BUCK SEMEN CHARACTERISTICS FROM A MEXICAN POPULATION OF THE CALIFORNIAN, WHITE NEW ZEALAND, AND CHINCHILLA BREEDS

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ABSTRACT

An experiment was conducted in order to find out if there are differences in semen quantity and quality between the most important rabbit breeds in Mexico. The trial was carried out in the Unidad de Investigación Aplicada en Producción Cunícola at the Universidad Autónoma Chapingo, Mexico. The climatic formula of the place is Cb (wo(w)(i`)g, with 571.5 mm of precipitation and average temperature of 15.2 °C. Fifteen males were acquired for each of the Californian (CA), Chinchilla (CH), and New Zealand White (NZ) breeds, from the National Rabbitry Centre at Irapuato, México. Animals with any abnormality or extreme weights were discarded when the experiment started. At that time the nine evaluated bucks by breed were 8 months old and had average live weights of 3.669, 3.663, and 3.986 kg for CA, CH and NZ breeds, respectively. Semen was collected twice a week with two collections per day. An artificial vagina and a doe as dummy were used to collect semen. Semen was evaluated macroscopically (n=578) and microscopically (n=423) for the traits Volume (V), Color (C), Gel Presence (G), Spermatozoa Concentration (CN), Massy Motility (M), Live Spermatozoa Percentage (L), and Normal Spermatozoa Percentage (N). Records were analyzed through the Statistical Analysis System (SAS, 8V, 1999), using the proceedings GLM for all the variables, exception made for G which was analyzed through FREQ proceeding. The arc sin transformation was applied to L, M, and N previously to the analysis. Tukey test was used to compare the means when significant differences were found. The rabbit populations of Californian, Chinchilla, and New Zealand White breeds from the National Rabbit Centre in Mexico showed differences in semen characteristics. The CA breed produced more volume and spermatozoa less motile than the other two breeds. These two parameters are very important in relation to the semen doses that can be produced to be used by artificial insemination. Similar evaluations in different year seasons, buck ages and breed lines are needed.

Key Words: rabbit**,** buck, breeds, semen.

NTRODUCTION

There is an increasing demand of meet in Mexico, which national production does not satisfy. An interesting option is rabbit meat (MARISCAL, 1990), which has been growing in the last decade. Such increasing in rabbit production requires technological developments for both industrial and backyard systems. For the industrial systems and because of the globalization, economies of scale are needed (RODRÍGUEZ, 2001).

Technical bases in reproduction, nutrition, health, and breeding are necessary. Reproductive technology is used to spread the genetic improvement, sanitary control, production synchronization and because of economical reasons. In relation to the reproductive performance on rabbits some authors refer that testicular activity in the buck is continuous (LÓPEZ and HERNANDEZ, 2000) but others consider that there is a seasonal behavior (MARISCAL, 1990).

In Mexico, currently, there is a rabbit improvement program to generate three lines, selected for litter size, milk production and post-weaning gain at the Universidad Autónoma Chapingo (UACh). In order to do that the most important rabbit breeds available in Mexico (Californian, Chinchilla, and New Zeeland White) have been evaluated. The reproductive performance of the Buck is a part of such evaluation. There are not studies for semen characteristics for the three breeds in Mexico.

The objective of this study was to investigate if there are differences in semen quantity and quality of bucks of the following breeds: Californian, Chinchilla, and New Zeeland, White all of them coming from Mexican populations.

MATERIAL AND METHODS

The trial was conducted at the Unidad de Investigación Aplicada en Producción Cunícola from the Preparatoria Agrícola Departament, UACh, Mexico, which is located at km 38.5 México-Texcoco Highwey, at 19° 29´ N latitude, 98° 53´ W longitude, and 2,250 metros over sea level altitude. (I don't know what is the climatic formula please detail it) The climatic formula of the place is Cb (wo(w)(i`)g, with 571.5 mm of precipitation and average temperature of 15.2 °C (GARCIA, 1981).

