



# Impact of prophylactic measures and the use of local food resources on the viability and growth of pre-weaning lambs in Djougou, in the northern region of Benin

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## 1 SUMMARY

This study is an assessment of the impact of hygiene and the utilization of local food resources on the viability and growth of pre-weaning lambs raised on the farm of the National Advanced School of Agricultural Sciences and Techniques of Djougou, Northern Benin. Daily cleaning of the barn, prophylactic measures and food supplementation with peanut and cowpea tops, yam and cassava peels, sorghum and rice bran, led to a viability rate of 100% and a daily average weight gain of  $100 \pm 10$  g to  $130 \pm 10$  g during the first three months of neonatal Sahelian lambs. These interesting findings could help breeders improving the viability rate of lambs, preventing lamb weight loss and allowing expression of zootechnical performances across seasons. At the macroeconomic scale, increase in sheep meat production and its subsequent urban consumption will likely favour adoption of such production strategy.

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## 2 INTRODUCTION

Traditional breeding of small ruminants is commonly practised in Benin. It is an extensive method of breeding, which relies on natural resources. This method of breeding highly depends on the breeds and on the availability of pasture resources. The small ruminants are composed mainly of trypano-tolerant Djallonké and trypano-sensitive sahelian sheep and goats and their crossbreeds. Pasturelands and water are abundant in the rainy season while they are scarce and with poor quality in the dry season. In this traditional breeding system, the sheep that are the subjects of the present study are characterized by

high mortality rate at the early ages and low productivity. Previous observations revealed that hygiene of habitats and medication decrease the mortality rate of young sheep in the rainy season (Soulemana, 2008) while food supplementation improves reproduction parameters and growth of lambs in the dry season (Doko *et al.*, 2012). In the Municipality of Djougou, small ruminants are maintained year round on natural pastures comprised largely of grasses, and whose nutritional value lowers very rapidly in the dry season. This generally leads to considerably low production, especially weight loss, and high



mortality and morbidity rates among young lambs. Under such conditions, supplementation of the basic diet is compelling. This study presents the results of the use of cassava and yam peelings, peanut and cowpea vines, dried sorghum and rice bran as food supplements for

ewes and pre-weaning lambs. It focuses on success factors and analyses weight productivity in conjunction with prophylactic measures and utilization of locally available agricultural by-products.

### 3. MATERIAL AND METHODS

#### 3.1. Study Environment and Human

**Activities:** The Application Research and Production Farm of the *National Advanced School of Agricultural Sciences and Techniques of Djougou* (FARP/ENSTA-Dj) served as the research venue for this study. The farm covers about 40 hectares of which only 5 hectares are used for cropping and as habitat. The remaining area consisting of shrubs within the fallow is bordered to the south by a forest gallery along a water stream that dries out in the dry season. The climate in Djougou is characterized by a rainy season that extends from May-June to October and a dry season going from November to April-May with a heavy rainfall in August-September. The average annual rainfall over the last ten years is 1,250 mm. The average temperature is 31 ° C with gaps ranging between 29 ° C and 33 ° C (ASECNA, 2004, Unnamed Source). Cropping followed by ruminant animal husbandry, consisting of cattle and sheep, are the main activities of the region. Farmyard animals include chickens, turkeys, and incidentally, guinea fowls and domestic ducks.

**3.2. Experimental Animals:** The experiment covered 26 male and female lambs of Sahel sheep breed. Parents were purchased a few months earlier in the cattle markets of Guéné in Malanville and Karimama in Northern Benin. These lambs of primiparous mothers were born and raised in the FARP (Djougou). They were selected randomly and a flock of lambs was set up between October 27 and November 8, 2011. The experiment lasted eight months, from October-November 2011 to June 2012. Lambs were raised together with their mother and kept in a barn built in bricks with corrugated roof. Sheep, chickens, and turkeys shared the same

spaces. On each lamb's ear, an identification number was engraved. Attached to one length of sheepfold, the animals had an exercise area of about 120 m<sup>2</sup> fenced with bricks and wire.

