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Evaluation of reproductive and production performance of Nicobari pig under humid tropical island ecosystem

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ABSTRACT

Nicobari pig is semi-feral, reared in free-range system with very low level of management. However, its population has been significantly reduced due to and after Tsunami in 2004. No systematic study has been conducted to explore the production potential of Nicobari pig. Therefore, a systematic comparison study was conducted between intensive and free-range system on growth and reproductive parameters in ICAR-CIARI, Port Blair. Reproductive parameters like age at first mating in male and age at first oestrus, oestrus cycle duration, oestrous duration, age at first mating, age at first farrowing, farrowing interval, litter size at farrowing and weaning, litter weight, still birth and mortality were recorded. Growth parameters like body weight at birth, at weaning and at months 3, 6 and 9 were recorded. Results revealed that significantly higher body weights at months 3, 6, 9 and 12 were recorded under intensive than in free-range system in male and female pigs and in male than in female. Non-significant differences was observed in the reproductive parameters in pigs between the two systems except parameters like oestrous cycle duration was higher and age at first mating, stillbirth and mortality were lower significantly in pigs under intensive system than in free range system. It was concluded that growth and reproductive performances of Nicobari pigs reared under intensive system has significantly higher beneficial than in free-range system.

Keywords: Free range system, Intensive system, Nicobari pig, Reproductive and growth performances

Andaman and Nicobar group of Islands are endowed with immaculate flora and fauna biodiversity (Kundu *et al.* 2010). Among the indigenous livestock, pig occupies 27.26% of the total livestock in Andaman and Nicobar Islands (Kundu *et al.* 2017). Nicobari pig is under threat of extinction and immediate conservation effort is necessary (De *et al.* 2014). Till 2012, this breed received very little attention and no systematic documentation was made. This breed has been registered as an Indian recognised pig breed (INDIA PIG-3300-NICOBARI09005). Genetic diversity was very high as compared to European breeds (De *et al.* 2014). Nicobari pig breed is well adapted and has high tolerance to various tropical adverse environments. Nicobari pigs are natural scavengers and size is from medium to large with low reproductive and growth performance. Nicobari pig breed is highly preferred among the tribals, it is a good source of protein supplement to them and also it helps to improve their family income. People of Nicobar group of Islands consume 70% of the pork produced in Andaman and Nicobar Islands while the rest of the islanders consume 30% of pork (Livestock Census, 2012). In spite of high scope for swine production in the Andaman and Nicobar Islands, systematic study has not been reported on the productive and reproductive performances of these animals. Reorganisation and rearrangement of this pig breed is significant for its conservation, preservation and propagation. Efforts have been made to conserve this breed outside its breeding tract with different management condition. The objective of the study was to evaluate the different reproductive and growth parameters under intensive system in comparison with free range system in Andaman and Nicobar Islands.

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MATERIALS AND METHODS

The present experiment complied with all relevant institutional and national animal welfare guidelines. Nicobari pigs (6) were procured from Car Nicobar, the breeding tract of Nicobari pig in the month of July, 2015 and reared under intensive condition in the Institute farm of ICAR-CIARI, Port Blair. Standard management practices were followed for these pigs. The experiment was continued till all the gilts farrowed and subsequent weaning of the new born piglets. Different reproductive parameters like age at first mating (days) in males and age at first oestrus (days), oestrous cycle duration (days), oestrous duration (h), age at first mating (days), age at first farrowing (days), gestation length (days), farrowing interval (days), litter size (no.) at farrowing (days), litter weight (kg), litter size (no.) at weaning in females, stillbirth (no. per sow) and mortality (no. per sow) were recorded (Table 1). The growth

