

UNIVERSITY OF CAPE COAST

**POST-WEANING GROWTH PERFORMANCE OF THE ASHANTI BLACK PIG UNDER
INTENSIVE MANAGEMENT SYSTEM**

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

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Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Cape Coast.

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ABSTRACT

The post weaning growth performance of the Ashanti Black pig (ABP) at National Pig Breeding Station at Babile in the Upper West Region of Ghana was assessed. The records of 211 weaners over a seven-year period (1999-2005 inclusive) were used in the study. The influence of year of birth, sex and size of litter at weaning on performance traits – weaning weight at 42 days, body weights at 120 days, at 180 days and at 240 days of age and post weaning growth rates were investigated. All the traits studied were significantly ($p < 0.05$) influenced by the effect of the year of birth, sex and litter size at weaning. The average performance levels attained during the study were weaning weight of $5.9 \text{ kg} \pm 0.08$, body weight of $12.7 \text{ kg} \pm 0.2$ at 120 days, body weight of $17.7 \text{ kg} \pm 0.3$ at 180 days and body weight of $24.1 \text{ kg} \pm 0.48$ at 240 days.

The average post weaning growth (PWG) rates measured from weaning to 120 days (PWG1), from weaning to 180 days (PWG2) and from weaning to 240 days (PWG3) were $87.1 \text{ g/day} \pm 2.2$, $86.0 \text{ g/day} \pm 2.2$ and $92.0 \text{ g/day} \pm 2.38$ respectively.

From the study, the post weaning growth performance of the ABP under intensive management is very encouraging as they compare well with other breeds of pigs under the local conditions. It has further added to the documentation of the performance of the breed which was hitherto non-existent.

There is therefore the need to preserve the breed under such system of production to bring out its potential to become a national breed for use in commercial pork production in Ghana.

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DEDICATION

To my wife Mavis Sarpong; daughters, Bridget, Anastasia and Benedicta; son Samuel Asiedu Owusu and all family members.

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LIST OF ACRONYMS

AgSSIP	Agricultural Services Sub-Sector Investment Programme
ABP	Ashanti Black Pig
ADG	Average Daily Gain
APD	Animal Production Directorate
ASF	African Swine Fever
CSIR	Council for Scientific and Industrial Research
GLM	Generalised Linear Model
MAFF	Ministry of Agriculture, Fisheries and Food
MoFA	Ministry of Food and Agriculture
MTADP	Medium Term Agricultural Development Plan
NBS	Nucleus Breeding Station
NLSP	National Livestock Services Project
NRC	National Research Council
PWG	Post weaning Growth Rates
VSD	Vertinary Service Directorate

CHAPTER ONE

INTRODUCTION

Background of the study

In recent times, interest has been generated in the indigenous livestock breeds in the sub-Saharan Africa with regard to their performance. Most of these breeds have the ability to survive under stressful environmental conditions like poor nutrition, disease challenges and high ambient temperatures.

The Government of Ghana through its agency Animal Production Directorate (APD) under the Ministry of Food and Agriculture had established nucleus breeding centres for indigenous pigs, sheep and goats to ensure their improvement, as an ex-situ conservation strategy. This was during the National Livestock Services Project (NLSP) year under the Medium-Term Agricultural Development Plan (MTADP) of Ghana 1992-1999.

One of such centres is the Babile Pig Breeding Station whose task was the improvement of the Ashanti Black Pig (ABP), an indigenous pig breed. The main objective of the project was to use this indigenous breed in production to increase pork consumption and, thereby increase protein in-take by the population which has been declining. 50-60% of pig in Ghana is concentrated in the northern sector (Ashanti and Brong-Ahafo regions inclusive) of the country and over 90% of this lot is made up of ABP (Barnes, 1994). Ahunu *et al.* (1995) observed that, the Ashanti Black Pig (ABP) constitutes 70-90% of the pig breeds

used under the traditional system of producing pigs in Ghana. It is known to be hardy, tolerant to most common diseases and has the ability to survive under poor management and extremes of environmental conditions (Ahunu *et al.*, 1995; Fetuga *et al.*, 1976; Darko and Buadu, 1998). Even with these qualities the ABP, is reared under poor conditions leading to its low productivity. This is manifested in a low litter size of 5-7 piglets at birth, average litter size of 4 at weaning, mature body weight of 60 kilograms and pre-weaning mortality of 22.3% (Baffour-Awuah *et al.*, 2005).