**3.3 Feed :** The diet was based on natural pastures in herbaceous-dominated fallow grasses (*Andropogon*). Thus, under the supervision of a shepherd, the sheep grazed on the pastureland once a day from 11:00 to 18:00 in the rainy season. In the dry season, they went to the pastureland both in the morning and in the afternoon and received, a food supplement made from dried cassava or yam peelings, groundnut or cowpea haulms, rice and corn bran. These animals were served feeds in two half barrels cut longitudinally. The choice and quantity of feed served to the sheep did not consider their physiological stage. Only the availability of by-products was the determining factor for the complementation. The shepherd distributed about 300 g per day and per ewe. Food supplementation with soybean tops, yam and cassava peels, sorghum, corn and rice brans was done once a day, in the morning before taking the animals out for pasture. Blocks of commercial, licking stone were given *ad libitum* to compensate mineral deficit in the dry season. Water was served *ad libitum* twice a day in the paddock in the morning and evening after grazing. During the first three weeks following lambing, the lambs were kept in the barn. Before weaning, which took place at three months; they suckled the ewes and had supplementation from a mixture of sorghum bran (40%), corn bran (24%), soybean (20%), rice bran (15%), and cooking salt (1%). For morning and evening meals, the shepherd distributed about 70 to 80g



of this mixture per lamb. Ewes and lambs were fed separately. After three months, lambs followed their mothers to pastureland for grazing.

**3.4. Hygiene and Prophylaxis:** Sheep pens and exercise area were cleaned with water every day. Waterers, feeders, and all operating equipment were also cleaned the same way every day. Every fortnight, these infrastructures, and breeding equipment were disinfected with a 25 ml per litre of water solution of *crezol*. These animals were given a 2 ml of the stress-lives (mixture of vitamins and amino acids) injections. From the second week onward, the newborn showed signs of weakness; a 0.1 ml/kg body weight injection of ivermectin® was given to fight gastrointestinal parasites at the end of the third month on weaning. They underwent a monthly or fortnightly dipping (considering the presence of ticks on the bodies of the animals) with abotik® (2 ml/L) after the third month on weaning. In case of diarrhoea, the lamb was given orally ten to twenty grams of veto-anti-diarrheal (sulfaguanidine) diluted in 0.5L of drinking water. For generalized infections, one to two doses of oxycline® 20% (oxytetracycline) was given by deep intramuscular injection. This corresponded to 0.1 ml/kg of body weight per injection. Common diseases (e.g. small ruminant cattle plague, trypanosomiasis) were treated when animals exhibited clinical signs. Ovipestovax vaccine against small ruminant cattle plague was applied to the entire sheep and lamb flock. Each ewe and lamb aged over three months received subcutaneous injection of 1 ml of it. This

## 4 RESULTS

**4.1. Dominant Pathologies:** Two major diseases dominated the infections table: lameness with a cumulative rate of 42.3% (11/26) and animal trypanosomiasis with a prevalence of 30.8% (8/26). To a lesser extent, diarrhoea was present with 15.4% (4/26). Cachexia remained the common pathological manifestation noted in all sick animals.

immunization occurred once every six months. Similarly, every three months from birth, each animal was given a 3.5 mg dose per kg of body weight of a solution of diminazene (Berenil, Hoechst) to prevent animal trypanosomiasis (Farougou *et al.*, 2012).

**3.5. Clinical Examination of Animals:** A general observation of all animals was done every day to detect any anomalies in the behaviour of animals. Clinical examination was also conducted before and during weighing, treatments, vaccinations, and during food distribution or any manipulation.

**3.6. Weight:** The weight of all the animals was obtained by weighing them at birth ( $D_0$ ) (within 24 hours after birth) and every other week up to three months ( $D_{90}$ ). Thereafter, the weighing proceeded on at fixed dates every month up to the seventh month ( $D_{210}$ ) using a spring balance (accuracy 50g). The weighing took place every morning between 07:00 and 09:00.

**3.7. Statistical analyses:** Survival was computed as percentage living lambs over 26 (the size of the lamb cohort). Data on lamb weights were used to compute daily average weight gain (ADG) on a monthly basis as follows:

$$ADG = (w_y - w_x) / 30$$

Where  $w_x$  is the initial weight and  $w_y$  is the weight after 30 days.

Both data on weight and ADG were plotted against observation dates, but on monthly basis for ADG.

**4.2. Viability of Lambs:** Of the 26 experimental lambs, no mortality was recorded during the first three months of the neonatal period, which corresponds to a viability rate of 100%. The two deaths recorded in this herd of lambs occurred after weaning ( $D_{90}$ ). The first lamb died five months later because of food poisoning and the second one six months later

with prominent symptoms such as general weakness (in spite of symptomatic treatments with antibiotics and vitamin complex).