Table 1. Reproductive attributes of Nicobari pigs of Andaman and Nicobar Islands

Age at first mating in male	The actual days from the date of birth to the date of first mating in male
Age at first oestrus	The actual days from the date of birth to the date of first oestrus in female
Oestrus cycle length	Total duration of oestrus cycle length
Oestrus duration	Total hours of duration of oestrus period
Age at first mating in female	The actual days from the date of birth to the date of first mating in female
Gestation length	The sum total number of days from the date of mating to a gilt/sow till the piglets were born (pregnancy period)
Age at first farrowing	The actual days from the date of birth to the date of first farrowing
Farrowing interval	Total number of actual days between the intervals of two farrowings (from the day of one farrowing till the day of next farrowing)
Litter size at farrowing	Total number of piglets born for each individual female in a farrowing
Litter weight at birth	The sum total weight of piglets in a litter at farrowing by weighing the total born piglets by placing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Litter size at weaning	Number of piglets weaned after completion of 8 weeks (60 days) was recorded and the total number of live piglets weaned in a litter was included in the present study.
Weight at birth	The weight of piglet at farrowing by weighing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Weight at three months	The weight of piglet at three month age by weighing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Weight at six months	The weight of piglet at six month age by weighing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Weight at nine months	The weight of piglet at nine month age by weighing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Weight at twelve months	The weight of piglet at twelve month age by weighing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Stillbirth	The piglets which were expelled dead at birth were designated as still birth. The percentage for still birth was calculated as the number of stillborn piglets divided by the total number of piglets born multiplied by 100
Mortality rate	The percent mortality was calculated as number of dead piglets till weaning divided by the total number of piglets born multiplied by 100

performances of the new born piglets were also recorded. The body weights (kg) at birth, weaning, months 3, 6, 9 and 12 were recorded. Productive and reproductive data was collected through filed survey under field condition in different villages of Car Nicobar islands. The study farms were selected with the assistance of local field veterinarians and tribal captains of respective villages. Statistical analysis of the data was done as per standard procedures. Student "t" test was conducted to assess the significant difference between the two rearing systems (Statistical Analysis System for Windows, SPSS (Version 10) Inc., Chicago, Illinois, USA). Tables were presented with the non-transformed data. The values with $P< 0.05$ were considered to be statistically significant.

RESULTS AND DISCUSSION

Productive and reproductive data are important to explore the potentiality of the breed. Hence, this study was designed to record the productive data in a scientific way. Nicobari pigs are maintained under free range condition and fed with locally available resources like root crops and coconut. Pigs are not fed with energy rich grains and concentrate feeds. Hence, the growth rate was found to be poor. Productive and reproductive performance of Nicobari pig was evaluated under intensive system of management for the first time. Growth performances observed in the study were comparable to the performances of other breeds, when maintained in an intensive system (Nath *et al.* 2013, Phengsavanh *et al.* 2010). De *et al.* (2014) reported on the basis of the survey with the tribal farmers, the mean age at first farrowing (months), litter size (no.) and farrowing interval (months) were 10.8±0.8, 6.8±0.4, and 8.3±0.4, respectively for the Nicobari pigs maintained under free range condition (Table 2). In the present experiment, the observations were comparable with the earlier report of De *et al.* (2014). Kadirvel *et al.* (2013) also reported similar weaning litter size in the non-descript pigs reared in North-Eastern India. Litter size at birth and weaning varied widely (Kumaresan *et al.* 2009) under small-holder production system. In the present experiment, the age at first oestrus, duration of oestrous and age at first mating also recorded and found to be lower than the data available with the exotic breed of pigs. However, no significant differences in other reproductive parameters (age at first oestrus, oestrus

duration, age at first farrowing, gestation length, farrowing interval, litter size at farrowing, litter weight and litter size at weaning) were observed between the two systems of rearing.

