Multivariate evaluation of the family pig production system in Caála, Angola

M. Chivangulula[1], Verena Torres[2], J. Morais[1], Jefilia Nalissimo Mário[3] and R. Gabriel[4]

[1]*Faculdad de Medicina Veterinaria, Universidad "José Eduardo dos Santos", Angola*

[2]*Instituto de Ciencia Animal, Apartado Postal 24, San José de las Lajas, Mayabeque, Cuba*

[3]*Dirección de la Educación de Huambo, Municipio de Ukuma*

[4]*Sociedad Inovafric, Huambo, Angola*

Email: macachiva@live.com.pt

For analyzing the sustainability of the family pig production system in the community 25 of the municipality Caála, Huambo province, Republic of Angola, in May 2011 a survey was realized to 25 pig producers within the context of a family production system, through which quantitative data was obtained. Small size breeds of slow growth but resistant to local conditions predominate under this system. A non-experimental longitudinal transversal design was applied and the multivariate statistical analysis, specifically that of main components from the correlation matrix between the indicators was used. Weight values of the variables in the components higher or equal than 0.6 were considered, according to the statistical model for impact measuring. Four main components were identified which accounted for 77.45 % of the variability of the system. The main component 1 was that accounting for higher variance, with 39.31 %. Components 2, 3 and 4 accounted for lower variance. Results demonstrate that the system is simple and of little investment. In general, families own from one to three females in extensive way. Water supply to the animals was considered adequate. The quantity of farrowings per year was approximately 1.13. It is suggested to improve the quantity and quality of the feeds; also to systematize veterinary assistance to reduce piglet mortality. It is necessary to work on pig conservation and in the development of the family production system.

Key words: *main components, family production system, pig*

Angola needs to increase animal protein production for covering the population demands. One of the most efficient ways for fulfilling this objective is to develop pig meat production, in view of its high reproduction rate and its adaptation capacity to diverse production and feeding systems. However, for pig rearing it is necessary to create a feeding basis that does not represent competition for humans (MINADER and FAO 2003).

According to Sarcinelli *et al*. (2007), pigs are found throughout the world. Approximately 44 % of the world population consumes its meat. The pig is one of the first animals that have been used as domestic rearing in family rearing systems. Its monogastric stomach, similar to that of man, allows it living and subsisting on leftovers of human food (Schiere 2000).

In Angola, pigs are found in all the national territory, due to its adaptability regarding the climate and feeding regime. It is very important to attain the growth and development of this species to eradicate hunger and to reduce poverty in this nation.

According to MINADER and FAO (2003) reports, the provinces of Namibe, Huambo, Huila and Kuando Kubango show great progress in pig rearing, only the family sector represents more than 95 % of its effective in the rearing of these animals. From this perspective, the family agriculture system is the most indicated for the consolidation of this new agricultural pattern, which will lead to the adjustment of this agriculture model (Veiga 1995). The family production systems are characterized, in their majority, by maintaining practices adapted to a great diversity of cultures (López 2000). Presently, they are facing the limited availability of feeds for the maintenance of breeds (Murgueitio and Calle 1999). From the economical point of view, they are viable and sustainable domestic systems. Also, there is sufficient margin for improving the pig production system, if small-scale resources are used (Kumaresan *et al*. 2009). These systems are characterized by being of low inputs, with the main objective of being source of incomes for the family economy (Kagira *et al*. 2009).

The Angolan government directs part of its activities to the strengthening of this economical line. Credits for agricultural and rural commerce activities will allow that small producers and rural families can increase their production levels through the exploitation of small land plots.

In Angola pig breeds of small size and slow growth predominate which are more resistant to local conditions. Their productivity is low and the mortality rate very high. Pig rearing is destined, generally, to self-consumption (MINADER and FAO 2003). Halimani and Muchadeyi (2012) refer that in South Africa the small producers acknowledge the value of local pigs and they are resolved to conserve them. This group of the population must be taken into account for the design and implementation of conservation programs.