**4.3. Weight:** the average weight of the lambs at birth was  $1.82 \text{ kg} \pm 0.49$ . A significant and continuous weight gain was noted in all lambs individually or collectively. The average weight at typical ages 30, 60 and 90 days were respectively  $4.84 \pm 2.01 \text{ kg}$ ,  $6.56 \pm 2.68 \text{ kg}$ , and  $8.22 \pm 3.41 \text{ kg}$ . This growth has continued even after 3

months (Figure 1). Slight variability was noted here and there inside the virtual flock of lambs. Daily Average Weight Gains were  $100 \pm 6 \text{ g}$ ,  $110 \pm 6 \text{ g}$  and  $130 \pm 5 \text{ g}$ , respectively between  $D_0$  and  $D_{30}$ , between  $D_{30}$  and  $D_{60}$ , and between  $D_{60}$  and  $D_{90}$ . Figure 2 presents an upward weight gain during the first three months and a downward weight gain from the 3rd to the 7th month, end of the observations.

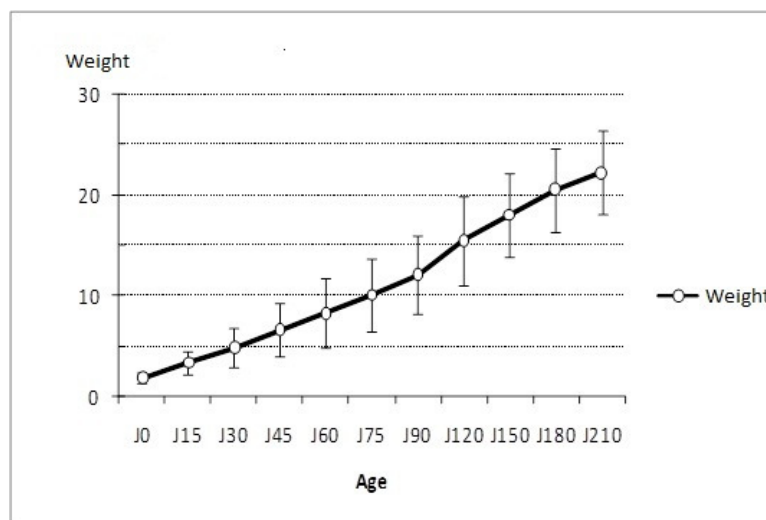


Figure 1: Evolution of the weight of lambs Sahelian

## 5. DISCUSSION

**5.1. Dominant Pathologies:** In this study, the dominant pathologies that may constitute major constraints for the Sahelian sheep breeding in the study area were lameness, animal trypanosomiasis, and diarrheal diseases. These results do not confirm those of Wanyangu and Peeler (1998) and Tchouamo *et al.* (2005) who observed that after diarrheal diseases, it is rather the respiratory diseases, which are responsible for at least 28% of mortality in small ruminants in West Cameroon. According to Mourad and Balde (2008), it is internal and external parasites and incidentally the lack of sufficient care in lambs and kids from 3 to 120 days instead that were the major constraints to small ruminant production. The climate and the experimental conditions

could account for such results. Indeed, according to Andrés *et al.* (2007), good nutrition, better immune status, and better hygiene could help prevent about 15% of deaths caused by diarrheal disease in Merino sheep reared in the South-West of Spain. Quite interesting results obtained in the present study are undoubtedly related to good feeding conditions, hygiene measures, and prophylaxis implemented to significantly reduce morbidity often reported here and there in small ruminants (Gbangbotché *et al.*, 2005; Bath *et al.*, 2005; Roger, 2008; Soulemana, 2008; Fragkou *et al.*, 2010; Bett *et al.*, 2012). The results of this study confirm the observations of Tiema Niaré (2012) who indicates that it is not excluded that in villages, insecure food conditions, alongside



inclement weather conditions, have an impact on the morbidity status and surely on the survival chance of lambs. Helping the lambs keep their stoutness and regular weight gain, food supplementation based on sorghum bran, corn, soybeans and rice, all added to mineral supplements and vitamins contained in the salt lick had undoubtedly contributed immensely to strengthening their resistance, thus limiting the number and prevalence of diseases to a minimum. We argued that health and medical prophylaxis coupled with the utilization of local resources have significantly reduced the spread of infectious, parasitic, and nutritional diseases diagnosed in lambs and their ewes.

