

# The period of gestation of rabbits and its fertility connection

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**Abstract.** The work researched the effect of multiple pregnancy on the gestation period of a female rabbit. To research the reproductive characteristics of female rabbits, physiologically mature live weight of at least 3 kg was selected. The reproductive characteristics of female rabbits were researched during three births. In the experiment, we used rabbit breeds such as New Zealand white and white giants, which were mated according to the scheme NZBxNZB and NZBxWG. The first litter of rabbits was analyzed as a control, and the second and third litters were analyzed as experimental groups. In the experiment, the polygamy ratio was 5:1. Female rabbits were mated in the morning and evening. The day of mating and the day of birth were recorded. The results obtained show that the length of the gestation period in rabbits is directly affected by the number of offspring. It has been established that the gestation period lasts longer in rabbits with a small number of offspring compared to rabbits with a large number of offspring.

## 1 Introduction

Rabbits are polyethnic animals by nature, and the number of developing offspring will directly depend on the conditions of feeding and living. Rabbits that are raised in the North will have fewer births compared to rabbits that are raised in the South. Also, embryo resorption (absorption) occurs when pregnant rabbits are fed in excessive amounts, and this condition leads to the death of offspring from 15 to 100 percent [1].

With increasing age, rabbits of the New Zealand White breed also experience an increase in fertility. The minimum amount of fertility is in baby rabbits which became pregnant for the first time and is 7.1-7.8 rabbit cubs. On the other hand, the highest fertility is 8.2 – 9.2 rabbit cubs, and, as stated, this figure persists until 4-5 births. Then it starts to decrease [2].

In rabbits, gestation period can last from 28 to 34 days. Offspring that are born from time to time can be born every other day and very rarely after 10 days. Gestation period in rabbits can last 29-30 days at a frequency of 10-11 offspring, last 31 days at a frequency of 9-10 offspring, last 32 days at a frequency of 8-9 offspring, last 33 days at a frequency of 6-

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7 offspring and last up to 34 days at a frequency of 4-5 offspring. In addition, the duration of the rabbit's gestation period also affects the live weight of the offspring being bred. Rabbits born at the age of 31 days have an average live weight of 57 g, while those born at the age of 33 days have an average weight of 60-61 g. [3].

The birth of a rabbit usually occurs in the evening and rarely occurs during the daytime. The delivery process can take 10-20 minutes, and sometimes it can take up to 50-60 minutes. The process of birth is relatively simple, without human assistance. The female rabbit licks and wraps the new born offspring in fluff. After giving birth, the female rabbit's body loses a lot of fluid and she feels thirsty. In the absence of sufficient water, it can drink her own urine, and even devour her newborn offspring (phytophagy) [4].

## 2 Materials and methods

In order to study the nature of mating of mother rabbits, a physiological study of an adult individual was conducted during three births of female rabbits with a live weight of at least 3 kg. At the same time, birth control of female rabbits was studied for the first time mated with New Zealand White breed and New Zealand White Giant breed, and for the second and third time the offspring were studied as an experimental group. Also, in each litter, the mating behavior of purebred and crossbred female rabbits was compared. In the experiment, polygamy was accepted in a ratio of 5:1. Female rabbits were mated in the morning and again in the evening. The days of mating and birth process have been recorded. The control of the rabbit's pregnancy was carried out by careful palpation of the abdomen on the 13th-15th day, to make sure the presence or absence of rabbit embryos, which are the size of walnuts, was determined by gentle palpation in the abdomen. When it was not possible to determine the pregnancy using this method, the behavior of the female rabbit was observed when it was introduced into the cage of the male rabbit. (During pregnancy, the female rabbit makes a peculiar moaning sound by taking itself into a corner). The fertility of a rabbit was estimated by the number of offspring born in the nest [5], evaluated in accordance with Attachments 5, 6; maternal quality - the level of filling the nest with fluff in the last days of the pregnancy period [6], with signs of care for the new born in the cage until they are separated from the cage without injury; care of offspring – not to scatter new born rabbit cubs, was calculated on the basis of self-breastfeeding. At all births, the female rabbits were kept in the cage with their new born rabbit cubs for one month, and the rabbit cubs were separated from the mother rabbit simultaneously. Separated female rabbits were given two to three weeks of rest, depending on their general condition.

## 3 Results and Discussion

The results obtained in the research of the pregnancy period and its relationship to actual fertility are presented in Table 1.

In this case, the pregnant female rabbits in the second and third litters, mated with purebred white male rabbit, were taken as an experimental group and compared with the same cage in the first litter control group.