Age at first mating was significantly ($P<0.05$) differed between the systems of management. Non-significant difference in age at first mating of male and significant difference in female was observed between the two rearing systems. Animals belonged to free range field system had significantly ($P<0.05$) higher age at first mating than at farm level which was in agreement with Das and Karunakaran (2000–03). Moreover, Chauhan *et al.* (1994), Raju (1998), Phookan (2002), Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) had reported delayed age at first mating in Indigenous Indian pigs. However, Babu *et al.* (2004) recorded age at first heat was as 176.67 days. The variation in the age at first fertile mating may be due to the variation in genetic makeup and genetic variation among the indigenous swine in various geographical region of India and also variation in nutrition level, body weight, social environment, temperature humidity index (THI), season of the year, breed characteristics, prevalence of different diseases or parasitic infestation along with the system of management practices (Table 2). On statistical analysis, non-significant ($P>0.05$) differences was observed between the free-range and intensive system of management (319.20±4.25 vs 301.70±2.4) for age at first farrowing of Nicobar pig. Das and Karunakaran (2000–03), Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) observed similar result with the present investigation. On the contrary, significantly higher values were observed by Das and Mishra (1992), Raju (1998) and Phookan (2002) for age at first farrowing in Indian indigenous pigs. However, Chauhan *et al.* (1994) reported significantly higher age at first farrowing for the indigenous pigs. Similarly, Bendanganger *et al.* (2008) has also been reported a comparatively lesser age at first farrowing for the indigenous local pigs (Table 2).

The gestation length of the local pigs did not differ between the two management systems. Gestation length in present study was in range with Irgang and Robinson (1984), Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016). However, Das and Karunakaran (2000–03) reported higher value than the present study. The variation may be due to differences in the breeds, management system, climatic condition and THI of the geographical location. Farrowing interval in Nicobar pigs was not significant differed between the systems of rearing. Similar farrowing interval was reported by Irgang and Robinson (1984) and comparable with Shostak *et al.* (1990). However, the present reports revealed higher farrowing interval as compared to reports from Das and Karunakaran (2000–03), Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) (Table 2).

Litter size at birth between the management systems had non-significant effect (Table 2). This was in agreement with Singh *et al.* (1990) and Mukhopadhyay *et al.* (1992). However, current result has higher value than the observations by Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) in Nagaland indigenous pig. On the other hand, it was lower than the observations of Lakhani and Bhadouria (1991) and Chauhan *et al.* (1994). However, similar value was observed in Indian indigenous pigs under unorganized farm (Bendanganger *et al.* 2008). Moreover, Babu *et al.* (2004) reported a higher average litter size at birth. Parameters such as type of pigs, management practices, mortality and morbidity rate and prevalent of different diseases and infections, climatic condition and THI might be the reasons for this variation.

Table 2. Reproductive parameters (Mean±SEM) of Nicobari pigs

Reproductive parameter	System of management	
	Intensive	Field Level
Males		
Age at first mating (days)	156.30±2.08	143.1±2.11
Females		
Age at first oestrus (days)	160.10±6.83	173.6±2.91
Oestrus cycle duration (days)	26.00±0.22[a]	21.01±0.20[b]
Oestrus duration (hrs)	66.00±0.44	88.56±3.57
Age at first mating (days)	160.00±5.77[a]	188.10±2.41[b]
Gestation Period (days)	114.64±0.23	116.12±0.11
Age at first farrowing (days)	301.70±2.4	319.20±4.25
Farrowing interval (days)	226.00±6.20	242.40±4.84
Litter size (No) at farrowing	6.50±0.34	7.19±0.18
Litter weight (kg) at birth	0.83±.29	0.79±0.71
Litter size (No) at weaning	5.33±0.33	5.23±0.14
Litter weight at weaning	31.28±3.19[a]	24.52±3.15[b]
Stillbirth (No. per sow)	0.20±0.01[a]	0.59±0.04[b]
Mortality (No. per sow)	0.22±0.08[a]	0.68±0.02[b]

Figures with same superscript (a, b) do not differ significantly ($P<0.05$) in rows.

Systems of management did not exert significant effect on litter size at weaning in Nicobar pigs (Table 2). Weaning litter size was within the observed range of Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) in Nagaland indigenous pig. However, significantly higher average litter size was at weaning by Chauhan *et al.* (1994) and lower values by Lakhani and Bhadouria (1991), Singh *et al.* (1990), Das and Mishra (1992) and Mukhopadhyay *et al.* (1992) in different breeds of pigs.