There has not been enough documentation of the performance of ABP. Recently; Baffour-Awuah *et al.* (2005) undertook a baseline study on the pre-weaning growth performance of the ABP at the Babile Pig Breeding Station under an intensive management system. The intention of the study was to help in accurate characterisation of the breed so as to conserve and utilise the breed in future breed development programmes.

The present study seeks to add up to the performance records of the ABP for the post-weaning phase of growth under an intensive management system.

Statement of the Problem

The problem associated with local indigenous breeds is the lack of accurate records on their performance to assist in planning improvement programmes.

It was recommended by Ahunu *et al.* (1995) that the ABP should be used in the pure and cross-breeding schemes for the development of the pig industry in Ghana. Thus, the conservation of ABP and a proper and accurate documentation of their performance (reproductive and growth) become imperative. It is

therefore necessary to document the level of post-weaning performance of ABP under intensive management systems in addition to already established baseline information of pre-weaning performance of ABP (Baffour-Awuah *et al.*, 2005).

Main Objective

The main objective of the study is to investigate the post-weaning growth performance of ABP under an intensive management system.

Specific Objective

The specific objective of the study is to add the results to the baseline documentation of the performance of ABP.

Justification

The ABP breed is predominant in the country and constitutes 70-90% of pigs used in the traditional system of production (Ahunu *et al.*, 1995). But the low productivity of ABP could be due to the conditions under which they are reared that is scavenging. Under such conditions, the levels of performance in both reproduction and growth are very low. It has been revealed by several workers that the ABP is hardy and tolerant to most diseases and has the ability to survive under poor management and extremes of environmental conditions (Fetuga *et al.*, 1976; Ahunu *et al.*, 1995; Darko and Buadu, 1998).

Advantage must be taken of these desirable qualities to improve on the performance of the indigenous breed to become a desirable material in an effort to develop and expand the pig industry in the country. Baffour-Awuah *et al.*

(2005) undertook a study to provide baseline information on pre-weaning growth performance of a herd of ABP under an intensive management system at the Babile Pig Breeding Station. There is therefore the need to extend the study to cover the post-weaning growth phase of pigs.

The present study seeks to document the post-weaning growth performance of ABP at the Babile Pig Breeding Station under an intensive management system so as to contribute to the characterisation of the ABP.

CHAPTER TWO

LITERATURE REVIEW

Pig Production in Ghana

The production of all major livestock types used for human consumption in Ghana increased over the past 10-year period from 1995 to 2006, except pigs whose population declined steadily due to the outbreak of ASF disease in early 1995 as shown in Table 1. Most of the pigs were destroyed and many of the producers lost their parent stocks as a result. The worse decline was in 2005 when there was a second outbreak of ASF with a total national population of 290 000 as against 365 000 in 1995. The population however started increasing in 2006 (VSD, 2007). The sharp increase in the pig population (64.5% increase) may be attributed to re-stocking of affected farms through the assistance of FAO.

Due to low productivity of indigenous pigs, most producers preferred the exotic breeds even though ABP are dominant over the exotic breeds (Livingstone and Fowler, 1984).

Table 1: Estimated livestock population ('000): 1995 - 2000

Year/ Type	1995	1996	1997	1998	1999	2000
Poultry	13,083	14,580	15,888	17,302	18,810	20,472
Sheep	2,070	2,149	2,496	2,576	2,658	2,743
Goats	2,156	2,233	2,659	2,792	2,931	3,077
Cattle	1,123	1,248	1,260	1,288	1,288	1,302
Pigs	365	355	347	332	332	324

Source: Veterinary Services Directorate, (2007) MoFA, Accra.

Table 1 (continued): Estimated livestock population ('000): 2001 - 2006

Year/ Type	2001	2002	2003	2004	2005	2006
Poultry	22,032	24,251	26,395	28,727	28,386	34,030
Sheep	2,771	2,922	3,015	3,211	3,211	3,314
Goats	3,199	3,230	3,560	3,925	3,923	3,997
Cattle	1,315	1,330	1,344	1,359	1,373	1,392
Pigs	312	310	303	297	290	477

Source: Veterinary Services Directorate, (2007) MoFA, Accra.

The profitability of a pig industry depends on the ability of the sow to produce large litters and wean most of them under ideal environmental conditions and management techniques (Okai *et al.*, 1982). The survivability of the weaned litters depends on several factors including good nutrition, good

health care, and good sanitation. These also ensure that they reach mature body weight within a short period after weaning.

