



Phenotypic characterization and performance evaluation of Wak Chambil: A unique indigenous pigs of north east region of India

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ABSTRACT

Wak Chambil pig is one of the unique and well adapted indigenous pig reared under low input backyard production system in the eastern Himalayan hill ecosystem. The present study was conducted in different districts of Garo hills division which consisted of North, East, South, West and South West Garo hills of Meghalaya. The objective of the current study has been made to identify the geographical distribution, breeding habitat, phenotypic and productive characteristics of the Wak Chambil pig. A survey was conducted from August, 2019 to March, 2021 and information on production system was collected from 250 Wak Chambil farmers across 28 villages were interviewed for evaluation of existing production system by providing structured pre tested questionnaire and visual observation. It was observed that pigs were small sized with mostly a mixture of black and white colour. Their well-built compact body structures with short limbs, small head, small eyes, medium snout, small erect ears, small hooves that touch the ground less frequently, as well as their pendulous belly make them unique among other pig breeds. The average body weight of adult (10 months) pig was 34.63 ± 2.02 kg. The average body length, height at withers, heart girth and neck girth at adult age (10 months) in pigs were 59.16 ± 1.04 cm, 41.26 ± 1.75 cm, 59.24 ± 1.81 cm and 52.92 ± 1.75 cm in male and 55.35 ± 1.83 cm, 40.71 ± 1.61 cm, 54.67 ± 1.72 cm, and 48.61 ± 1.65 cm in female, respectively. The average age at first heat, age at first conception, age at first farrowing and gestation period of Wak Chambil pigs were 198.28 ± 0.67 days, 239.82 ± 0.39 days, 341.00 ± 0.61 days, 110.26 ± 0.52 days, respectively; while average litter size at birth and litter size at weaning were found to be 5.5 ± 0.73 days and 4.5 ± 0.91 days, respectively. These pigs are having smaller body size, adequate growth rate and lower litter performance as compared to the other indigenous pigs of north eastern region. It can be concluded that the Wak Chambil pig of Meghalaya possesses unique physical, reproductive, and productive characteristics which distinguish it from other indigenous breeds of pigs in the region.

1. Introduction

The North-Eastern region of India is one of the major biodiversity hotspot in the world. In addition to its plant diversity, the region also lends itself to a huge variety of animal genetic resources. In Meghalaya, about 80% of livestock is dispersed among marginal, small, and medium landholders, and 81 percent of people rely on agriculture for their livelihood. Different breeds signified genetic diversity in

their phenotype in terms of productivity, adaptability, and longevity in a number of agroclimatic conditions and throughout a large geographical area. On the other hand, the animal genetic resources are still underutilized and not being suitably conserved. Twenty percent of the globe's 7616 livestock breeds are endangered or extinct and the extinction of this breed could pose a serious challenge to feed a growing population in the near future (FAO, 2007). In general, the

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people of this region have an integrated subsistence low input tribal production system, where livestock and poultry play complementary roles in improving their socio-economic conditions and livelihoods.

The total livestock and poultry population of this region is about 87.14 million, which includes 13.31 million cattle, 0.51 million buffalo, 0.37 million sheep, 5.40 million goat, 4.24 million pig, 17 thousands horse and pony, 7 hundred mule, 9 hundred donkey, 33 thousands yak, 0.38 million mithun and 69.22 million poultry (Anonymous, 2019). Among them, 25.07 % are indigenous population and remaining is crossbred population. Although there are 202 registered breeds of livestock and poultry in India, but this region has only 19 registered breed which include two cattle, one buffalo, two goats, two sheep, four pigs, two horses, one yak, four chickens and one duck breed (NBAGR, 2021). Out of the eight registered pig breed of India, four belongs to north eastern region, namely Niang Megha, Tenyi Vo, Doom and Mali (NBAGR, 2021). This regions overall pig population is 3.95 million, accounting for 38.5 percent of the country's total pig population (Anonymous, 2019). The tribal farmers in the region maintain a variety of nondescript animal that are categorized as indigenous local. However, farmers usually neglect the populations of these indigenous local breeds due to their low productivity, despite their adaptation to low-input agroecosystems.

