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CALIFORNIA RABBITS PERFORMANCE UNDER HIGH ALTITUDE CONDITONS IN GITEGA - BURUNDI*

(With 6 Tables)

By

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اداء الارانب كاليفورنيا تحت ظروف الارتفاع عن سطح البحر بمدينه جتيجا - بوروندى

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اظهرت النتائج تحت الظروف البيئيه لمدينه جتيجا - بوروندى والتى ترتفع عن سطح البحر بحوالى ١٦٨٠ متر ان الارانب كاليفورنيا لها نفس اوزان الجسم فى الفتره من عمر ١٠ اسابيع وحتى عمر ٢٤ اسبوع. مثل تلك المتحصل عليها لاوزان الجسم لهذا النوع من الارانب سواء فى الظروف المثاليه للتربيه أو تلك المشابهه لمدينه جتيجا فى الارتفاع عن سطح البحر.

لوحظ من النتائج أن الأرانب التى لم تصل إلى تمام وزن الجسم قبل موسم الجفاف وتوقف سقوط الأمطار فى نهاية شهر يونيه كانت أقل وزناً من الأرانب التى وصلت إلى تمام وزن الجسم مبكراً قبل موسم الجفاف - لهذا ينصح ببدء موسم التناسل مبكراً لتفادى الأنخفاض فى معدلات النمو وحتى تصل الأرانب إلى تمام وزن الجسم قبل توقف سقوط الأمطار.

من النتائج يتضح أن هناك أنخفاضاً ملحوظاً فى الصفات التناسليه وذلك ربما يرجع إلى نقص ضغط وكمية الأكسجين فى المناطق المرتفعه عن سطح البحر حيث أن أنخفاض نسبة الأكسجين فى الجو المرتفع عن سطح البحر تؤدى إلى بعض التغيرات الفسيولوجيه لجسم الحيوان والتى تؤثر بصوره مباشره على صفات التناسل لدى كل من الذكور والإناث.

لهذا ينصح بعمل دراسات فسيولوجيه مستفيضه لدراسة أمكانية تحسين صفات التناسل لدى الأرانب كاليفورنيا تحت ظروف الأرتفاع عن سطح البحر ونقص نسبة الأكسجين فى الجو.

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RABBITS PERFORMANCE IN GITEGA-BURUNDI

SUMMARY

The results under Gitega-Burundi conditions showed that California rabbits had similar body weight from 10- to 24 weeks of age as that well known at sea level or similar environmental conditions. It was noticed that the rabbits which did not attain their somatic maturition before the dry season had lighter body weight than that reached somatic maturation early. To avoid this problem, the reproduction season must begin early to achieve somatic maturation before the dry season. The results showed low values for the reproductive traits which may be attributed to the effects of oxygen hypoxia. It is important to search for increasing the reproductive efficiency in California rabbits by physiological studies under the high altitude conditions.

INTRODUCTION

The introduction of rabbits in Burundi, like under developmental countries is very important to increase animal protein sources. Rabbit's meat is of a better quality than other animals *(LEBAS et al., 1984)*. Under high altitude environment, there was a marked decrease of oxygen pressure and concentration which lead to oxygen hypoxia *(FRISANCHO, 1975)*.

Many workers had been studied the growth of the California rabbits under sea level or tropical and high altitude conditions. In France, *LEBAS et al. (1984)* pointed out that the adult body weight ranged from 3.6 to 4 Kg. *PAEZ et al. (1980)* in a tropical area with high altitude (Mexique - 1800 m over sea level), showed that the body weight mean at sexual maturity of California rabbits was 3.5 Kg. *PONCE DE LEON (1977)* in Cuba, found that the means of adult body weight of california males and females, were 4.05 and 3.87 Kg., respectively under tropical conditions with high humidity. In other tropical area without altitude (Brazil), *NUNES et al. (1985)* found that the body weight at birth, 8 and 17 weeks of age in California rabbits was 87, 1607 and 2758 g., respectively.

As for the reproductive traits, *PAEZ et al. (1980)* under high altitude coditions (1800 m over sea level), showed that the age and body weight at sexual maturity was 140 days and 3.5 Kg, respectively. *POUJARDIEU and VRILLON (1973)* in France, indicated that the age at sexual maturity was 206 days.

Litter size and live young rabbits at birth had variable means, it ranged 7.1-8.0 and 5.72-7.5, respectively *(POUJARDIEU*

& VRILLON, 1973; PONCE DE LEON, 1977; ELAMIN, 1978; GASCIA et al., 1980 and PAEZ et al., 1980). PAEZ et al. (1980) showed that the pregnancy rate was 69% under high altitude conditions. LEBAS et al. (1984) indicated that there were many differences between breeds for all the reproductive traits at the different environments which needs many studies.

