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Performances and efficiency of (peri-) urban pig breeds under different production managements in Ouagadougou, Burkina Faso

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Introduction

Globally, the demand for pig meat is supposed to reach 34.6 million metric tons in 2030, representing a 66% increase from the year 2000 as a baseline. In sub-Saharan Africa the demand will reach 1.1 million metric tons, corresponding to a 155% increase for the same period (FAO, 2011). Within the same period, the urban demand for pig meat will increase by about 235% in sub-Saharan Africa (FAO, 2011). Several pig production systems operate in the vicinity of West African cities and rely on different pig genotypes and production strategies, resulting in different production performances (Fualefac et al., 2014; Kiendrebeogo et al., 2014; Kouamo et al., 2015; Oke et al., 2006). Consequently, the average carcass weight of slaughtered animals is highly variable (D'Orgeval, 1997). Unlike ruminants little is known about the efficiency of pig farming systems in West African cities. Thus, what is the situation of pig breeds' performances and their resource use efficiency in West African cities? We hypothesized that in cities such as Ouagadougou (a typical densely populated and expanding West African capital city), production performances and resource use efficiency are positively correlated to the use of breeds of higher production potential as an attempt towards intensification of livestock production. Consequently, the objective of the current study was to determine production performance and resource use of different pig genotypes under different (peri-) urban husbandry and feeding management systems.

Material and methods

Study site

Our study was carried out in Ouagadougou, the capital city of Burkina Faso, located in hot semi-arid Sudano-Sahelian West Africa. The annual rainfall was 731 and 821 mm in the study years 2014 and 2015, respectively, whereby the rainy season (RS) stretches from May to October. The early dry season (EDS) with lowest temperatures (minima of 14 °C) runs from December to February and the late dry season (LDS) with highest temperatures (maxima of 40 °C) runs from March to May (own records).

Households and animals

Six pig farms were purposively selected after prior clustering of 181 surveyed livestock keeping households, whereby the selected pig farms belonged to two out of the identified four (peri-)urban farm clusters (Roessler et al., 2016). Three of the monitored pig farms kept exclusively local pigs and the three others kept crossbred pigs (imported x local).

Table 1: Number of pigs per genotype and age group at the start of the study

Pig group	Dry f	Lactating f	Pregnant f	Adult m	Young m, f	Suckling m, f
Local breed (n)	5	3	1	0	65	0
Crossbred (n)	5	1	3	0	28	14

n: number of animals, f: female, m: male.

Data collection

Each farm was visited ten times every 6-10 weeks from October 2014 until February 2016. Animal identification (genotype, sex, age group, physiological status) was followed by regular quantification of the animal intake (births, purchases, gifts) and offtake (sales, deaths, thefts) data. Furthermore, body weight development and types, quality and amounts of feed offered at the barn were recorded at each visit, and representative samples of all pig feeds offered were taken. The age groups of pigs were (in months): suckling piglets (<2), young animals (>2-11 for crossbred pigs, >2-12 for local pigs) and adult animals (>11 for crossbred pigs, >12 for local pigs).

Data calculation

Sampled feedstuffs were analysed for dry and organic matter (DM, OM), following standard VDLUFA (2012) methods. Feed nitrogen (N) concentration was determined in a VarioMax® CN analyzer (Elementar Analysensysteme GmbH Hanau, Germany) or Near Infrared Spectroscopy (NIRS) and multiplied with factor 6.25 to obtain the crude protein (CP) concentration. The pre-caecal CP digestibility of all feedstuffs was taken from Feedipedia (2017) or Close and Menke (1986) to calculate the concentration of digestible protein (DP). Metabolizable energy (ME) content of all feedstuffs were taken from the same sources. The daily supply of DP and ME was calculated accordingly. ME and DP requirements for maintenance and growth were calculated using pig-specific values (Ulbrich et al., 2004). To determine the adequacy of energy (or protein) intake in the barn, the daily amount of ME (or DP) supplied was divided by each animal's total individual ME (or DP) requirements. The obtained ratio was called ME (or DP) supply level and was stratified as: adequate energy (or DP) supply (0.8 – 1.2); mild energy (or DP) deficit (0.5 – <0.8); severe energy (or DP) deficit (<0.5); mild energy (or DP) surplus (>1.2 – 1.5) and substantial energy (or DP) surplus (>1.5).