In the process of mating first litter of female rabbits, which were mated with NZW-New Zealand White breed x NZW-New Zealand White breed, the gestation period lasted  $31.8 \pm 0.2$  days, and the fertility was  $6.0 \pm 0.4$  offspring (lim 5-7).

In the period of second birth of female rabbits, the pregnancy period lasted  $30.2 \pm 0.4$  days, and the fertility corresponded  $9.0 \pm 0.9$  offspring (limit 7-11).  $3.0 \pm 0.98$  ( $P < 0.05$ ) more offspring were obtained in the second birth than in the first birth, and the pregnancy period

was shortened by  $1.6 \pm 0.44$  days ( $P < 0.05$ ). By the third birth period, the fertility of female rabbits was  $9.2 \pm 0.8$  offspring (Lim 8-12).  $3.2 \pm 0.89$  ( $P < 0.05$ ) more offspring were obtained in this birth than in the first birth. But the duration of litter was shorter by  $2.0 \pm 0.42$  ( $P < 0.01$ ) days, respectively. The pregnancy period in the first litter of NZW-New Zealand White breed x WG-New Zealand Giant breed mated rabbits was  $31.6 \pm 0.24$  days. The fertility was  $6.2 \pm 0.37$  offspring (lim 5-7).

**Table 1.** Continuity of the gestation period corresponding to fertility in rabbits.

Crossbreeding	Number of parturition	♀ x ♂	Fertility	lim	Pregnancy, day
Homogeneous	I	NZW x NZW	$6.0 \pm 0.4$	5-7	$31.8 \pm 0.2$
	II	NZW x NZW	$9.0 \pm 0.9^*$	7-11	$30.2 \pm 0.4^*$
	III	NZW x NZW	$9.2 \pm 0.8^*$	8-12	$29.8 \pm 0.37^{**}$
Heterogeneous	I	NZW x WG	$6.2 \pm 0.37$	5-7	$31.6 \pm 0.24$
	II	NZW x WG	$8.4 \pm 0.24^{**}$	8-9	$30.6 \pm 0.24^*$
	III	NZW x WG	$9.0 \pm 0.32^{**}$	7-10	$30.0 \pm 0.32^*$

\*  $P < 0.05$ ; \*\*  $P < 0.01$ ; NZW-New Zealand White breed, WG-White Giant breed.

It was  $0.2 \pm 0.54$  offspring ( $P > 0.05$ ) more than the female rabbits mated in NZW-New Zealand White breed x WG-New Zealand White breed. In rabbits that gave birth for the second time, the pregnancy period lasted  $30.6 \pm 0.24$  days, and the number of offspring was  $8.4 \pm 0.24$  (lim 8-9). The number of offspring obtained was  $2.2 \pm 0.44$  ( $P < 0.01$ ) more than the first birth, and the duration of pregnancy was shorter by  $1.0 \pm 0.34$  ( $P < 0.05$ ) days. The number of offspring obtained from rabbits during the third fertile period averaged  $9.0 \pm 0.32$  offspring (Lim 7-10), and pregnancy lasted  $30.0 \pm 0.32$  days, respectively. Compared to the control group,  $2.8 \pm 0.49$  ( $P < 0.01$ ) more offspring were obtained in this litter, and the duration of pregnancy was  $1.6 \pm 0.4$  ( $P < 0.05$ ) days shorter. In neither case was there a significant difference in the duration of fertile and pregnancy periods between rabbits mated in either form.

As for the increase in the number of offspring obtained during the period from the first to the third birth, positive  $+0.63$  and  $+0.84$  were found in female rabbits (in terms of the nature of mating), while negative  $-0.95$  and  $-0.87$  correlations were found between the corresponding mating season.

The obtained results show that the duration of the pregnancy period in rabbits is directly affected by the number of offspring. The pregnancy period was longer in rabbits with low sputum compared to rabbits with high sputum. Also, it was observed that the fertility of rabbits, the percentage of live rabbits in the cage increased in the next litter compared to the first litter. This can be clearly seen in the example of Table 2.