The rabbitry was made of the following materials: the floor was concrete, the roof consisted of asbestos sheets, and the walls were made of zinc sheets except for the ventilation inlets. There were individual commercial cages (78 X 56 X 29 cm). A food hopper was used to feed the animals. The cages had an automatic watering system with nipple drinkers.

Fifteen bucks of each of the Californian (CA), Chinchilla (CH), and New Zeeland White (NZ) breeds were acquired from the National Rabbitry Center, located in Irapuato, México. Animals with extreme weights and having some physical problem were put

aside, keeping only 9 from each breed. The average weight of the bucks was 3.669, 3.663, and 3.986 kg for CA, CH and NZ, respectively. All of them were 8 months old.

Animals were feed *ad libitum* with commercial pellets (Malta Cleyton, TM) which had the following nutritional content: 9.64% moisture, 16.48% crude fiber, 10.41% minerals, ether extract ;15.98% crude protein, and 51.78 % of nitrogen free extract.

After two months of training period for the bucks, using an artificial vagina and a doe as dummy, semen was collected from August to November 2003

Semen was collected during the morning two times per week (2-3 days in between). Two collection per day (10 to 15 min apart) were obtained if the bucks were willing to do it. The temperature inside the artificial vagina was maintained between 42 and 45° C. Immediately after collection semen was kept in water bath at 37° C, until evaluation. A conventional thermometer was used to record temperature in the interior of the artificial vagina after the first semen ejaculate was taken.

Semen Color (C), Semen Volume (V) and the presence of Gel in the Semen (G) were recorded macroscopically according to ALVARIÑO (1993).. Volume was recorded (in ml) directly in the collection tube, Total Volume was the addition of the two collections. C was classified in a scale of 1 for aqueous, 2 for milky, and 3 for creamy. Microscopic characteristics were evaluated as well. Massy Motility (M) was determined by microscopical evaluation (10x) and expressed as % of motile cells. Concentration (number of spermatozoa/ml) was measured with a Newbauer Haemocytometer. Percentage of live spermatozoa (L) and Normal Spermatozoa (N) were microscopically (40X) evaluated using Eosin-Nigrosin dye (HAFEZ and HAFEZ, 2002). Semen was discarded when contaminated by urine or blood. Because of such reason or because the buck did not showed *libido* the number of ejaculates (NE) varied from 0 to 2 for each extraction day.

The statistical model for the analysis was: $Y_{ijk}= \mu + R_i + NE_j + F + T1 + \epsilon_{ijk}$, where Y_{ijk} represents the independent variable (any of the semen characteristics); μ the general mean; R_i the breed effect, NE_j as previously defined; F and T1 extraction date and artificial vagina internal temperature respectively as covariates; and ϵ_{ijk} represents the experimental error.

Before the analysis arc sin transformation was performed for M, N, and V in order to stabilize the variance (KUEHL, 2000), and then Proc GLM from the Statistical Analysis System (SAS, v. 8, 1999) was used, and Tukey test for mean comparisons. Gel content was analyzed trough Proc FRQ and tested by Chi square test.

RESULTS AND DISCUSION

Lest square means from semen macroscopic characteristics by breed are shown in table 1. There were significant differences ($P \leq 0.01$) between breeds for volume but not

for color and Gel presence. Californian breed was superior to both CH and NZ breeds for ejaculate volume. Collection date significantly affected volume (data not shown). This can be explained by the fact that bucks were getting older and maybe because of seasonal effects.
The internal temperature of artificial vagina was not significant which suggests temperature was within the accepted range.

Table 1. **Macroscopic semen evaluation by breed.**

Breed	N	Total Volume (ml)	Color	Gel Presence (%)
Californian	194	1.37 [a]	2.06	30.4
Chinchilla	192	1.21 [b]	1.98	22.2
New Zealand White	192	0.89 [b]	2.05	22.2

Means with same literal by column are not different (α≤ 0.05).

