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Research Article

Morphometric Characterization and Production System of Rabbits Reared in the Amoron'i Mania Region Madagascar

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Abstract

In Madagascar, rabbit farming is still family-based and carried out using traditional techniques. 272 farmers and a 3018 rabbits, in the District Fandriana, Ambositra, Ambatofinandrahan and Manandriana, were surveyed. 35% of counted rabbits were measured, and 14 breeds were characterized. Among the 1060 rabbits subjected to morphological identification, the Local Breed (LB) emerged as the most populous, followed by the Giant Hutia (GH) and the White Bouscat Giant (WBG). Our findings indicate a wide range of Life Weight (LW; from 120 to 4860g), averaging 1320g at 25 weeks (wks) for all breeds combined. While the Flemish Giant (FG) exhibited the highest average (LW) at 2082g at 27wks of age, contrasting with the highest LB's 1230g at 23wks. Other breeds introduced by the FIDA and FORMAPROD projects averaged around 1500g LW. A positive and significant correlations (p<0.001; r=0.71) between age and LW was founded, and a significant correlations (rho= 0.79 vs rho= 0.89) with body length (BL). In summary, our study provides valuable insights into the demographics of rabbit farming, breed characteristics and morphological measurements.

Keywords: Madagascar; Phenotypic correlations; Rabbit breed; Rabbit farming

Introduction

Rabbit is reared systematically on a vast scale. The EU is the second largest meat-rabbit producer in the world, after China, where advanced breeding techniques and disease management strategies have evolved [1]. The trade pattern is currently from Asia (mainly China) and South America (mainly Argentina) to European countries. In 2018, the top 5 export destinations were Germany, Belgium, Italy, Portugal, and France [2]. Rabbit farming has emerged as an innovative solution to address food scarcity in several African countries, including Madagascar, as explored [3]. Furthermore, the limited consumption of rabbit meat among the Malagasy population is attributed to lack of habits [4]. Moreover, meat consumption in Madagascar is still low, averaging 5.4 kg/person/year [5] of which 75% was bovine meat [6]. While in Madagascar, rabbit farming predominantly follows a family-based model, relying on traditional techniques often lacking essential knowledge in rabbit husbandry and management [7]. However, the predominant housing system utilized by farmers was the mixed animals pen and rabbit farming was a secondary activity for Amoron'i mania women and also local breed was the most kept in Madagascar [8]. Rabbit farming meets FAO GOALs for equity and access to family income.

The aim of the present study was to characterize the rabbits reared in the Amoron' i Mania region of Madagascar. Moreover, correlation analyses were performed on traits measured as a function of rabbit age and LW, in order to promote the improvement of breeding techniques and overall productivity in Madagascar.

Materials and Methods

Selected farms and survey methods

Direct observations were carried out from June to November 2023, by visiting 272 rural rabbit farms in the Amoron'i Mania region, in the District Fandriana, Ambositra, Ambatofinandrahan and Manandriana. A survey form was conducted at first as a formal discussion with the owner to fill the form. To confirm the data collected by filling the pre-established questionnaire, direct observations were performed. In total 35% of total rabbits (3018) were subjected to characterization and measurements (1060 rabbits).

Characterization and measurements of rabbits reared in Madagascar

The measured parameters were both quantitative and qualitative. The rabbit body measures were: body length (BL), head (HdL), muzzle (MzL), Ears (ErL), feet (FL), tail (TL) and hair length (HrL), width of chest (or thoracic) (CW), belly (BW), head (HdW), ears width (ErW) and inter-orbital distance (OD), height at withers (WH), height at back (BckH) and height at sacrum (ScH), Chest circumference (CCr), belly circumference (BCr) and spiral circumference (SCr), live weight (g) and age (weeks).

The linear body measurement of each rabbit was taken between 2 and 152 weeks using a tape measure in centimeters (cm) and the live weight of the rabbit expressed in grams (g). All morphometric parameters were measured on each animal using the same method described by Randriamandratondrakotonirina and [9].

Qualitative parameters were represented by body conformation, coat color and eye color to identified rabbit breeds. To identify the rabbit breed from the body conformation, coat and eye color and the shape of the ears [10] and the local breed was a cross between medium-sized giant breeds and is generally bicolored.

Statistic analysis

Data analyzes were performed using Stat R Studio software (R 4.2.3) and descriptive statistical analysis. All data were analyzed by the Shapiro-Wilk normality test if the data were normally distributed. Analysis of variance was used to estimate least squares means and analyze the effect of LW and A on rabbit's bodies measured. Pearson's correlation was used to analyze the association between LW and A of Rabbits measured (normally distributed data) and Spearman's correlation was used to estimate the phenotypic correlation between LW, A and morphometric traits (non-distributed normally data). Significance was set for $P<0.05$.

Results and Discussion

Field surveys

A total of 3018 rabbits were surveyed, of which 1060 were measured (35% of all rabbits counted), and 14 breeds were characterized (Table 1).