Pig production is one of the fastest ways of meat production as they have a short gestation period, large litter size and a source of employment as well as means of eradication of poverty in the country and which according to Whittemore (1980) half of all the meat eaten in the world is from pigs. Pigs are omnivores and would consume a wide range of feedstuffs. Pigs are kept primarily for pork production. In addition to pork, pigs supply pigskin for soft leather, bristles for brushes, lard (fat) for cooking, hormones for medicinal purposes and manure for soils and fish ponds (Youdeowei *et al.*, 1986).

According to Eusebio (1980), with good husbandry and management, adequate feeding and health care, pigs can produce four or five times more meat than cattle per tonne of live weight. Pork and poultry meat, according to FAO (2001) represented 63% of all meat consumed globally in 1993. This shows how extensively the pig is used as a source of food. According to Holness *et al.* (2005), pig meat consumption in the developing world has shown a steady increase at the expense of beef during the past decade, in part due to the lower fat content and healthier image of pig meat. Okai, (1998) observed that Ghana is not only a net importer of animals and meat and meat products but imports as much as 70% of its animal protein requirements. In Ghana, among the livestock, pigs are the ones that hold the immediate to short term solution to animal protein deficiency (Annor-Frempong and Segbor, 1994) since they are able to efficiently convert feed (agro-industrial by-products) into edible meat (Morrison, 1961; Annor-Frempong and Segbor, 1994; Barnes, 1994). Their

requirements for feed and other digestible nutrients are much less than those required by other farm animals. However, the efficiency of utilization of feed for pork production depends on the provision of a well balanced diet and on husbandry conditions and genetic selection conducive to high efficiency (Pond and Maner, 1974). Pigs have fast growth rate and reach sexual maturity within 5-7 months. On the account of the pig's high fecundity and growth rate, pig production can yield a relatively rapid rate of return on the capital employed (Payne, 1990). The ability of pigs to mature and multiply faster than cattle and sheep confers material advantage in terms of opportunity for rapid genetic change. The inherent prolificacy and early sexual maturity of the sow means that pigs numbers can be expanded very rapidly. This always has been an economically attractive feature of keeping pigs and is one of the reasons why the pig, with the fowl, have been the peasant or small-holder's traditional livestock (Taverner and Dunkin, 1996). According to Holness *et al.* (2005) the following are advantages of pig production to the resource- poor farmer in the developing world, such as Ghana, compared to other forms of livestock production:

- (i) Pigs could be confined and reared in relatively small area. As a consequence, they are not subject to the same problems which confront cattle, sheep and goat production in many regions where communal land tenure is common.
- (ii) For some reason that they require a small area, pig production is particularly appropriate in densely populated areas.

- (iii) If pigs are kept in pens, they do not contribute to erosion and land degradation, a trend which continues to expand in developing world associated with grazing lands.
- (iv) Pigs would convert a variety of crop waste, kitchen waste and agro-industrial by-products into high quality meat.
- (v) Pigs are very efficient converters of concentrate feeds to meat when compared to ruminants. However on low-quality high fibre diets they are less efficient than the ruminants.
- (vi) Pigs give a relatively rapid return on investment as even on low planes of nutrition; a pig is ready for slaughter at twelve months of age.
- (vii) Pigs are often considered as 'living banks' which could be slaughtered in times of particular financial need, for example for the payment of medical bills or school fees.
- (viii) Pigs have a higher dressing percentage than any other livestock species that is the carcass forms a higher proportion of the body at slaughter.
- (ix) The size of pigs compared to cattle makes slaughter and marketing more flexible and easier process
- (ix) Pigs produce relatively rich manure which becomes a very important resource to the crop farmer when the price of inorganic fertilizer is prohibitive.

Pig Production Systems in Ghana

There are varied pig production systems in Ghana. They range from extensive (traditional) to intensive (commercial) production systems. In between

these systems could be found subsistence or semi-intensive production system where the pigs may be kept for varied reasons without much effort to improve upon the system.