**Table 2.** Multiple births for the doe.

Crossbreeding	Number of parturition	♀ x ♂	Kindling, n				
			in all	living	%	lifeless	%
Homogeneous	I	NZW x NZW	30	22	73.3	8	26.7
	II	NZW x NZW	45	41	91.6	4	8.9
	III	NZW x NZW	46	46	100	-	0
Heterogeneous	I	NZW x WG	31	23	74.2	8	25.8
	II	NZW x WG	42	39	92.9	3	7.1
	III	NZW x WG	45	45	100	-	0

Analysis of this chart shows that a total of 30 offspring were born from purebred New Zealand White breed in the first litter. 22 offspring of these or 73.3% were alive, and 8 heads or 26.7% were dead. 30 offspring were obtained from female rabbits mated with New Zealand White Giant rabbits, and 23 heads or 74.2% were alive, 8 heads or 25.8% were dead. It was found that not all of the dead rabbit babies in both cages were born to the

mother in this order. In particular, it was observed that in a cage of female rabbits mated with a male rabbit of a New Zealand White Giant breed, 5 rabbits died as a result of mechanical and external side effects (when the female rabbit bit the body of offspring while separating her baby from the navel, it was crushed under her feet, some of them gave birth outside the cage).

A total of 45 rabbits were born in the cage of pure mated female rabbits during the second order digital breeding process, 41 or 91.1% of them were alive, 4 or 8.9% were dead. A total of 42 rabbits were born in a cage of female rabbits mated with a New Zealand White Giant rabbit breed, there were 39 live rabbit cubs or 92.9%, and 3 dead rabbits or 7.1%. Rabbits that died as a result of mechanical impact in this breed were observed only in cages of pure mated rabbits and made up 1 head.

The number of offspring in the nests of the female rabbit that gave birth for the third time was 46 and 45, respectively, and 16 and 14 more generations were obtained compared to the one that gave birth for the first time. In this litter, there was no case of death of rabbit offspring due to natural or mechanical effects in both nests.

The research also examined the maternal behavior of female rabbits during every three births. The study of maternal behavior in rabbits began in the 1950s of the last century and is being studied to this day. [7-8].

The mechanisms of influencing the maternal behavior of rabbits during the lactation period on the growth and development of offspring in the nest have been studied by foreign scientists [9-11].

The study of the manifestation of maternal qualities in rabbits is considered important not only for personal breeding farms, but also for the industry-wide rabbit breeding network. Maternal qualities and viability of baby rabbits in the nest are important markers in the selection of rabbits [12].

According to the data of [13], the quality of motherhood is understood as the ability of a rabbit to give birth, to breastfeed and raise its offspring 100%.

Because the genotypes of wild and domesticated rabbits are 99% identical, the expression of maternal behavior is almost indistinguishable between wild and domesticated rabbits [14-15].

In the study, domesticated rabbits tried to dig a cage by spreading the litter 6-8 days before giving birth. 1-2 days before giving birth, they carry food stalks to the nest. Then it plucked the fluffy wool from the chest and abdomen and formed a nest.

It is important that the nest is filled with fluffy wool. Because rabbit babies are born with their eyes closed, without wool and very thin, the fluff preserves body heat and ensures normal thermoregulation, therefore, it also affects storage [16].

Some female rabbits did not fill the nest with fluffy wool at all, and some continued to fill it three days after giving birth. Filling the nest with fluffy wool depends on the "maternal experience" of the rabbit.

In the research, the maternal quality of female rabbits was evaluated according to the scale recommended by [6], the instinct to prepare the nest with fluffy wool and the condition of the offspring born in the nest (Table 3).

**Table 3.** Maternal quality assessment scale.

No.	Indicator	Point
1	The nest is not formed	1
2	The nest is formed, but there is no fluffy wool	2
3	The nest is formed and has a small amount of fluffy wool	3
4	The nest is formed and 1/2 has fluffy wool	4
5	The nest is formed and completely covered with fluffy wool	5
Extra points		+1

The analysis of this table shows that in evaluating the quality of motherhood, the main attention is paid to the level of fluffiness of the nest. The more the mother rabbit shapes the nest and covers the surface with fluffy wool, the higher the score for maternal quality.

The results of evaluation of maternal quality of female rabbits during three births in the study are presented in Table 4. The analysis of the table shows that 40% of purebred mated female rabbits during the first breeding period formed a nest, but did not cover it with downy wool, and the weight of rabbits rated with 4 and 3 points was equal to 20%. In this litter, the share of female rabbits that did not form a nest at all was 20 percent. Female rabbits with a score of 5 were not observed. In general, the maternal quality of rabbits was evaluated with an average of  $2.4 \pm 0.5$  points.