In the municipality of Caála, the pig production system is the traditional family type, since is the group most contributing to pork production. This is a simple system of little investment, in which the families are owners of one or three females. Animals are of small size and are fed with what is periodically supplied, some

supplements are of low nutritive value.

This study was aimed at analyzing the sustainability of the family pig production system in the community 25 of the municipality Caála, Huambo province, in the Republic of Angola, from the analysis of the variability of this productive system.

Materials and Methods

The survey was applied to pig cattle producers in the community of Caála, Huambo province of the Republic of Angola, during May 2011. By means of this instrument was obtained quantitative information on the family pig production system in the region. A database was built for the characterization, diagnostic and identification of the critical points of this type of productive system. As variables were studied the production per producer, water frequency, farrowings per year, litters per farrowing, stillborn piglets, post-weaning deaths, amount of feed, total stay days, agricultural area and total area.

The investigation design was a non-experimental, longitudinal transversal. The statistical analysis was made by the multivariate method; specifically the main component analysis was applied from the analysis of the correlation matrix between the indicators, according to the selection criterion of components with eigen value, higher or equal to the unit ($\lambda \geq 1$) (Hair *et al*. 1999 and Torres *et al*. 2001).

Also, the weight values of the variables in the components (matrix of rotated variables) higher or equal to 0.6 were considered, according to the statistical model of impact measuring (Torres *et al*. 2010). All data were processes through the statistical package SPSS (2006) on Windows 7.

Results and Discussion

Results were related to the correlation matrix. The analysis evidenced that it is not a matrix of identity ($P < 0.001$), and that the KMO was 0.63, indicating an acceptable value (Hair *et al*. 1999).

The analysis of main components concluded that with four main components it is possible to account for 77.45 % of the variability of the system. The main component 1 was that accounting for higher variance, with 39.31 %, according to what was established in the method (table 1). Components two, three and four accounted for lower variance.

Table 1. Total variance explained

Components	Eigen value (λ).	Percentage of the variance	Accumulated percentage
1	4.72	39.31	39.31
2	2.28	19.00	58.31
3	1.23	10.25	68.56
4	1.07	8.90	77.45
5	0.95	7.96	85.41
6	0.59	4.96	90.37
7	0.52	4.31	94.68
8	0.24	2.01	96.69
9	0.19	1.56	98.24
10	0.16	1.32	99.56
11	0.04	0.32	99.88
12	0.01	0.12	100.00

By means of the matrix of rotated components, according to the method Varimax, the most contributing variables to the system were identified (table 2). The variables production per farmer, farrowings per sow, amount of feed and weaned piglets were the indicators of the first main component that accounted for 39.31 % of the total variability, and was labeled as production, feed and water.

The second component accounted for 19 % of the indicators farrowings per year and total stay, with higher negative value labeled as stay and farrowings per year. In the component three, the most important indicators were total area and agricultural area. With lower negative value the stillborns accounted for 10.25 % of the total variability, labeled per areas. Component four was characterized by post-weaning death, with total variability of 8.90 % labeled as post-weaning mortality.

The variable amount of feed of the first component, as well the total area, of the third component, contributed the same information. According to Camelo *et al*. (2008) this will allow the selection of these variables in subsequent studies.

One of the premises for the application of these techniques is the degree of correlation between the variables that must be higher than 40 %. The statistical processing of all the case studies was carried out through the model for measuring the impact of innovation or technology transfer in the agricultural field (Torres *et al*. 2008). The variables measured had a degree of correlation higher than 50, which is considered adequate (table 3).