Systems of management did not reveal a significant effect on litter weight at birth, still intensive system have higher birth weight (Table 2). Das and Karunakaran (2000–03) and Singh *et al.* (1990) observed significantly higher litter weight at birth. Similarly, Das and Mishra (1992), Mukhopadhyay *et al.* (1992), Chhabra *et al.* (1996), Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) reported relatively higher values than in present investigation. The variation in the litter

weight at birth and at weaning may be due to management variation in the Nicobari pig of different region.

System of management showed significant effect on litter weight at weaning in Nicobar pigs (Table 2). Litter weight at weaning of Nicobari was in agreement with the results of Chusi *et al.* (2015a), Chusi *et al.* (2015b), Savino *et al.* (2015) and Savino *et al.* (2016) in Nagaland indigenous pig. Pigs reared in intensive management have significantly higher litter weight than in free range system of rearing. Litter weight at weaning found significantly lower than the reports made by Das and Mishra (1992) and Chhabra *et al.* (1996) and higher values than the observations by Singh *et al.* (1990) and Mukhopadhyay *et al.* (1992).

Still birth revealed significant effect on systems of management in Nicobar pigs. Stillbirth and mortality were significantly ($P<0.05$) higher in free range than in intensive system of rearing (Table 2). This result was in agreement with the observations of Gupta *et al.* (1982). However, the results of the present study revealed lower values than observations made by Raju (1998) with pre-partum still births percent of 9.52%. On the other hand, higher values were reported than the observations made by Svendsen (1980) and Shrestha *et al.* (1984). Locality played significant effect on mortality rate in Nicobari pigs. Mishra (1987) reported higher mortality rate than in the present study. The variation in the mortality per cent might be due to the variations in the management system and also prevailing diseases and parasitic infection and infestation (Table 2).

Body weight at birth was not differed significantly, whereas, it was differed significantly ($P<0.05$) at months 3, 6, 9 and 12 between the genders and between the systems of management. Significantly higher body weights at months 3, 6, 9 and 12 of age were recorded in pigs under intensive condition than in free range in both male and female. The result revealed that birth weight did not differ significantly between male and female and between the two systems of rearing, whereas, the body weight at months 3, 6, 9 and 12 was differed significantly ($P<0.05$) between the genders in intensive system and at month 12 in free range system. However, non-significantly higher body weight was observed in male than in female in free range system for the Nicobari pigs at birth (Table 3 and Fig.1.). Deo *et al.* (1992) and Phookan (2002) reported comparatively lower and Pandey *et al.* (1997) and Kalita *et al.* (2001) reported comparatively higher birth weight than the report in the present study. Singh *et al.* (1990) reported higher weaning body weight than the report of the present result. Deo *et al.* (1992) also observed higher average adult body weight than the present results. Lower average adult body weight was might be due to the variations in genetic makeup and differences in management system. Nicobari pigs were statistically significant ($P\leq0.05$) on body weight at weaning and at months 3–12. Animals belonging to intensive system had significantly higher body weight than at free-range system. Difference in body weight was due to possibilities of existence of disparity in genetic combination

Table 3. Body weight in kg (Mean±SEM) of Nicobari pig under intensive and farmer's field condition

Age	Sex	System of management	
		Intensive	Field level
Birth	Male	0.86±0.05	0.81±0.06
	Female	0.81±0.09	0.79±0.07
Weaning	Male	6.56 ± 0.27^{aA}	4.95±0.15
	Female	5.17 ± 0.12^{B}	4.42 ± 0.13^{b}
3 months	Male	8.32 ± 0.14^{aA}	6.47 ± 0.10^{b}
	Female	7.17 ± 0.17^{aB}	6.15 ± 0.15^{b}
6 months	Male	50.00 ± 0.20^{aA}	28.39 ± 0.30^{b}
	Female	42.27 ± 0.32^{aB}	26.47 ± 0.22^{b}
9 months	Male	64.00 ± 0.27^{aA}	38.39 ± 0.34^{b}
	Female	54.60 ± 1.07^{aB}	36.57 ± 0.54^{b}
12 months	Male	77.50 ± 0.29^{aA}	43.06 ± 0.74^{bA}
	Female	66.90 ± 1.08^{aB}	40.95 ± 0.78^{bB}

Figures with same superscript (a, b) do not differ significantly (P<0.05) in rows. Figures with same superscript (A, B) do not differ significantly (P<0.05) in columns.