**5.2. Viability of Lambs:** In this study, the viability rate recorded from birth to weaning (D90) was 100%. This corresponds to a mortality rate of 00%, significantly lower than the 14% obtained by Doko *et al.* (2012) in Djallonké sheep breeding in Ouaké, a village very close to the study area. The mortality rate is also lower than the 11.7% observed by Missohou *et al.* in West Djallonké sheep in Togo, than the 16.4% obtained by Berhan and Van Arendonk (2006) in Menz and Horro sheep in Ethiopia, than the 17.8% obtained by Gongnet *et al.* (1996) in Fulani-Fulani and Touabire lambs, a race close to Sahelian Fulani sheep in Senegal, and than the 7.18% recorded by Nianogo (2012) in Mossi sheep in the Gampéla experimental station in Burkina Faso. Contrary to the observations by other authors (Gongnet *et al.*, 1996; Fragkou *et al.*, 2010) who reported a high average rate of the total mortality, the period of 0 to 3 and 7 days does not appear in this study to be one where the viability of lambs is most compromised. Average mortality rates have already been reported here and there, at birth, during the first fifteen days, before and after weaning. They have been controversial since the study conditions varied. Therefore, if Fragkou *et al.* (2010) set the mortality thresholds of lambs to 3-5% for successful breeding, this study stands as a model to be made available to agro-pastoralists in the

study area. These results are obtained thanks to an increased surveillance of the lambs, the rigorous observance of hygiene and prophylaxis, and mainly to the utilization of local feed resources (harvesting and processing by-products) to supplement the basic diet whose quantity and quality become hypothetical in the dry season. The deficient and insufficient diet in the dry season, while weakening the lambs, exposes them to diseases. In contrast, food supplements based on various local agricultural by-products associated with vitamin mineral complex, while helping with continuous weight gain, strengthens the ability of lambs to resist environmental conditions. Drug treatment alone is not enough to protect animals for long insofar as very often, the environment is constantly infested with pathogens (Barbara *et al.*, 2006), and the major cause of lamb mortality before weaning is malnutrition (Gongnet, 1996). These provisions support the observations of this study. If greater mortality risks are also reported in primiparous ewes (Gbangboché *et al.*, 2005; Fragkou *et al.*, 2010), it is worth mentioning that all the sheep used here were primiparous whose ages at first calving were between 16 and 18 months. These ages are within the range of 13-23 months required and reported by Gbangboché (2005). Far from being a risk factor, the age at the first lambing of the sheep used in this study influenced the rate of viability obtained. The high rate of viability of the lambs and additional weight gain thanks to feed supplementation should compensate the extra costs of food, prophylactic measures, and hygiene for this semi-intensive system of breeding to be viable. Further economic studies will help clarifying this.

**5.3. Weight Performances:** Taken individually or collectively, a substantial and continuous weight gain in all the lambs in the experiment is observed. The weight analysis indicates that the lambs have a phase of moderate growth, more or less stable during the first three months following their birth, followed by a phase of faster growth from the third to the seventh





month (Figure 1). Correlations between birth weight and monthly weights of the lambs are positive but decreasing with time, especially after the fourth month (D120), that is to say, one month after weaning, the beginning of pasturelands attendance. These results suggest that the average birth weight of a Sahelian lamb under the FARP/ENSTA-Dj conditions was  $1.89 \text{ kg} \pm 0.49$  against  $1.46 \text{ kg} \pm 0.46$  obtained by Doko *et al.* (2012) on Djallonké lambs, 2.9 kg reported by Gbangboché *et al.* (2002) on Sahelian lambs reared on station; 2.1 kg and 2.4 kg recorded by Mukasa-Mugerwa *et al.* (2000), respectively in Menz and Horro sheep in Ethiopia. Such controversial results indicate the effect of genotype. At the weaning at three months, the study also shows an average weight of  $12.05 \text{ kg} \pm 3.89$ , substantially higher than the 7.8 kg obtained by Doko *et al.* (2012) on Djallonké farm lambs. Season of birth may interfere with the contrasting observations, as suggested by Abassa *et al.* (1992) study on the Djallonké lambs at the Kolokopé Center in Togo, who reported that lambs born in November-December (early dry season) are generally more efficient. Evaluating the milk production and weight performances of goats and their kids, Gnanda *et al.* (2005) used a food supplementation made from the local bran and cowpea haulm, as well as a mineral supplementation ad libitum for 14 weeks. They then concluded that with a good mixture of local food resources, one could significantly improve the milk production of the Sahelian goat, a species close to the Sahelian sheep in the dry season. The authors also observed that this improvement becomes significant when a mineral supplementation is associated with the diet. These results, similar to those of this study suggest that a good control of the food system, which includes a better management of natural pasturelands and a food supplementation during the lean period, combined with a prophylaxis and hygiene program help the sheep expressing their zootechnical potentials. This means that the food