The study of some productive and reproductive traits on California rabbits in this area of Burundi (1680 m over sea level) will be of a great importance. Moreover, it will help to introduce and to study the adaptability of this breed of rabbits to Gitega conditions.

The aim of this work is to study the effect of high altitude environment on some productive and reproductive traits of California rabbits under normal conditions of rearing and mangement. Moreover, it will help to recommend the possibility of using this breed of rabbits at Gitega-Burundi (1680 m over sea level) conditions.

MATERIAL and METHODS

This work was carried out in the poultry farm of the Agricultural High Institute (Gitega) University of Burundi. On 41 females and 10 males of California rabbits which were bought from the development center of Mutoyi (40 Km from Gitega) in two groups, one of them was introduced at February 1989 and the second one was at May 1989.

They were ear banded and reared in individual cages. After adaptation period of two weeks, the rabbits were weighed every two weeks from 10 to 24 weeks of age to the nearest gram. All animals fed ad libitum on a bellet commercial growing ration which contained 16% protein and 2600 kcal.M.E./Kg with coccidiostat supplementation as recommended by LEBAS et al. (1989). They were reared under the normal conditions without any modifications of mangement.

Only the rabbits which completed their records of body weight were considered in the statistical analysis. Accordingly, the number of females and males completed their record were 18 and 5 for each group. At somatic maturation, the females were introduced to males with considering the sex ratio (5 females/male) to begin the season of reproduction (LEBAS et al., 1984). All the females weighed at the mating time and those had positive test for pregnancy were considered as an adult animals. Age and body weight at first mating was recorded to determine both the age and body weight at first mating. At birth, litter size, live young rabbits and successful parturitions were recorded for each female within one year of

reproduction. Females showed no pregnancy during the reproduction year were elimenated from the statistical analysis. The total number of females that completed their records were 14 for group 1 and 16 for group 2.

During pregnancy and lactation periods all animals were fed ad libitum on a commercial ration contained 17% protein and 2400 kcal.ME./Kg *(LEBAS et al., 1984).*

Means, analysis of variance and correlation coefficients for body weight and reproduction traits were estimated according to *SNEDECOR and COCHRAN (1957)* after the transformation of the pregnancy percentages to the arc-sin proportion.

RESULTS

Females and males body weight means of each group from 10 to 24 weeks of age are presented in Table 1.

The general mean at 10 weeks of age was 1761.3 g, while it was 3720.9 g at 24 weeks of age.

The analysis of variance (Table 2) showed no significant differences between groups until 16 weeks of age. It were significant ($p<0.05$) at 18 and 22 weeks of age and at 20 weeks of age it were highly significant ($p<0.01$). The differences between males and females were not significant from to 10 to 22 weeks of age, only at 24 weeks of age there was a significant differnece ($p <0.05$) between the two sexes. The interaction between groups and sexes were significant ($p <0.05$) at 18, 20 and 24 weeks of age, respectively, and it was highly significant ($p <0.01$) at 22 weeks of age. The result showed that the females of group 2 were grown better than that of group 1 (Table 1), but the males of group 1 were grown better than the males of group 2. This indicates that both males and females of the two groups had not the same trend of growth. This result may be refer to the differences in the climatic conditions during the rain and dry season and the adaptability of the two sexes for these conditions.

The phenotypic correlations between weights at the different ages (Table 3) showed possitive and highly significant values. This indicate that body weight of rabbits increased progressively from one age to another in relation to the first weight, and the heavy rabbits will continue heavier than the light ones. This result showed that the body weight at the later age depends on the first. Moreover, it is possible to select the individuals for body weight at an early age.

The reproductive traits means in California rabbits under Gitega conditions (Table 4) showed that at first mating, the age was 216.4 days and the body weight was 3879.1 g. The litter

size was 6.63, number of live young rabbits was 4.98 and the pregnancy percentage was 54.0%. The analysis of variance (Table 5) showed no significant differences between the two groups for age and body weight at first mating, litter size and the percentage of pregnancy. The only highly significant difference between the two groups was found for the number of live young rabbits at birth which refered to the effect of dry season on the late pregnancy which indicated a marked decrease for group 2.

The phenotypic correlations (Table 6) between reproductive traits indicated possitive and significant ($p < 0.05$) values between age at first mating and litter size and between body weight at first mating and the percentage of pregnancy. There were possitive and highly significant correlations ($p < 0.01$) between the litter size and number of live young rabbits was found.

DISCUSSION

The results of body weights indicated that under the high altitude conditions at Gitega-Burundi, California rabbits had the same weights like that at sea level *(LEPAS et al., 1984)* or at similar altitudes *(PONCE DE LEON, 1977 and PAEZ et al., 1980)*. Results of growth showed that it is possible to introduce this breed in Burundi to increase the animal protein sources. On the other hand, rearing rabbits was easily manged and reach slaughtering time earlier than other animals *(LEBAS et al., 1984)*.