The extensive or traditional production system is mainly found in the rural village production unit (Devendra and Fuller, 1979). The output of such system is low as the animals are left to roam in the village for left over household wastes. Supplementation is provided occasionally with locally available agro-industrial by-products such as pito mash, maize bran, palm kernel cake etc. (Ahunu *et al.*, 1995). The Ashanti Black Pig (ABP) constitutes 70-90% of the breed used in the indigenous system with some minimal housing or shelter provided (Ahunu *et al.*, 1995). During the cropping season, the animals are confined as a way to prevent them from destroying crops sown. In some villages, this is the only time that these animals are under confinement. Most of the time, they are allowed to scavenge for feed around the villages. The important role the pig plays in the social life of the village, in traditional family rituals and exchange of meat as well as in the provision of high-quality protein in the diet, should not be underestimated (Holness *et al.*, 2005). The growth rates of pigs under this production system are slow as lot of energy are expended in scavenging activities in addition to high worm infestation. Improvement in this traditional system of production could be achieved through enclosure of pigs in pens or yards. By so doing, piglet mortalities are reduced, energy lost through scavenging are also reduced, improve the health status of the animals by ensuring routine programme of vaccinations and parasite control. Separation of pigs into groups according to their final purpose could also be achieved through

such confinement. Protection from predators, theft and the harsh weather are other benefits from confining the pigs. A controlled breeding programme could be implemented. Sow oestrus could be monitored and boars could be introduced to sow at set times in order to optimise the number of litters per sow per year (Holness *et al.*, 2005). Most traditional systems of pig keeping are characterised by a small number of pigs per holding, therefore, their integration with other farming enterprises including cropping.

The commercial pig production in Ghana is mostly carried out in the peri-urban areas where pigs are kept under total confinement throughout the year. The exotic breeds mostly Large White and Landrace and their crosses are mostly used, especially, in the southern sector of the country (Barnes, 1994). Producers under this system are business minded and, for that matter invest a lot of inputs in the enterprise for rapid maximisation of returns. The animals are housed permanently in especially designed structures all year round and fed on well balanced diets (Ahunu *et al.*, 1995). The motive of such producers is the production of lean tissue to satisfy the consumer demand for lean meat (Livingstone and Fowler, 1984). Pigs raised by institutions of higher learning and other government and quasi-government organisations do much better because the welfare of the animals is uppermost in the management practices there (Barnes, 1994).

Semi-intensive system is a production system where pigs are confined in a limited space. Some amount of fodder (agricultural waste and kitchen refuse) and water are provided by the producers at certain times of the day. This system of pigs keeping opens up possibilities for improved feed and disease control,

which in turn can result in faster growing and healthier pigs and/or in larger litters (Dick and Geert, 2004). As the animals are confined, it prevents the destruction of crops and from being stolen. It serves as a saving account or insurance policy for the owners.

The interest in pig production in Ghana was whipped up after the 1987 Pork Show organised by MoFA with the expectation that production of pork and pork products would rise to high levels. But this has not been the case as the industry is confronted with a number of factors which were identified by Barnes (1994) as housing, feeding and marketing as well as African Swine Fever (ASF) disease. These constraints are found in all the production systems in the country; and if not addressed, the pig production will sometime reach total collapse. In spite of these constraints, production is being carried out throughout the country with some value addition to the pork. Fresh pork is being processed into bacon, ham and sausages which are in high demand by consumers. According to Teye *et al.* (1996), factors such as the age, sex, health and conformation of the animal selected for fattening, system and level of feeding, management and handling practices are some of the most important on-farm and pre-slaughter determinants of meat quality for processing. Payne (1990) mentioned also that factors of major importance for commercial meat production are the age and weight at which an animal produces a carcass of desired conformation, the require degree of fatness and the efficiency of food utilisation necessary to obtain these objectives. The dressing percentage of the ABP (70.2%) was found to be higher than that of the Large White (69.4%) in a study conducted by Manyo-Plange and Barnes (1996). The efficiency with which feed is converted into pig meat is

governed by the genetic quality of the stock, their environment, stage of growth, feeding method and level of feeding (MAFF, 1977). The efficient feed conversion and ability to utilise a wide range of feed materials are valuable attributes, the pig's outstanding feature is its phenomenal rate of meat production, especially when expressed in terms of output per breeding female. It is resultant of three factors; the ability of the sow to produce large numbers of progeny at frequent intervals, early sexual maturity and (with appropriate nutrition and housing) a rapid growth rate. In combination, these traits translate into much higher annual meat output per breeding female than those of sheep, beef cattle and broiler chicken (Taverner and Dunkin, 1996).