The diversity of domesticated pig was developed due to years of evolution within a specific niche as a result of adaptation and selection. These pig genetics resources are playing vital role in food and livelihood security of the people and maintaining genetic diversity in the ecosystem. These indigenous pigs are able to survive and reproduce in adverse agro climatic condition even in low or/and zero input production system. These indigenous local pigs reared by tribal farmers are yet to be explored, characterized and documented. Among the indigenous local pigs, one important pig known as Wak Chambil pig are very popular in this region. However, there is no information available on productivity, geographical distribution and characteristics of the Wak Chambil breed of Meghalaya. Therefore, the present study was made to assess the phenotypic characteristics of Wak Chambil pig by evaluating their physical traits, production performances, breeding habitat and management system. Hence, genetic improvement plans may be designed to enhance the productivity, and registration of this breed population can be done.

2. Materials and Methods

2.1 Study area, sampling pattern and population distribution

In order to locate their geographical distribution and population status, the survey was conducted in different districts of Garo hills division which consisted of North, East

South, West and South West Garo hills, Meghalaya. The geographical location of the study place lies between 25°30'N latitude to 90°20'E longitude. The Garo hills, which are located in the western part of the plateau at lower elevations, experience high temperatures of 22°C to 30°C for most of the year. There are warm temperatures between 7°C and 25°C throughout the year and a humidity level between 55-87%, and the area experiences about 1,150 cm of rainfall annually.

The survey was conducted from August, 2019 to March, 2021. The primary data was collected from 250 Wak Chambil farmers across different districts of Garo hills of Meghalaya. Stratified sampling was performed in each district through a two-stage process. At least two villages from each block within each district and two pig farmers within each village were chosen on random basis for the study. The information on rearing pattern, feeding and breeding management, flock size and its structure, reproductive performance and disease prevalence of Wak Chambil pigs were collected by providing structured pre tested questionnaire to the farmers and visual observation. The market demand of this variety was also assessed by interviewing the butchers randomly. The secondary data was collected from the state veterinary dispensary, government of Meghalaya near by the respective area of investigation.

2.2 Phenotypic characterization and performance evaluation

The phenotypic characteristics of Wak Chambil pigs such as physical traits viz., body/hair coat colour, ear orientation, snout pattern, belly type and top line; body measurement traits viz., body length, height at withers, heart girth, neck girth, and bristle characteristics such as bristle density, bristle length, bristle diameter, and bristle yield, were measured at various ages. Different body measurements were taken with measuring tape according to the guidelines of the Food and Agriculture Organization (FAO, 2012). All pigs were properly restrained in their natural positions on plain ground during measurements, and the measurements were taken in duplicate to eliminate the possibility of errors. The growth traits such as body weight at different age (birth, weaning, 4 months, 6 months, 8 months and 10 months) were recorded. Data were collected from 299 pigs which include 260 pigs (112 male and 148 female) for body weight and measurement traits, 27 sows for reproductive and litter performances traits and 12 adult pigs (6 male and 6 female) for study of bristle characteristics. A digital electronic balance was used to measure the body weight of the studied animal. The reproductive and litter performance traits such as age at first heat, age at first conception, age at first farrowing, farrowing rate, gestation period, farrowing interval and number of piglets produced per sow per year were also recorded and evaluated in the present study. For the

collection of information on reproductive traits and litter performance, pigs with at least one farrowing were randomly selected. Survey was conducted with butchers from weekly markets of different districts to collect data on carcass quality, demand, slaughter age and weight at slaughter of Wak Chambil. The description of different body measurement traits, reproductive parameters and bristle characteristics were described in Table 1 .

2.3 Statistical analyses

The recorded data were analyzed using the SPSS computer package (SPSS, 2001) and expressed in mean±standard error. The student's t test was conducted to determine statistical significance ($P<0.01$) for the effect of sex on body weight and body measurement at different ages and bristle traits.

3. Results and Discussion

3.1 Distribution and population intensity

The present study revealed that the home tract of Wak Chambil is mostly distributed in different districts of Garo hills of Meghalaya. According to the Garo tribe these pigs are locally known as “Wak Chambil”, wak means pig in garo language and Chambil is a fruit scientifically known as *Citrus macroptera*. This pig acquired such name due to the resemblance of its belly to the round shape of this fruit. It is also known by other names like Garo wak or desi pig. The population density was found highest in West Garo hills and lowest in South West Garo hills district. Some of the villages with Wak Chambil population are Amindagre, Adingre and Jengjalgre in West Garo hills. People also reared other pig breeds, generally crossbreeds, which they referred as wakma meaning pigs having high body weight. The Wak Chambil population has been recorded as 620 numbers in Garo Hills. These pigs are found in interior villages of East Garo hills, West Garo hills, North Garo hills, South Garo hills and South West Garo hills.