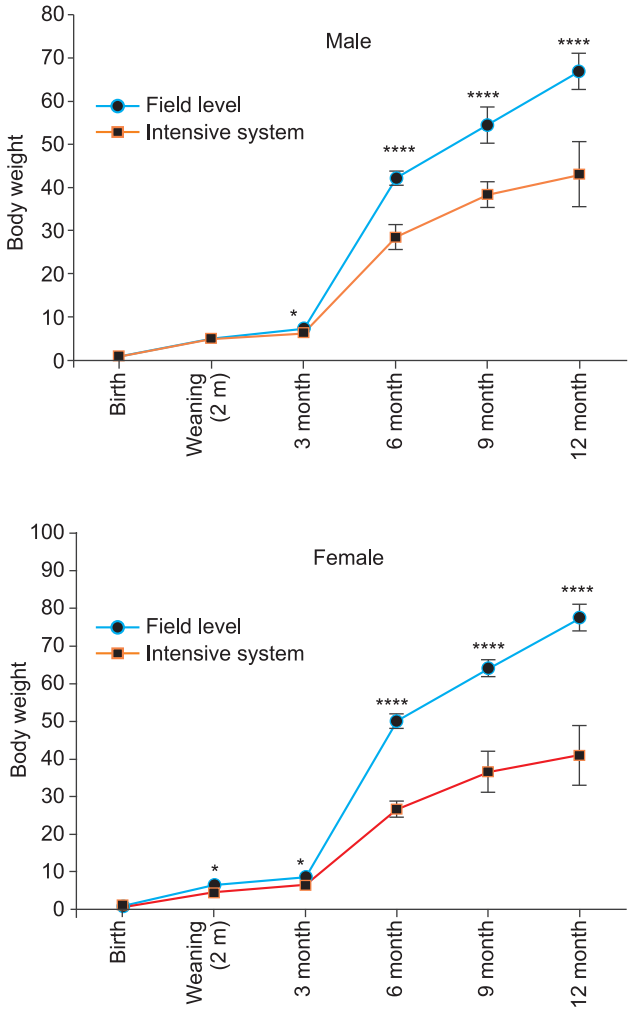

Fig.1. Body weight (Mean±SEM) of Nicobari pig under intensive and farmers field condition.

between two groups of pigs. Based on the low live weight and poor growth performance, Nicobari pig breed is smaller than the exotic and its crossbreds which may be due to genetic variation among the pig breeds. Similar report was observed in Ghoongroo pigs in India (Pan *et al.* 2005), Tanzania indigenous pigs (Mbaga *et al.* 2005) and Mexican hairless pigs (Lemus *et al.* 2003). This variation may be due to genetic, different environmental factors like climate, nutrition availability and management practices. However, the present study result was in agreement with the observations of Holness (1991). Smaller size of Nicobari pigs may have a greater capability to survive under the harsh environmental conditions and diseases than larger size as part of the evolutionary adaptation to the conditions of low-input production in the rural village areas (Lekule and Kyvsgaard, 2003). Nicobar pigs have great potential to contribute significantly to the indigenous pork industry of Andaman and Nicobar Islands based on their valuable source of meat and secondary income to the rural economy. These growth performances may be useful in selection of breeding stock for improvement of pork production in its home tract of Nicobar and other islands of Andaman and Nicobar Islands.

The growth and reproductive performances of Nicobari pigs reared under intensive system of rearing are better than in free range system. This pig breed is well adopted and suitable for intensive system of rearing.

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