Breed Description of ABP

The indigenous ABP is described by Devendra and Fuller (1979) and Barnes and Fleischer (1998) as being generally black with a small short body, a relatively long and narrow head with a prolonged snout. The abdomen of a heavily gravid sow almost touches the ground. The ABP is also known to be hardy, tolerant to most common diseases and stresses and survive under poor management and extremes of environmental conditions (Fetuga *et al.*, 1976; Ahunu *et al.*, 1995; Darko and Buadu, 1998). Local breeds of pigs, such as the ABP have a great propensity to put on fat tissues (Serres, 1992). The breed, considering its dominance and adaptation and survival under harsh local environmental conditions, should have been the preferred breed in the development of the pig industry in most developing countries. But this is not the case because of its poor growth and low reproductive performance. According to

Baffour-Awuah *et al.* (2005), the ABP may function well in cross breeding programmes with the exotic breeds like Large White and Landrace by exploiting the complementarity of the hardiness of the local breed and the fast growth and better reproductive performance of the exotic breeds. Holness *et al.* (2005) also described the indigenous pigs as better-adapted to 'harsher' environments and poor management systems. They are more mobile and better equipped to scavenge and root. They are considerably less susceptible to heat stress and more resistant to most local diseases and parasites. These characteristics contribute to hardiness and survivability when crossed with an exotic breed. Indigenous breeds are earlier-maturing than their exotic breeds, and hence would start depositing fat in the carcasses at an earlier age than their exotic counterparts.

The performance of ABP under Traditional Management System

The ABP is the preferred choice under the traditional management system and constitutes 70-90% of the breed used (Ahunu *et al.*, 1995) because of the availability for production among the resource poor farmers.

Demand for animal protein will continuously increase as a result of global human population explosion. The dependency of the rural folks on the ABP as a source of animal protein under the traditional system of production cannot be over emphasized as the breed is dominant and is the most reared. According to Serres (1992), local breeds, such as the ABP have good resistance to heat and exposure to the sun and are excellent in tolerating wide dietary changes.

The traditional management system of pig production is found in the rural areas. In this system, there is low input by way of feeding, housing and health care with the resultant low output. The animals are left to scavenge for food at the backyards and roads of the villages and rubbish dumps. These pigs drink muddy, parasite infested water under ditches. Consequently, such internal parasites as lungworms (*Metastongylus species*), intestinal round worms (*Ascaris lumbricoides*), nodular worms (*Oesophagostomum spp.*) and kidney worms (*Strephenurus dentatus*) are common in such pigs (Youdeowei *et al.*, 1986). Deworming and spraying against endo- and ecto-parasites are not practised in the traditional management system. Modern breeds of pigs or any crossbreds survive with difficulty under this low-input management system. This is because the animals are susceptible to environmental stress. In view of this, there is limited information on performance of the ABP due to the absence of carefully kept production records at the village level (Okai *et al.*, 1994). Under extensive management conditions, the ABP breed attains a mature body weight of 60kg with low litter sizes at birth (5-7 piglets) and high pre-weaning mortality (Devendra and Fuller, 1979). Productivity of these village pigs is generally low, with low litter size and low growth rates (less than 120g/day) largely due to poor management, parasites and diseases (Holness *et al.*, 2005).

As the animals are vulnerable to many dangers under the traditional system much of their body weights are at the fore quarters including the head and fore limbs as defence mechanism against any possible predators and to run away in haste in case of any danger (Manyo-Plange and Barnes, 1996). Under this management system, controlled breeding is not practised due to non-

identification of pigs. Furthermore, improper feeding produces fatty carcasses or cysts in muscles as a result of tape worm infestation rendering the whole animal unwholesome. Performance testing which is the testing of an animal under a standard environment so as to assess such traits as rate of growth, efficiency of feed conversion and thickness of backfat at various points (MAFF, 1977) is virtually absent under the traditional management system. The greatest asset of performance testing is to ascertain the breeding value of an animal before being used for breeding.

The performance ABP under Intensive/Commercial Management System

The production levels of the indigenous ABP raised under commercial/intensive system has not been well documented, partly due to the fact that most of the research institutions and commercial farms do not keep this breed.

In a study conducted by Darko and Buadu (1998) on a herd of ABP kept on the University of Science and Technology (now Kwame Nkrumah University of Science and Technology, K.N.U.S.T) farm, they reported the following performance levels for the herd under intensive management system: average birth weight, 0.71kg; average litter size, 7.7; pre-weaning piglet mortality (including still *births*), 18.2%; average number of piglets weaned, 6.3; and average weight at weaning at 42 days, 6.0 kg. The study also recorded pre-weaning growth rate of 100g/day and post weaning growth rate of 196g/day.