Statistical analyses

Descriptive analyses were computed for herd structure and animal intakes and offtakes. The rank-based non-parametric Kruskal-Wallis test was used to compare animal groups for the different performance related variables. For proportion comparison of the different DP and ME coverage levels the Pearson's Chi-squared test was applied. Logarithmic, polynomial and power functions (not following the biological principles of mammal's growth) were used to depict growth curves. A threshold for significance was set at a p-value of ≤ 0.05. Statistical analyses were done with IBM SPSS Statistics 20.

Results

Offtakes of pigs

The mortality rate was 61% and 14% in local and crossbred pigs, respectively ($p \leq 0.001$), and especially young animals died. For local pigs the mortality rate was influenced by the season and was highest during LDS (50%, $p \leq 0.001$). With respect to marketing, 62% of sales were reported during EDS and LDS in local pigs and crossbred pigs, respectively (Table 2).

Table 2: Animal offtakes for two different pig genotypes in Ouagadougou

	Genotype	Local (n)					Crossbred (n)				
	Season	RS	EDS	LDS	Tot	$p \leq$	RS	EDS	LDS	Tot	$p \leq$
Outflow type	Group										
	Dry sow	5	1	8	14		0	0	2	2	
	Adut male pig	2	0	1	3		0	1	1	2	
Died	Young pig*	12	9	34	55	0.001	3	3	5	11	n.s.
	Suckling piglet*	4	6	9	19		0	1	0	1	
	Dry sow	0	2	2	4		2	1	15	18	
Sold	Adut male pig	0	1	2	3	n.s.	1	2	1	4	0.001
	Young pig*	2	10	1	13		11	7	21	39	

p: p-value, n: number of animals, * male and female, n.s.: not significant, RS: rainy season, EDS: early dry season, LDS: late dry season, Tot: total.

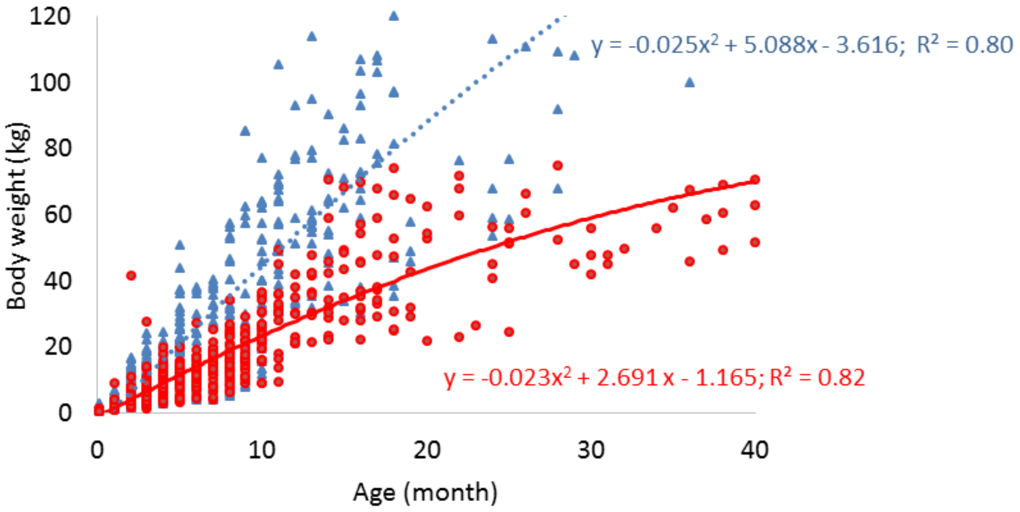

Figure 1: Weight-age diagram for crossbred (CB, blue) and local breed (LB, red) pigs in Ouagadougou, Burkina Faso.