3.2 Production system

The present study revealed that Wak Chambil is mostly reared in backyard system. Mostly farmers rear only 1-3 pigs, solely for their own household purpose. In the north eastern region, pigs reared in backyard production systems are the most common practice (Kadirvel *et al.*, 2013). Housing also included low enclosures or pig sty made with locally available materials like bamboo, wood, etc. Some farmers also reared pigs in concrete structures with low walls with no standard space requirement. It was found that a similar type of housing pattern was used in the rearing of the Bareilly desi pig (Boro *et al.*, 2018; Kadirvel *et al.*, 2013). One unique way of rearing pigs by farmers were tied rope in their girth and tethered to a tree. No specific housing was provided to the

pigs reared in girth tethering system. Rearing pig by girth tethering system in Bareilly desi pigs (Boro *et al.*, 2018) and native pig of Bangladesh (Ritchil *et al.*, 2013) has already been reported in small holder production. The herd size ranges from 1 to 4 in backyard earthen housing, 2 to 4 slatted floor housing, 2 to 6 concrete floor housing and 1 to 2 girth tethering system. Herd size in backyard and girth tethering and slatted housing system was found to be small as marginal and small farmers prefer these systems. Despite that, a wide range of herd sizes were observed in concrete floor housing system, which is primarily preferred by large and medium sized farmers.

Majority of the farmer reared Wak Chambil for fattening purpose which is similar with other indigenous pigs of this region as reported earlier (Kadirvel *et al.*, 2013). Preference of the farmers in fattening pig production might be due to lack of availability and higher maintenance of cost of high quality breeding boar. The shortage of breeding boar could be due to early castration of male piglets due to high demand of pork in this region. In some cases, pigs were purchased by village trader from producers and supplied to retailer or butcher. Transportation of the pigs was done in a structure made of single bamboo known as “wakhop” in garo meaning basket for carrying pig. Both piglets and adult pigs were placed comfortably in the basket and effortlessly carried to the weekly market. Usually pigs are slaughtered after 12 months of age. There is a great demand of the offals in the market and no portion of pig is left out unconsumed except for the eye balls, teeth, hairs and hooves. The price of pork per kg is Rs. 350/- while the piglet cost around Rs. 2500-3500/- after weaning and the cost of adult pig ranged from Rs. 7000-8000/- depending on the size.

3.3 Physical characteristics and body measurement traits

Wak Chambil is small sized pigs with mostly a mixture of black and white colour (30%). About 70 % of the pigs were found to be white with black spots. Their body weight range from 25-30 kg in adults. They have small head, small eyes, medium length snout and small erect ears. A pendulous belly is observed in aged animals, especially in females. Generally, males are smaller in size than females. They have a compact body and short limbs. Top line is almost straight in both sexes; however, it became gradually concave with the advances of age. The bristles are long and dense and they are also found to be present on the face. The surface area of the hoof touching the ground is lesser as compared to that of Niang Megha as the dew claws are raised. The female pigs have 6 to 8 pairs of functional teats spread over the mid ventral line. Other indigenous pig breeds found in north eastern region of India are aggressive in nature and having long snout with long bristle (Banik *et al.*, 2016).

The different body measurement traits of Wak Chambil at different age's viz., birth, weaning, 4 months, 6 months, 8 months and 10 months were presented in Table 2. The average body length, height at withers, heart girth and neck girth at adult age (10 months) in pigs were 59.16±1.04 cm, 41.26±1.75 cm, 59.24±1.81 cm and 52.92±1.75 cm, respectively in male and 55.35±1.83 cm, 40.71±1.61 cm, 54.67±1.72 cm, and 48.61±1.65 cm, respectively in female. The average body length and height at withers in male pig were found to be significantly higher ($P<0.05$) than female in 8 and 10 months of age; however no significant difference ($P<0.01$) on body length and height at withers between male and female was observed at birth, weaning (2 months), 4 months and 6 months of age. The average heart girth and neck girth were found to be significantly higher ($P<0.05$) in male than female in all age groups except at birth and weaning weight, where there were no significant differences ($P<0.01$) of heart girth and neck girth between the two sexes. The different body measurement traits of Wak Chambil at different ages were found to be lower than Doom and Niang Megha pig (Khargharia *et al.*, 2014), Suwo pig (Zaman *et al.*, 2017) and Mizo local pig (Kalita *et al.*, 2018).