The local breed (LB) was the most numerous (413 individuals), followed by the White Bouscat Giant (WBG) (252 Individuals), Hutia Giant (HG) (Hollandais of Madagascar) (139 individuals) and White Vienne Giant (WVG) (87 individuals), while the other breeds were rarely (less) in the Amoron'i Mania region (less than 47 individuals). In 2019, Randriamandratondrakotonirina was counted 9 rabbit breeds in Amoron'i Mania where the White Bouscat Giant was numerous, followed by Chinchilla and local breeds, while the Angora and White Vienne Giant "breeds" were rare in the Amoron'i Mania Region. This difference in the value of several rabbit breeds was due to the presence of new breeds of male breeding rabbits (commercial breeds) such as the Flemish Giant, Giant Papillon, New Zealand White and California White, which were distributed in 2022 (2022-2026) by the FIDA (Fonds International de Développement Agricole) project and FORMAPROD (Vocational training and agricultural productivity improvement programme) working in the agricultural sector in Madagascar.

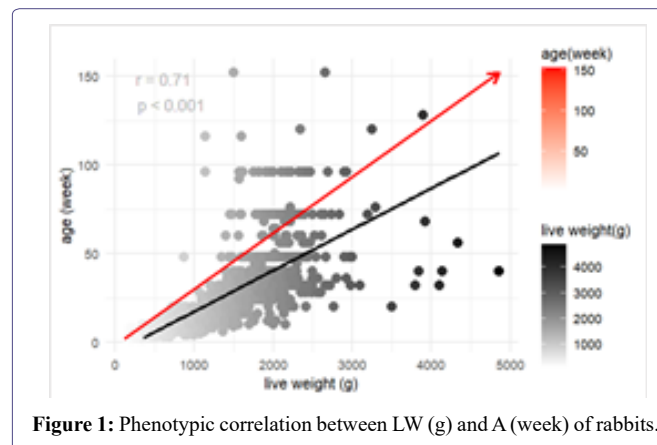| Breed	N.	mean (g)	min (g)	max (g)	sd (g)	se (g)	CV (g)
AL	17	1510.00	410	2930	836.009	202.762	55.364
ANG	8	1100.00	320	2300	859.185	303.768	78.108
CH	25	1529.60	280	3840	662.051	132.410	43.282
CW	3	1430.00	810	2000	596.573	344.431	41.718
DUR	47	1515.96	400	2980	714.099	104.162	47.105
FBG	24	1507.08	320	2600	536.619	109.537	35.607
FEL	1	610.00	610	610	NA	NA	NA
FG	34	2087.97	220	4860	1184.275	203.102	56.719
GP	4	1472.50	880	2700	843.697	421.849	57.297
HG	139	1439.28	220	3920	639.358	54.229	44.422
LB	413	1230.89	120	3900	660.925	32.522	53.695
NZW	6	1038.33	350	2250	811.527	331.305	78.157
WBG	252	1254.13	160	4100	690.079	43.471	55.025
WVG	87	1224.37	210	2340	613.220	65.744	50.084

Table 1: Live weight of rabbit's breeds reared in Amoron'imania.

The Table 1 showed that the LWs of all breeds were observed. Flemish Giant (FG) has a higher LW, varying from 220.0 to 4860.00g with an average of 2087.97 g at the age of 27 weeks. While the local breed (LB) which was the most numerous and raised by the farmers had a lower average LW (between 120 and 3900 g with an average LW of 1230.89 g at the age of 23 weeks) than the Flemish Giant (FG) breed. However, Alaska (AL), Chinchilla (CH), Dutch Rabbit (DUR) and Fauve de Bourgone Giant (FBG) breeds presented the same high values around 1500 g of average LW. According to Randriamandratondrakotonirina (2019) found that White Bouscat Giant (WBG) breed rabbits have the highest average LW at 1528.7 g, followed by the Alaska (AL) with 1516.3g on average. While the local breed (LB) has a high average LW of 1333.8 g compared to our results (1230.89 g). Angora (ANG) and White Vienne Giant (WVG) have a relatively low LW, varying between 489.5 and 2315.0 g with an average of 1101.7 g for Angora (ANG) and between 429.0 and 1759.0 g with an average of 935.4 g for White Vienne Giant (WVG). Regarding LW, the highest average value (2087.97 g at the age of 27 weeks for the Flemish Giant) observed in this study is higher than of White Bouscat Giant with a LW average of 1528.7 g in Amoron'i Mania (Randriamandratondrakotonirina, 2019). Thus, the endemic Algerian rabbit (LW = 1610.49 g) at the age of 13 weeks found by [11] and the highest local breed by the Amoron'i Mania farmers have a lower LW (1230 g at the age of 23 weeks) than of rabbit's local breed (LW for sale = 1860 g) in Morocco [12]. This difference in LW of rabbits varies depending on the breed [13]. Furthermore, according to [14] productive performance, carcass characteristics, meat composition and LW of rabbits were strongly affected by genotype and breeding system caused by the traditional farming systems as mixed animals and pen floor housing and direct floor breeding system, which results in chronic (poor) meat production performance rabbit in Madagascar.