**Table 4.** Representation of maternal quality of female rabbits during three births.

Crossbreeding		Number of parturition					
		I		II		III	
	♀ x ♂	Lim	$\bar{X} \pm S_x$	Lim	$\bar{X} \pm S_x$	Lim	$\bar{X} \pm S_x$
Homogeneous	NZW x NZW	1-4	$2.4 \pm 0.5$	3-5	$4.2 \pm 0.4$	4-5	$4.8 \pm 0.2^{**}$
Heterogeneous	NZW x WG	2-3	$2.4 \pm 0.2$	3-5	$4.2 \pm 0.4$	4-5	$4.8 \pm 0.2^{**}$

\*\* $P < 0.01$

The average value of the total score in female rabbits mated with a male New Zealand White Giant rabbit breed was  $2.4 \pm 0.2$ , the percentage of rabbits with a score of 2 was 60%, and the share of rabbits with a score of 3 was 40%. There were no female rabbits rated 4 and 5 for maternal quality.

Maternal quality was scored higher when the mother rabbits gave birth to the second litter compared to the first litter. In particular, during the second birth period, there were no mother rabbits that did not shape the nest at all, or did not shape and cover it with fluffy wool. Maternal quality of purebred female rabbits mated with male white rabbits was estimated with  $4.2 \pm 0.4$  points on average. There are 3 female rabbits in both groups; 4; Evaluated in the range of 5 points, their share is 20, respectively; 40; It was 40 percent.



**Fig. 1.** Type of rabbit nest by 3 and 5 points.

Rabbits that have given birth for the third time are evaluated by maternal quality 1; 2; 3 points were not given at all. Female rabbits of this breed were evaluated only with 4 and 5 points, and their total share in both groups was 20%, 80%, respectively. In this litter, maternal quality was given an average of  $4.8 \pm 0.2$  points, and rabbits of both groups were

rated higher by  $2.4 \pm 0.5$  and  $2.4 \pm 0.3$  points ( $P < 0.01$ ) compared to the first litter. No reliable difference between the groups was found when comparing the second birth.

The period of separation of rabbit baby from the nest is a responsible task. Improper storage and feeding of young rabbits separated from the nest early leads to the occurrence of gastrointestinal diseases and the death of many young generations. There is no clear opinion on the question of when to separate baby rabbits from the nest. Many factors are taken into account when separating from a nest. These include: the complete supply of feed to the rabbits, the number of cages kept, the period of realization of the rabbits and the period of reproduction from the mother rabbits, and other factors.

Rabbit cubs are blindfolded until they are ten days old. From the age of 19-20 days, it leaves the nest and begins to eat food pellets independently. If the female rabbit is not nursing enough, and the nest is too hot, or the temperature is too low, the baby rabbits may leave the nest early.

In order not to have a negative impact on the growth and development of rabbit babies, it is noted in sources that the period of separation from the nest should not be earlier than 25-28 days [17].

According to [18], rabbit babies can be separated from the nest at the age of 28-45 days.

In the research, the rabbits were separated from their mothers when they were one month old, using the method of simultaneous separation. The survival rate of rabbits in the nest was calculated by calculating the milk yield of female rabbits and the percentage of the number of rabbits present at the time of weaning compared to the initial number. The survival of the offspring obtained from the female rabbits during the three births of the study until weaning is reflected in Table 5 and Figures 2 and 3.

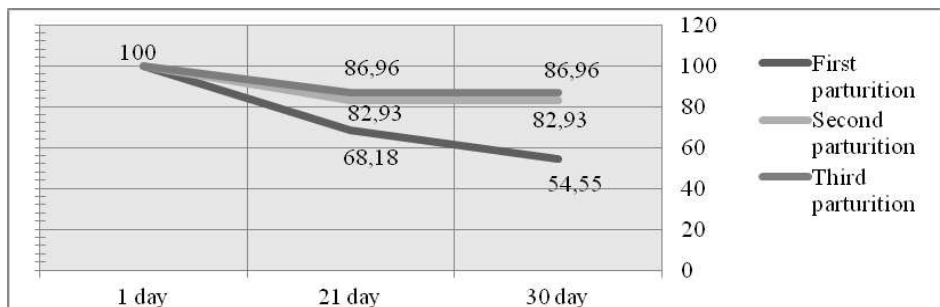
The analysis of this table shows that an average of  $4.4 \pm 0.51$  rabbits left in the nest of New Zealand White breed that gave birth for the first time,  $3.0 \pm 0.71$  or 68.18 percent under the age of three weeks,  $2.4 \pm 0$  under the age of one month. 51 heads or 54.55 percent of offspring were saved. A similar situation was observed in female rabbits mated with male white rabbits. In particular,  $4.6 \pm 0.24$  rabbit babies were left in the nest with the mother rabbit,  $3.0 \pm 0.45$  rabbits or 65.22 percent under the age of three weeks,  $2.4 \pm 0.24$  or 52.17 percent under the age of one New Zealand White Giant generation survived.