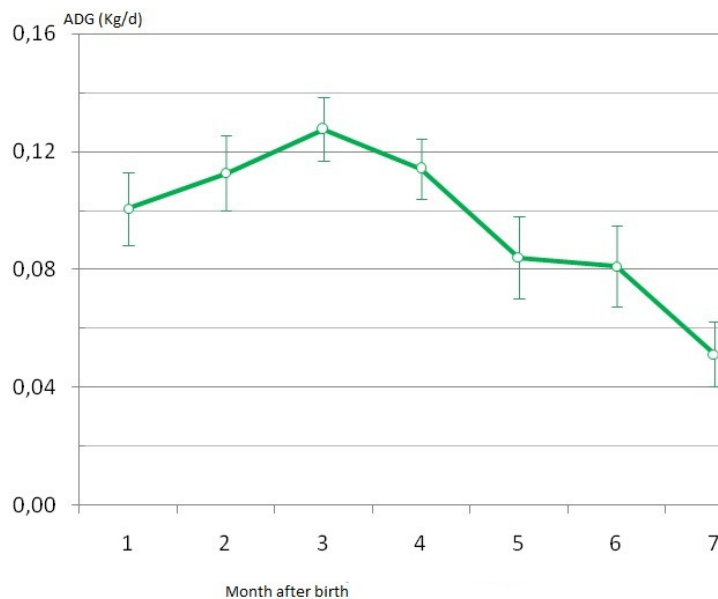
supplementation used here and the minerals contained in the salt lick, led to the improvement of milk production and of the food quality for the lambs. Consequently, there was a spectacular increase of the viability and very remarkable ADG in lambs. Kitchen waste, agricultural and agro-industrial by-products, have been used (Gnanda *et al.*, 2005; Alkoiret *et al.*, 2007; Gnanda *et al.* 2012 Gongnet *et al.*, 2012) to improve the ADG of village-farmed animals. However, if their use were becoming widespread among agro-pastoralists in the study area and over the Sahelian regions, the availability and the nutritional value of the by-products would be the determining factors for sustainable application of this rearing method.

**5.4 Growth Rate:** The growth rate of lambs increased gradually from birth to day 90 with relatively high values (100, 110 and 130 g) ADG. Maximum performance is observed between days 60 and 90. During this period, the average daily gain reached  $130 \pm 40 \text{ g}$ . These results observed during the first three months could reflect both the quality of the nutritional value of the feed, the milk yield of the sheep, and performance of the lambs in the growth phase. They corroborate Roel *et al.* (1999) who, in a diagnostic study conducted on-farm in Burkina Faso reported a cause and effect relationship in the growth of young sheep born to mothers that received food supplementation. A “weaning crisis” was observed after 90 days. This expresses itself through a decline in the growth rate leading to daily average gains, which move away from the 130 g bar at day 90, to reach values of 110 g and 80 g between days 90 and 180. As moderate and transient as it may appear, this slower growth rate characterized by the decreases of the daily average gains noted after three months in all lambs seems to be directly related to the weaning, a period during which one goes progressively from a milk diet to a coarse feed. These results suggest that the critical period for lambs rearing of the FARP is in the months following the weaning. While the weight gain is more or less



sensitive to indicate that the animals continue their growth, the growth rate slows in turn to indicate that the level of quantitative and qualitative needs of production is insufficient. One might think that this is due to the new diet,

the digestive physiology, and the functioning of related organs of the lambs. Individual variations, sometimes very marked, observed both at the level of the evolution of weight and the growth rate is of great interest for the breeding programs.



**Figure 2:** Average daily gain (ADG) of lambs Sahel at different stages of growth

## 6 CONCLUSION

Food improvement based on agricultural by-products, dry processing led to the highest rate of viability, and an accelerated growth during the first three months of the neonatal period in Sahelian lambs in the study area. This study, which has also highlighted an attempt to adapt the Sahelian sheep in the warm and humid region, is worth pursuing in order to collect reliable data likely to initiate a real program of sheep production improvement. Zootechnical results obtained show a significant increase in the sheep production. The expected financial benefit

of a sustained utilization of these various and varied local food resources help anticipate that the gross income of this semi-intensive system of sheep production is a comparative advantage to be in line with the traditional systems. This approach could be an alternative to improve sheep productivity as sheep meat production and the urban consumption thereof will likely augment. These results suggest interesting research for development prospects in animal production in the region.

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