Like other indigenous pig breeds of north east India, Wak Chambil have very long and good quality bristles and bristle yield also high. The average bristle yield (g), bristle density (no. /cm²), bristle length (cm) and diameter (micron) of adult Wak Chambil were 90.14±1.17, 74.50±0.75, 7.11±0.19 and 295.51±2.69, respectively (Table 3). Male pig has significantly higher values for different bristle traits than female except for bristle length where no significant effect of sex was observed. Bristle length and diameter of Wak Chambil were comparable with Hampshire X Ghungroo pig (Mohan *et al.*, 2015), however it was lower than Doom (Rahman *et al.*, 2019) and Bareilly desi pigs (Boro *et al.*, 2020).

3.4 Production performance

The average body weight of Wak Chambil at birth, weaning, 4 months, 6 months, 8 months and 10 months of age were 0.54±0.06 kg, 5.42±0.47 kg, 11.21±0.45 kg, 19.82±0.64 kg, 27.59±1.53 kg and 33.68±2.16 kg, respectively (Table 4). The birth and weaning weight of Wak Chambil is comparable with Niang Megha and Doom pigs (Khargharia *et al.*, 2014). Body weight at different age group of Wak Chambil were found to be lower than other indigenous pig breeds viz. Doom and Niang Megha (Kharghari *et al.*, 2014), Mali (Dandapat *et al.*, 2010), Suwo (Zaman *et al.*, 2017) and Mizo local (Kalita *et al.*, 2018) pig of north east India. In the present study, male pigs showed significantly ($P<0.05$) higher body weight for different age group except at birth where no significant difference ($P<0.01$) between male and female was observed which was comparable with Khasi local pig (Bhowal, 1997).

3.5 Reproductive performance

The average age at first heat, age at first conception, age at first farrowing and gestation period of Wak Chambil were 198.28±0.67 days, 239.82±0.39 days, 341.00±0.61 days, and 110.26±0.52 days, respectively (Table 5). Several researchers reported that the age at first heat, age at first conception and age at first farrowing were found to be higher in Ghungroo (Gokuldas *et al.*, 2015; Sahoo, 2012), Niang Megha (Khargharia *et al.*, 2014), Mali (Dandapat *et al.*, 2010) and Naga local pigs (Borkotoky *et al.*, 2014) as compared to Wak Chambil. Similarly, the inter farrowing interval of Wak Chambil were found to be shorter than Naga local pig (Borkotoky *et al.*, 2014) and Mizo local pig (Kumaresan *et al.*, 2007), but for it has comparable farrowing interval with other local pig breed of north east India. The average litter size at birth and weaning were found to be 5.5±0.73 and 4.5±0.91, respectively, which resembles to the Naga local pig (Borkotoky *et al.*, 2014). By comparing the different body measurement, growth and reproductive traits from the available literature it was observed that Wak Chambil pig has smaller body size, adequate growth rate and lower litter performance than the other indigenous pigs of north eastern region. Pork from this animal attracted a higher demand because of its greater back and abdominal fat than that of crossbred or exotic pigs, which also increased the acceptability and demand for pork because consumers in the region preferred fatty meat rather than lean meat.

4. Conclusions

Wak Chambil pigs raised in a low input backyard production system in the hill ecosystem have smaller body sizes and high productivity and reproductive performance. These pigs have well-built compact body structures with short limbs, small head, small eyes, medium snout, small erect ears, small hooves that touch the ground less often, as well as their pendulous belly make them unique among other pig breeds of the region. Due to unrestricted crossbreeding, this pig population is in declining condition; therefore, conservation is highly recommended in this area. Therefore, the current study on Wak Chambil pig could be essential to the documentation and registration of the breed, which will contribute to the development of an appropriate breeding policy and future conservation strategies.

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Table 1. Description of Morphometric, Reproductive and bristle traits under study

Traits	Description
Body length (cm)	Distance from the occipital bone (midpoint between ears) to the base of the tail.
Height at withers(cm)	Distance from the ground surface to the top of shoulder.
Heart girth(cm)	Circumference of the chest behind the elbow joint
Neck girth(cm)	Circumference of the neck region.
Age at first heat (days)	Numbers of days from date of birth to the date of first cycle.
Age at first conception(days)	Numbers of days from date of birth to the date of first fertile service.
Age at first farrowing(days)	Numbers of days from date of birth to the date of first piglet born.
Gestation period(days)	Numbers of days from the date of conception to the date of farrowing.
Inter farrowing interval (days)	Periods between two consecutive successful farrowing.
Litter size at birth (nos)	Number of piglet born alive in a single farrowing.
Litter size at weaning (nos)	Numbers of live piglets weaned in a litter.
Litter weight at birth (kg)	Total birth weight of all the piglets born alive in a single farrowing.
Bristle yield (g)	Amount of bristle obtain from an adult pig from a single cut.
Bristle density (fiber/cm ²)	Total number of bristle fiber present in 1 cm ² body surface area.
Bristle length (cm)	Length from the base to the tip of the bristle
Bristle diameter (micron)	Circumference of the bristle measured by projection microscope