The significant differences between groups from 18 to 22 weeks of age may be due to the hot weather during the dry season (June-September) which lead to a decrease in the growth rate during this period. *CRESPI et al. (1984) and NUNES et al. (1985)* under tropical conditons showed similar result. The only significant difference between sexes was noticed at 24 weeks of age. *PONCE DE LEON (1977)* come to the same conclusions.

The results under Gitega conditions showed that the age at firt mating was later and the body weight was heavier than that mentioned by *POUJARDEU and VRILLON (1973) and PAEZ et al. (1980)*.

The percentage of pregnancy was lower than that reported under similar conditions *(PAEZ et al., 1980)*. The decrease of this percentage was refered to the fact that under high altitude conditions, the pressure and concentration of oxygen in the atmosphere decrease which resulted in many physiological changes that had direct effect on the fertility of rabbits males and females *(LEBAS et al., 1984)*. The number of litter

size and live young rabbits at birth was lower than that found in tropical areas *(PONCE DE LEON, 1977, 1977 AND PAEZ* et al., *1980).* It was noticed many differences between the results obtained under Gitega-Burundi conditions and the other results reported under sea level or similar conditions of altitude on California rabbits. This result agreed with the conclusion of *LEBAS* et al. *(1984).*

From this study, it is possible to recommend that under Gitega-Burundi conditions, physiological studies must be carried out to search for the effect of both seasons and oxygen hypoxia on some productive and reproductive traits on California rabbits.

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Table 1- Body weight means (g.) at the different ages of the two sexes within groups.

Age	Group 1		Group 2		General mean
	Females	Males	Females	Males	
10- weeks	1728.3	1940.0	1775.6	1650.0	1761.3
12- weeks	2055.6	2420.0	2156.7	1940.0	2122.2
14- weeks	2398.9	2600.0	2469.4	2230.0	2430.0
16- weeks	2650.0	2820.0	2872.2	2620.0	2752.2
18- weeks	2938.9	3138.0	3269.4	2910.0	3086.7
20- weeks	3199.4	3322.0	3577.8	3170.0	3357.6
22- weeks	3446.1	3530.0	3783.3	3280.0	3569.1
24- weeks	3644.7	3690.0	3870.0	3400.0	3720.9

Table 2- F values and test of significance between groups and sexes of body weights.

Source of var.	df	10-weeks	12-weeks	14-weeks	16-weeks	18-weeks	20-weeks	22-weeks	24-weeks
Groups	1	0.075	0.053	0.049	1.476	4.069*	5.623**	4.335*	2.119
Sexes	1	0.139	0.313	0.019	1.575	0.407	1.125	2.989	3.256*
Interaction (groups x sexes)	1	2.138	0.000	2.511	1.155	4.946*	3.889*	5.555**	5.084*
Error	42								

*,**: Significant and highly significant at 5% and 1% level, respectively.

Table 3- Phenotypic correlations between the different ages for body weights.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
10- weeks(1)	1	0.798**	0.788**	0.747**	0.681**	0.569**	0.476**	0.443**
12- weeks(2)		1	0.848**	0.787**	0.765**	0.688**	0.638**	0.620**
14- weeks(3)			1	0.845**	0.799**	0.695**	0.663**	0.641**
16- weeks(4)				1	0.884**	0.824**	0.768**	0.731**
18- weeks(5)					1	0.863**	0.824**	0.783**
20- weeks(6)						1	0.868**	0.842**
22- weeks(7)							1	0.877**
24- weeks(8)								1

** : Highly significant at 1% level.

Table 4- Means of the reproductive traits for the two groups.

Trait	Means		General mean
	Group1	Group2	
Age at first mating	208.7	224.0	216.4
Body weight at first mating	3989.3	3768.8	3879.1
Litter size at birth	7.22	6.04	6.63
Live young at birth	5.99	3.96	4.98
Percentage of pregnancy	55.4	52.6	54.0

Table 5- The analysis of variance (F values) between the two groups for the reproductive traits.

Source of var.	F values
Age at first mating	2.350
Body weight at first mating	2.371
Litter size at birth	3.650
Live young at birth	17.580**
Percentage of pregnancy	0.080

**: Highly significant at 1% level (df 1 and 28 for groups and error, respectively).

Table 6- The phenotypic correlations between the reproductive traits.

Trait	(1)	(2)	(3)	(4)	(5)
Age at first mat.(1)	1	-0.083	0.367*	0.069	-0.053
Body weight at first mat.(2)		1	0.010	0.184	0.382*
Litter size at birth(3)			1	0.606**	0.010
Live young at birth(4)				1	-0.102
Percentage of pregnancy(5)					1

*, **: Significant and highly significant at 5% and 1% level, respectively.