Asian Journal of Animal Sciences, 2012
ISSN 1819-1878 / DOI: 10.3923/ajas.2012.

Reproductive Performance, Meat Chemical Composition and Quality of Sudan Baladi, New Zealand White and California Rabbit Breeds

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ABSTRACT

Ten females and two males from NZW, CAL and local Baladi rabbit were used to study the reproductive performance, meat chemical composition and quality of Sudan Baladi and New Zealand white rabbits. Compared with temperate rabbit breeds, Sudan Baladi (SB) rabbit breed was found to have smaller litter size, lighter birth weight and weaned small litter-size, than New Zeland white and California breeds. Weaning weight was similar in the three rabbit breeds. Still birth rate and mortality rate were lower for Sudan Baladi rabbits than for the two temperate rabbit breeds. Chemically, Sudan rabbit meat had less moisture and more fat than New Zealand white, a finding which reflected differences in maturity. The colour of the meat of Sudan Baladi rabbit was darker red and than that of New Zealand white. The former breed had slightly tough meat than the latter one.

Key words: Reproductive performance, meat quality, local Baladi rabbit, temperate rabbit breed

INTRODUCTION

The rabbit with its high fecundity and non-competitive diet with humans for cereals is envisaged to contribute in alleviating animal protein shortage in developing countries where people subsist on cereal diets low in protein. Specialized meat producing rabbit breeds as New Zealand white and California have been developed in temperate countries but nowhere has a particular breed of rabbits been developed for tropical conditions. Some non specialized local rabbit breeds adapted to tropical conditions offer a considerable scope for development (Owen, 1981). Litter size (the number of kits born) is the most important economic character in rabbit production (Belhadi, 2004; Nofal *et al*., 2005). Local Egyptian rabbits as Baladi red and Geiza white were found to produce a litter size that compares favorably with exotic specialized rabbit breeds (Afifi and Emara, 1987). In this study reproductive performance, meat chemical composition and quality of Sudan Baladi and New Zealand white rabbits were evaluated.

MATERIALS AND METHODS

Experimental animals: Ten females and two males from NZW, CAL and local Baladi rabbit their average weight was 1982 g for the NWZ and 1957 g for the CAL, respectively. Females of each breed were kept in a separate pen while males were individually caged in pens provided with watering and feeding facilities. Feed constituted of green Lucerne plus a concentrate are offered ad-mortem. The ingredients proportions and chemical composition of the concentrate mix are given in Table 1.

Table 1: Ingredient proportion of the experimental diet

Item	Percentage
Ingredients	
Sorghum grain	57
Cottonseed cake	25
Wheat bran	15
Lime stone	2
Salt	1
Calculated composition	
ME (MJ kg^{-1})	11.34
CP (%)	14

Reproductive performance: The rabbits were kept for a period of five months to attain sexual maturity. Subsequently, each female was introduced to a male of the same breed for mating. Seven were left in the male cage overnight, then returned to her pen. Ten days post mating, pregnancy was diagnosed by abdominal palpation and non pregnant females were remated. At the last stage of pregnancy, each doe was provided with an earthen jar for nesting. Does were observed daily for kindling. Twenty four hours post kindling, kindling rate and stem birth and birth weight, were recorded. Mortality was recorded till weaning at 28 days post-partum.

The weaned rabbits of each breed were separately housed and offered the concentration mix for twenty days (adaptation period). Subsequently thirteen, unsexed individual of the same average weight from each breed were selected for fattening. They were offered the concentrate mix (Table 1) in mash form, plus Lucerne for 24 h at 40°C. Each carcass was then split into two sides along its midline and the left side was dissected into muscle (lean plus intramuscular fat). Muscles were minced and used for chemical analysis. The right side was used for colour and shear force determination. Meat colour was taken as the mean of the meat colour values of thorax, lumber and thigh regions. The *L. dorsi* muscles of the right side were dissected and frozen stored for shear force determination. An instron model 1000 was used for shear force measurements. Data were then statistically analyzed as in Snedecor and Cochran (1980).

RESULTS

Reproduction performance: Date pertaining reproductive performance of Sudan Baladi, NZW and CAL rabbit breeds are given in Table 2. Sudan Baladi rabbits had significantly ($p<0.001$) small liter stem than either NZW or CAL rabbits. Similarly number of kits born alive per litter was significantly ($p<0.05$) smaller in Sudan Baladi than in either NZW or CAL rabbits. The domestic rabbits of Sudan weaned 2.6% kits while NZW and CAL rabbits weaned 4.1 and 4.0%, respectively.