**Table 5.** The safety of rabbits to a junction from the wean, heads.

Crossbreeding	♀ x ♂	Number of parturition	Age					
			1 day	lim	21 day	lim	30 day	lim
			$\bar{X} \pm S_x$	n	$\bar{X} \pm S_x$	n	$\bar{X} \pm S_x$	n
Gomogen	NZW x NZW	I	$4.4 \pm 0.51$	3-6	$3.0 \pm 0.71$	1-5	$2.4 \pm 0.51$	1-4
	NZW x NZW	II	$8.2 \pm 1.01$	5-11	$6.8 \pm 1.07$	5-10	$6.8 \pm 1.07$	5-10
	NZW x NZW	III	$9.2 \pm 0.80$	8-12	$8.0 \pm 0.55$	7-10	$8.0 \pm 0.55$	7-10
Heterogeneous	NZW x WG	I	$4.6 \pm 0.24$	4-5	$3.0 \pm 0.45$	2-4	$2.4 \pm 0.24$	2-3
	NZW x WG	II	$7.8 \pm 0.20$	7-8	$6.2 \pm 0.37$	5-7	$6.2 \pm 0.37$	5-7
	NZW x WG	III	$9.0 \pm 0.32$	8-10	$7.8 \pm 0.37$	7-9	$7.8 \pm 0.37$	7-9

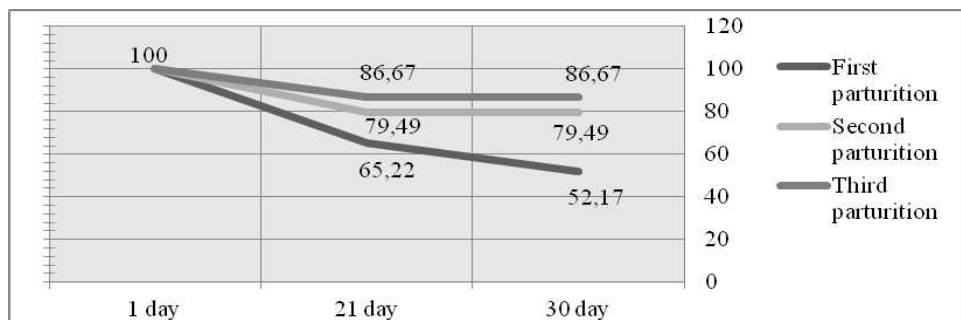
During the first litter, almost half of the rabbits in the nest did not survive until weaned. Such a situation can be explained by insufficient manifestation of "maternal experience" and maternal quality in rabbits.





**Fig. 2.** The safety of purebred rabbits to a junction from the wean, %.

On average,  $8.2 \pm 1.01$  rabbit cubs were left in the nest of purebred mother rabbits giving birth for the second time.  $7.8 \pm 0.20$  rabbit cubs were left in the nest from the hybrid generations, and their retention rate was  $6.2 \pm 0.37$  or 79.49 percent at the age of twenty-one and thirty days.



**Fig. 3.** The safety of mongrel rabbits to a junction from the wean, %.

The highest preservation of baby rabbits was observed in the nest of female rabbits, which gave birth for the third time. In this case, an average of  $9.2 \pm 0.80$  young rabbits were left in the nest of purebred mated rabbits. At the age of three weeks and up to one year of age, the rabbit survival rate was  $8.0 \pm 0.55$  heads or 86.96 percent, respectively. In cross-paired female rabbits, it was found that  $9.0 \pm 0.32$  offspring kept in the nest until three weeks of age and one year of age were  $7.8 \pm 0.37$  or 86.67 percent.

The higher retention of rabbits in the nest during three litters can be explained by the fact that the mother rabbits scored high on maternal quality and had "maternal experience" during the litter.

## 4 Conclusion

From the obtained results, it can be concluded that the duration of the epregnancy period in rabbits is directly affected by the number of offspring.

The estrus period lasts longer in rabbits with low shedding compared to rabbits with high shedding. The mothering quality of female rabbits and the keeping of rabbits in the nest increases with age and the number of litters, and this situation is explained by the increase of "maternal experience" in them. Therefore, it is appropriate to take into account the age and number of births when evaluating the quality of motherhood.

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