Phenotypic correlations of LW and A with morphometric measurements in Rabbit Amoron'i Mania
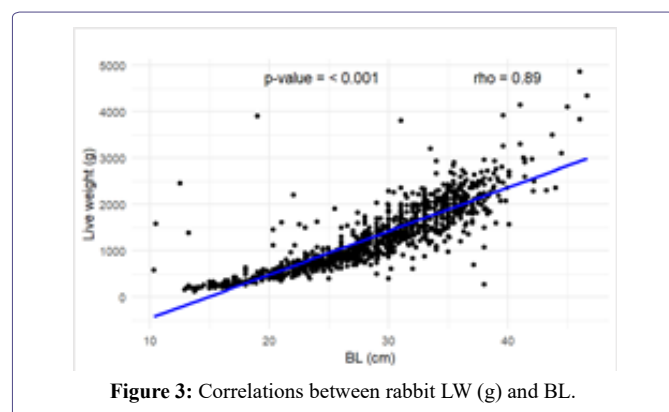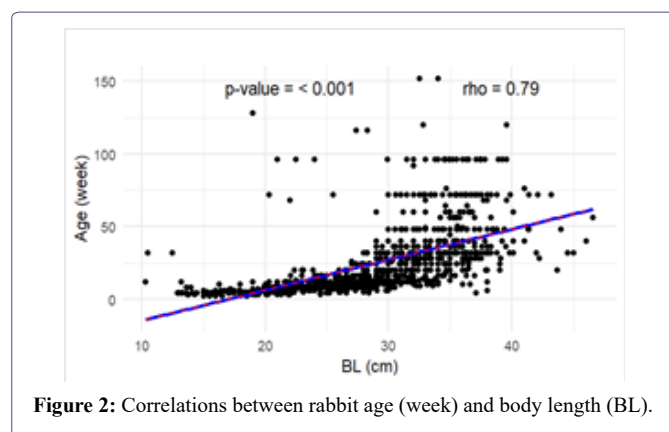
Phenotypic correlation between LW and A was presented in Figure 1. A positive and significant correlation ($p < 0.001$) was observed between live weight and age of the measured rabbits ($r=0.71$). This means that in general, as age increases, weight also tends to increase (Figure 1).

Figure 1: Phenotypic correlation between LW (g) and A (week) of rabbits.

Phenotypic correlations between a (wk) and BL, and between rabbit LW (g) and BL are presented in (figures 2&3) respectively. Positive and significant correlations (p<0.001) were observed age and body weight on BL. This means that as body weight and age increase, BL also increases. In fact, the study revealed that body weight is strongly correlated with body length (BL), head length (HdL), foot length (FL), back height (BckH) and belly circumference (BCr) (not illustrated), accordingly as weight increases tends to increase with measured parameters. It should also be noted that increasing a given parameter does not necessarily result in an increase in the corresponding parameter. Therefore, selection for increasing such a measured parameter may not lead to an increase in the corresponding morphometrics (OD, ErW, HrL, TL). Our result agreed with the result of [9] who reported positive and significant (p<0.001) correlation between body weight and body length. The result of [14] was also in agreement with the present study. Reported [7] the highest value of correlation (r=0.82) between live weight and total length.

Figure 2: Correlations between rabbit age (week) and body length (BL).

Figure 3: Correlations between rabbit LW (g) and BL.

Significant and positive correlations between age and LW, and LW and BL at around 75 wks of age (Figures 1 and 2, respectively), were found. According [15] showed that age class of NZW significantly affected BW, HL, and BL whereas most morphometric characteristics were not difference among age classes and the result indicated that after six months of age, bones were growing slower or almost stopped may be due to housing systems, feeding and environmental systems. These results confirmed by [16] that high temperature can significantly decrease growth and reproductive performance. While the results that environment manipulation could be increased the performance of NZW doe at the different areas in Indonesia. Agreed with [17,18] that morphometric characteristics were affected by management techniques environment, and feed quality [19-23].

Conclusion

Rabbit farming in Amoron'i Mania region is still traditional and constitutes a secondary activity of married women. Several projects have worked in collaboration with farmers but the production systems are still weak due to the lack of scientific studies on production systems, the lack of knowledge on the importance of rabbit meat consumption and especially the lack of production techniques on the part of farmers while rabbit breeding is the best source of income for people in rural areas this is why the average live weight was very low (1230 g at the age of 24.87 weeks which corresponds to the weight at slaughter). Rabbit genotype and management system showed major interactions and affected almost all traits analyzed. To improve the housing and performance of rabbits, assess the productive reality of territory, rabbit rearing for its intrinsic characteristics (environmental and productive potential, for women equity) should be further studied, funded and supported for technical assistance.

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