Sudan Baladi (SB) rabbit had significantly ($p>0.002$) lighter birth weight than NZW or CZL rabbit breeds. Weaning weight was not significantly different between the three breeds. California rabbits had the heaviest weaning weight, followed by SB and NZW rabbits. Still birth rate was maximum in the NZW, intermediate in CAL and least in SB rabbits. Mortality rate from birth to weaning was highest in CAL (67%) intermediate in NZW (42%) and least in SB (22%).

Chemical composition and quality of rabbit meat: Table 3 gives proximate composition and some quality attributes of rabbit meat. The moisture content of SB rabbit meat was slightly lower than that of NZW but the difference was not significant. Protein percentage showed the same pattern of change as moisture percentage. Fat content was significantly ($p>0.001$) greater in the musculature of SB than in that of NZW rabbits. Ash content was not significantly different in the musculature of the two rabbit breeds.

Table 2: Reproductive traits of Sudan Baladi and temperate rabbit breeds

Traits	SB	NZW	CAL	SE	Level of significance
No. born/litter	3.22[b]	7.25[a]	7.5[a]	0.64	***
No. born alive/litter	2.67[d]	5.63[c]	7.17[c]	0.86	*
No. weaned/litter	2.62	4.10	4.00	0.74	NS
Birth weigh (g)	42.58[f]	62.71[a]	60.22[a]	2.07	***
Weaning weigh (g)	390.43	383.56	415.42	20.13	NS
Still birth (%)	3.6	9.4	4.4	-	-
Mortality (%)	22.2	41.7	67.4	-	-

Means on the same line with different superscripts differ significantly ($p<0.001$) for a, b, e and f and ($p>0.05$) for c and d

Table 3: Meat, proximate composition and quality attributes of Sudan Baladi and New Zealand white rabbits

Parameters	SB	NZW	Level of significance
Moisture (%)	68.16±2.8	70.0±2.03	NS
Protein (%) N×6.25	24.30±3.2	25.8±2.30	NS
Fat (%)	6.13±0.68	3.10.62	***
Colour			
L	44.6±3.3	50.5±2.3	***
a	8.5±1.6	9.6±1.9	NS
b	8.5±1.0	7.4±1.3	*
Shear force (kg cm^{-2})	3.1±1.0	2.5±0.5	NS

Colour: L: Degree of witness, a: Degree of redness and b: Degree of yellowness. NS: Not significant, *: $p<0.05$, ***: $p<0.001$

Meat colour components showed that SB rabbit meat had significantly lower lightness (L) values, lower redness (a) value and significantly ($p<0.05$) higher yellowness (b) value than NZW rabbit meat. Shear force which measures muscle fiber strength, was not significantly different between the muscles of SB and NZW rabbits. In fact the former rabbit breed had slightly higher shear force values than the latter.

DISCUSSION

The finding that New Zealand white and California rabbit breeds has significantly larger litter size than Sudan Baladi rabbits might possibly be due to the fact that the former two breeds were a specially selected and developed for improved reproductive performance (King, 1978; Owen, 1981). Damodar and Jatakar (1985) found that New Zealand white had a litter size of 4.9 under subtropical conditions of India, a value which compared favourably with the performance of this breed under the environmental conditions of Sudan. El-Amin (1978) reported a live litter size of B.S. for SB rabbits which was similar to the value found in this study (Table 2).

Differences in the size of litter weaned were a reflection of the differences in size of litter born (Table 2). Birth weight of SB rabbits was significantly lighter than that of New Zealand white and California. This was due to differences in dam body size. Khalil *et al.* (1986) reported that doe effect is considerable to be the most important factor affecting body weight at birth and up to weaning. Sudan Baladi rabbit had a mature weight of 1.5 kg (El-Amin, 1978) while NZW and CAL rabbit had an average mature weight of 5.0 kg (King, 1978).

Anous (1999) concluded that NZE rabbit is superior in growth rate and grams of weight produced at time of marketing when it was compared with local breed of Burndi which may reflect higher feed conversion ratio for NZW rabbit compared to local breed. High mortality rate was observed for the temperate rabbit breeds than for SB rabbits and this reflected adaptability of the

latter breed to environmental conditions for Sudan. Grobnes *et al.* (1985) reported a mortality rate of 31% for NZW under sub-tropical conditions of India, a value which was slightly higher than the mortality rate observed for the breed under Sudan environment.

Chemically the meat of Sudan Baladi rabbits had less moisture and significantly more fat than that of SZW and CAL. Sudan Baladi rabbit almost attained its mature weight when slaughtered at alive weight of 1.4 kg while at a slaughter weight of 1.8 kg the NZW was still p\growing. These differences in maturity might possibly explain the observed differences in meat chemical composition. Meat colour differences might also be explained by breed differences in muscle composition indicatedly (Lawrie, 1979). Shear force, was higher in the NZW rabbit muscles. The former breed was noticed to be more active than the latter one and activity and exercise are known to increase muscle fiber strength (Lawrie, 1979).

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