According to reports of MINADER and FAO (2003), pig farmers generally contribute between one and three litters. These data are in agreement with the amount of animals that each family own which are, approximately, between three and six. According to Halimani and Muchadeyi (2012), the number of adult pigs contributes to the efficiency of pig production. The production has positive effect on family incomes and to the reduction of poverty (Assa 2012). The amount of water supplied to a pig litter varies between 5.08 to 10.46 L daily, a parameter that is considered adequate. Alonso and Rodríguez (2001) refer that needs for water intake vary in a wide range that has to do with the quality of the diet, physiological condition of the animal, weight and climatic factors. Restrictions between two and six liters of water are established for each 45 kg of weight.

Also results demonstrate that with this local breed it was possible to obtain from three to five litters per

Table 2. Matrix of main components

Variables	Main components			
	CP1	CP2	CP3	CP4
Production per farmer, u	0.81	0.26	0.19	0.22
Water frequency, kg	0.61	0.08	-0.08	-0.56
Farrowings per year	0.33	0.76	0.00	0.16
Litters per farrowing, u	0.72	0.44	-0.39	0.10
Weaned litters, u	0.71	0.44	-0.04	0.30
Stillborns, u	0.37	0.08	-0.65	-0.08
Farrowings per sow, u	0.84	0.10	-0.19	-0.01
Post-weaning mortality, u	0.12	0.00	0.21	0.87
Amount of feeds, kg	0.88	0.04	-0.01	-0.20
Total stay, month	-0.08	-0.92	0.05	0.24
Total area, ha	0.16	0.16	0.88	0.03
Agricultural area, ha	-0.08	-0.26	0.72	0.38

Table 3. Descriptive values of the components

Feed production and water		
Variables	Means	Typical deviation
Production per farmer, u	5.33	3.34
Water frequency, kg	10.46	5.08
Litters per farrowing, u	4.92	3.30
Weaned litters, u	3.08	2.47
Farrowings per sow	0.88	0.99
Amount of feeds, kg	7.54	5.55
Stay and farrowings per year	Means	Typical deviation
Farrowings per year, farrowing/year	1.13	0.61
Total stay, month	3.33	0.48
Areas	Means	Typical deviation
Total area, ha	2.08	0.65
Agricultural area, ha	1.67	0.48
Stillborns, u	1.58	1.93
Post-weaning mortality	Means	Typical deviation
Post-weaning mortality, u	0.25	0.44

farrowing, if it is considered that we are dealing with rustic animals living practically wild for hundreds of years and that traditionally have as average five to six piglets per farrowing.

The amount of feed supplied to the pigs at the different ages was considered low, since intervals of 5.55 to 7.54 kg were obtained, taking into account that the farmers can have litters from 1 to 13 piglets (Alonso and Rodríguez 2001), and that the average consumption of piglets is of 2.70 kg. According to Nath *et al*. (2013), the majority of the pigs is reared under intensive systems and fed home cooked food (kitchen residues and local available plants). Carter *et al*. (2013) reported that the utilization of local available foods allows using efficiently the resources, promote sustainable pig production and improve the means of support of small farmers.

Pre-farrowing sows and those with one, two, three, four and five days of farrowing until weaning had an average feed consumption of 5 kg/d. Empty sows, covered sows (5 weeks) and gestating (6-12 and 13-16 weeks) consumed as average 3 kg/d. The amount of farrowings per year was of 1.13. Following the criteria of Alonso and Rodríguez (2001), one sow with a farrowing for 1.4 years is not considered good for rearing. However, litter mortality was of one to two

animals per farrowing. Lobago *et al*. (2006) reported high mortality rate before weaning.

Presently, a more detailed research is required for identifying and quantifying the specific reproductive disorders and the interacting factors associated to these little satisfactory results. Also studies directed to determine the causes and factors engaged with this high mortality must be carried out. In that respect, Halimani and Muchadayi (2008) stated that piglet mortality is the main cause of the losses of the herd. It is important to improve the quality and quantity of the feed. Also it must be borne in mind, the veterinary assistance to reduce litter mortality and to conserve the pigs in the locality. In this context, it is necessary to intensify the work for developing these systems of family production. It is suggested to continue studies on family systems for guaranteeing the feeding security of the country.

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