6$/ml)	Mass motility (%)	Progressive motility (%)	Sperm abnormality (%)	Dead sperm (%)	Total sperm output	Motile sperms	Live sperms	Normal sperms
	16%CP									
1	1.08±0.05	280.33±7.82	77.80±0.86	79.80±1.07	18.80±1.51	12.60±0.80	302.29±13.05	241.30±11.11	264.06±10.78	245.41±11.18
2	1.08±0.04	280.83±6.45	77.40±1.27	80.40±1.52	20.65±1.09	12.85±0.79	302.77±11.59	243.98±11.76	264.12±10.99	240.43±9.99
3	1.02±0.03	276.22±3.89	75.20±0.91	78.40±0.77	22.10±0.74	13.03±0.36	281.94±9.02	221.36±7.94	245.31±8.19	220.23±8.46
7	0.72±0.05	234.33±6.95	62.37±2.45	65.51±2.37	24.10±0.55	13.63±.0.25	178.05±15.84	128.06±14.13	154.55±14.02	137.23±12.91
Ejaculates/wk	**18%CP**									
1	1.12±0.05	285.00±7.28	80.60±1.66	82.40±1.60	18.20±1.27	12.00±0.77	318.68±14.67	262.78±13.98	280.21±11.72	260.70±12.99
2	1.10±0.05	285.33±4.13	80.70±1.21	82.80±1.06	19.55±0.96	12.40±0.68	313.35±14.66	259.36±12.15	274.06±11.98	252.06±12.04
3	1.06±0.03	282.45±2.91	79.20±0.84	81.13±0.94	21.07±0.78	12.27±0.46	299.73±10.14	243.69±9.77	262.94±9.00	236.88±8.97
7	0.81±0.04	243.62±6.82	66.34±2.45	69.34±2.33	23.07±0.56	13. 11±0.25	206.84±15.97	154.01±15.15	180.44±14.18	161.19±13.24
Ejaculates/wk	**20%CP**									
1	1.23±0.03	294.67±7.66	84.40±1.21	86.00±1.30	17.40±1.05	11.40±0.85	361.96±9.83	311.14±8.59	320.83±10.18	299.01±9.35
2	1.21±0.04	294.00±4.46	84.80±1.58	86.70±1.54	17.95±0.87	11.35±0.81	355.00±12.24	308.25±13.36	314.26±9.89	290.99±9.68
3	1.20±0.03	290.22±3.11	82.07±0.85	84.33±0.83	18.37±0.67	11.63±0.33	347.36±10.62	293.21±9.99	360.89±9.35	283.84±9.70
7	0.89±0.04	251.00±6.87	70.14±2.28	72.91±2.18	21.20±0.55	12.27±0.21	232.84±16.85	180.93±16.84	205.02±15.10	186.06±14.36

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