Other authors (ROCA *et al*., 1987; VILLANUEVA and VILLEGAS, 1995; IYESCAS and SÁNCHEZ, 1996; HERRERA and MENDOZA, 1997), have not found volume differences between CA and NZ breeds. Volumes found in this study (1.37 and 0.89 ml for CA and NZ breeds respectively) were superior to those reported in the literature for these two breeds in the same year-season. VILLANUEVA and VILLEGAS (1995), HERRERA and MENDOZA (1997), and GARCÍA and GUTIERREZ (1998) found volumes ranged from 0.5 to 0.7 ml.

No color differences were reported by Iyescas and SÁNCHEZ (1996), MARISCAL (1990) and ROCA *et al*. (1987). Whereas HERRERA and MENDOZA (1997) and LUZI *et al*. (1993) reported color differences for CA and NZ breeds. VILLANUEVA and VILLEGAS (1995), and SORIANO (1996), who analyzed the first and second ejaculates of the same day, reported a different gel presence between CA and NZ breeds. In this experiment the presence of gel was considered for the two ejaculates together. MARISCAL (1990), reported gel presence differences between the first and second ejaculates.

Lest square means from semen microscopic characteristics by breed are shown in table 2. There were significant differences ($P \leq 0.01$) between breeds for semen motility but not for spermatozoa concentration, live spermatozoa, and spermatozoa normality ($P \geq 0.05$). Chinchilla breed had superior semen motility to NZ. Californian breed was not different to the two other breeds for this characteristic.

Table 2. **Microscopic semen evaluation by breed.**

Breed	N	Motility (%)	Concentration (Cells/ml)	Live Cells (%)	Normal sperm morphology (%)
Californian	147	80.40[ab]	320.00	90.23	94.84
Chinchilla	163	85.71[a]	282.22	89.94	94.18
New Zealand White	113	76.06[b]	325.55	90.92	94.69

Means with same literal by column are not different (α≤ 0.05).

As ALVARIÑO (1993) indicated, motility is one of the most important characteristics for semen quality. Other authors (MARISCAL, 1990; VILLANUEVA and VILLEGAS, 1995; SORIANO, 1996; HERRERA and MENDOZA, 1997) have reported no differences between CA and NZ breeds as was the case in this experiment.

Spermatozoa concentration, live and normal spermatozoa resulted from this trial were within the values reported for rabbits (ALVARIÑO, 1993). No breed differences for concentration was reported by VILLANUEVA and VILLEGAS (1995), IYESCAS and SÁNCHEZ (1996), whereas MARISCAL (1990) and HERRERA and MENDOZA (1997) reported CA and NZ differences for some microscopic characteristics. Year-season, collection frequency, and breed effects and their interactions could explain such differences.

The numbers of doses that can be generated from a semen ejaculate integrate both macro and microscopic characteristics. Following HAFEZ and HAFEZ (2002) formula and using the results in table 1 and 2, the number of doses that can be produced weekly by buck are 45, 37 and 28 for the CA, CH, and NZ breeds.

This calculation applies to the population here studied in the summer and autumn seasons, more studies have to be done in other year seasons, buck ages, and breed populations.

CONCLUSIONS

The CA, CH, and NZ rabbit populations from the National Rabbit Centre in Mexico showed differences in semen characteristics. The CA breed produced a higher semen volume whereas the CH and CA semen had the higher motility values, both traits are very important in relation to the semen doses that can be produced to be used by artificial insemination.
The three breeds had the same values for other semen characteristics such as color, gel presence, percentage of live and normal spermatozoa. Most of the literature reports have similar results but a few studies found differences for these characteristics. Both macro and microscopic characteristics are within the normal values reported for rabbits. Other studies are needed, considering other year seasons, buck ages, and breed populations.

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