Weight development and feed use efficiency

In Figure 1 the trend lines show that, irrespective of age, crossbred pigs were about 0.5 to two times heavier than local pigs with wide variations. As far as the homestead supply with feed energy (ME) was concerned, the proportion of local pigs experiencing a severe ME deficit was slightly above 50%, whereas adequate and moderate deficit and supply, respectively, concerned each about 25% of the local pigs. In crossbred pigs the proportion of substantial ME oversupply and severe ME deficit situations were highest, together representing almost 90% of the cases (Table 3). The coverage of DP requirements was characterized by a high proportion of severe DP deficit but also substantial DP oversupply supply in local pigs, with a share of about two fifths of the cases for each of the two supply levels.

Table 3: Adequacy of coverage of metabolizable energy requirements (intake (MJ ME d^{-1}) / requirements (MJ ME d^{-1})) and DP requirements (intake (g d^{-1}) / requirements (g d^{-1})) through homestead feeding in local (n=559) and crossbred (n=506) pigs in Ouagadougou, Burkina Faso

			(Over)supply		Deficit	
Breed		Adequate	Moderate	Substantial	Moderate	Severe
Metabolizable energy						
Local breed	% (n)	14.0 (78)^{c}	13.2 (74)^{c}	11.3 (63)^{d}	12.2 (68)^{b}	49.4 (276)^{a}
Crossbred	% (n)	4.7 (24)^{c}	6.7 (34)^{c}	48.4 (245)^{d}	0.6 (4)^{b}	39.3 (199)^{a}
Total	% (n)	9.6 (102)	10.1 (108)	28.9 (308)	6.8 (72)	44.6 (475)
Digestible protein						
Local breed	% (n)	11.1 (62)^{c}	4.5 (25)^{d}	37.9 (212)^{a}	7.9 (44)^{c}	38.6 (216)^{a}
Crossbred	% (n)	2.6 (13)^{c}	2.4 (12)^{c}	55.7 (282)^{b}		39.3 (199)^{a}
Total	% (n)	7.0 (75)	3.5 (37)	46.4 (494)	4.1 (44)	39.0 (415)

Different superscript letters indicate significant differences ($p \leq 0.05$) between levels of coverage of metabolizable energy (above) and digestible protein (below) requirements within the same group (in the same row).

Discussion

Unbalanced feeding and high mortality (often due to poor hygienic conditions and major health care deficits) in local pigs are key weaknesses of Ouagadougou's (peri-) urban pig farming sector. The use of commercial pig feed and fishmeal at low extent is limited to crossbred animals that can be considered to be more intensively managed than local pigs with important farm to farm and seasonal variations (data no shown). When available, brewers' spent grain is heavily used for pigs of both breeds, together with grain (sorghum and maize) residues – a phenomenon observed in most West Africa cities (Mopate Logtene et al., 2014). By suppling local pigs mainly with protein rich feeds, metabolizable energy is the main limiting factor in the animals' diet. Farmers lack the knowledge necessary to supply pigs with appropriate feed quality and quantity for their reproduction and growth requirements (Ayizanga et al., 2018). Resource use efficiency in (peri-) urban pig farms is rather poor, and the genotypes that are used by pig farmers do not express their full potential in the different production systems and can perform better if properly managed.

Conclusions and outlook

In West-African cities such as Ouagadougou, the extensive pig production system is being progressively replaced with an intensive one. Improved crossbreds are increasingly used but farmers lack the necessary knowledge to appropriately feed their pigs. There is a strong seasonal feeding pattern with variation in feeding intensities, frequencies and feed type utilization, resulting in highly variable performances. These practices need to be improved towards resource efficient pig farming involving skillful allocation of feedstuffs, controlled mating (so as to avoid inbreeding), appropriate provision of healthcare and improved farm biosecurity.

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