Table 2. Body measurement (cm) traits of Wak Chambil at different age group in home tract

Age group	Body length		Height at withers		Heart girth		Neck girth	
	Male	Female	Male	Female	Male	Female	Male	Female
Birth	20.15	19.85	14.26	13.52	23.12	22.43	19.16	18.64
	±0.31	±0.34	±0.21	±0.26	±0.21	±0.47	±0.34	±0.52
	(26)	(32)	(26)	(32)	(26)	(32)	(26)	(32)
Weaning	35.17	34.10	18.45	17.73	29.38	28.12	26.79	25.81
	±0.54	±0.37	±0.41	±0.28	±0.72	±0.66	±0.36	±0.54
	(21)	(29)	(21)	(29)	(21)	(29)	(21)	(29)
4 months	42.81±0.86	41.29	30.18	21.48	36.18	35.24	34.58	32.58
		±0.62	±0.95	±0.51	±0.81	±0.62	±0.27	±0.45
		(27)	(20)	(27)	(20)	(27)	(20)	(27)
6 months	48.51±0.64	48.26	36.52	26.19	42.25	44.63	40.15	41.28
		±0.59	±0.35	±0.88	±0.74	±0.41	±0.56	±0.82
		(24)	(18)	(24)	(18)	(24)	(18)	(24)
8 months	56.22±0.48	53.47	38.26	36.86	55.61	52.18	48.52±1.59	46.71
		±1.06	±1.68	±1.59	±1.37	±1.28	(15)	±1.67
		(20)	(15)	(20)	(15)	(20)		(20)
10 months	59.16±1.04	55.35	41.26	40.71	59.24	54.67	52.92	48.61
		±1.83	±1.75	±1.61	±1.81	±1.72	±1.75	±1.65
		(16)	(12)	(16)	(12)	(16)	(12)	(16)

Table 3. Bristle characteristics of adult Wak Chambil

Bristle traits	Male (n=6)	Female (n=6)	Average (n=12)
Bristle yield (g) /cutting	98.38 ^a ± 1.12	82.44 ^b ± 1.23	90.14 ± 1.17
Bristle density/cm ²	76.42 ^a ± 0.89	72.58 ^b ± 0.61	74.50 ± 0.75
Bristle Length (cm)	7.31 ± 0.21	6.98 ± 0.17	7.11 ± 0.19
Bristle diameter (micron)	314.61 ^a ± 2.87	276.42 ^b ± 2.52	295.51 ± 2.69

Means with different superscript differs significantly (P <0.05); Within the parentheses are the numbers of observation.

Table 4. Body weight (kg) at different ages and growth rate (g/day) of Wak Chambil under field condition

Age groups	Male	Female	Average
Birth	0.57±0.05 (26)	0.51 ± 0.07 (32)	0.54±0.06 (58)
Weaning	5.64 ± 0.71 ^a (21)	5.21±0.24 ^b (29)	5.42 ±0.47 (50)
4 Months	11.51±0.62 (20)	10.92±0.31 (27)	11.21±0.45 (47)
6 Months	20.72 ± 0.27 ^a (18)	18.92±1.01 ^b (24)	19.82±0.64 (42)
8 Months	28.62± 1.24 (15)	26.56±1.82 ^b (20)	27.59±1.53 (35)
10 Months	34.63 ± 2.02 ^a (12)	32.74±2.30 ^b (16)	33.68±2.16 (28)

Means with different superscript differs significantly (P <0.05); Within the parentheses are the numbers of observation

Table 5. Reproductive performance traits of Wak Chambil under field condition (N=27)

Reproductive Parameters	Mean ± SE
Age at first heat (days)	198.28 ± 0.67
Age at first conception (days)	239.82 ± 0.39
Age at first farrowing (days)	341.00 ± 0.61
Gestation period (days)	110.26 ± 0.52
Inter farrowing interval (days)	201.53 ± 0.59
Litter size at birth (no)	5.5 ± 0.73
Litter size at weaning (no)	4.5 ± 0.91
Litter weight at birth (kg)	2.75± 0.48