In a recent study, Baffour-Awuah *et al.* (2005) looked at performance of the ABP under an intensive management system at the Babile Pig Breeding Station

in the Upper West Region of Ghana. Performance traits examined were litter size at birth and at weaning, pre-weaning mortality, birth weight, weaning weight, body weight at 120 days and pre-weaning and post-weaning growth rates. They reported an average litter size at birth of 7.7 with mean birth weight of 0.99kg; average litter size at weaning was 6.0 and mean weaning weight at 42 days was 6.7kg with an average pre-weaning growth of 135.6g/day. The mean body weight of piglets at 120 days was 12.0kg and an average post-weaning growth from weaning to 120 days of age was 69.5g/day. The pre-weaning mortality rate of piglets was 22.3% with survival rate of 77.7%. This study showed an improvement in the pre-weaning performance of ABP over that reported by Darko and Buadu (1998). Both studies (Darko and Buadu, 1998; and Baffour-Awuah *et al.*, 2005) showed a significant ($P < 0.05$) influence of litter size on birth weight of piglets. However, Baffour-Awuah *et al.* (2005) reported a higher pre-weaning mortality rate than that of Darko and Buadu (1998).

Performance testing is done under the intensive system in order to select replacement stock for breeding. Under the same management conditions for the ABP and the Large White pigs, a study by Manyo-Plange and Barnes (1996) indicated that the ABP had a better carcass quality than the Large White Pigs. This advantage of ABP over the Large White pigs revealed the potential of ABP as good source of lean meat production when kept under good management conditions.

Growth Performance during the Post-weaning Phase

Growth is one of production parameters of importance in the livestock industry (Ngere, 1972). The target of any producer is to obtain reasonable market weight of the animal in a short time to reduce cost. Variation in growth of pigs costs producers a significant economic loss. There is the need to recognise the causes of these variations in growth and devise strategies to overcome them for maximum benefits.

Brody (1945) defines growth as the constructive or assimilatory synthesis of one substance at the expense of another (nutrient) which undergoes dissimilation. It implies that changes in chemical composition of the body occur during the process of increasing in size.

Growth is the increase in body weight of an animal from conception to maturity. Growth of tissues, organs and of the whole organism (the pig) occurs in two phases; increase in number of cells (hyperplasia) and increase in size of cells (hypertrophy) which are under the influence of genetically and environmentally controlled hormone and enzyme systems within the body (Pond and Maner, 1974). Growth and body composition after weaning are influenced by nutrition, growth-modifying agents added to feed, genetics, environment (for example ambient temperature, available pen space, pig density and sex) (McGlone and Pond, 2002). Post-weaning growth-measured as 120-day body weight, 180-day body weight and 240-day body weight as well as the growth rates at these various stages during the post-weaning phase are considered in this study.

The growth rate during the post-weaning phase is defined as the average gain in weight over the periods between weaning and subsequent growing ages (Ahunu *et al.*, 1995; Baffour-Awuah *et al.*, 2005) noted that growth rate (average daily gain) in the pig is measured as the amount of body weight the pig puts on each day over a certain period of its life cycle. Okai *et al.* (1994) indicated that the average daily gain can be observed over different phases of growth during the pre-weaning period and post-weaning period. The changes in nutrient requirement of the pig influence changes in growth rate and body composition. The physical form of the diet is important as improved performance may be due to improved utilization of nutrients or to less feed wastage or both (Pond and Maner, 1974). Apart from nutrition, breed of pig, sex, general management and husbandry practices may have influence on the growth rate.

Post-weaning growth of pigs is influenced by weaning weight with those having heavier weaning weight registering higher growth rates post-weaning. Factors such as sex and year of birth were reported to have significantly affected growth performance of swine (Bereskin *et al.*, 1973). Post-weaning growth performance is more influenced by efficiency and effectiveness of the management practices and individual pig genetic composition in spite of variations (Dedecker, 2000). The young pig has a high potential for growth (Hodge, 1974; Harrell *et al.*, 1993). Numerous factors influence the extent to which this potential is expressed, among which energy (food) is the most important.

Factors affecting the Post weaning Growth Performance of Pigs

There is a transition period immediately after weaning during which the weaner pig adjusts to its new environment. This period, referred to as the post-weaning growth check or 'lag', is very critical for the survival of the animal. During this transition period from the dependence on sow's milk to a dry cereal-based diet, the pig experiences several physiological transformations and stresses and the degree of these changes depends upon the weaning age, weaning weight, coping ability, health status, feed intake, diet composition, digestive capacity, genetic potential for growth, quality of management and the environment, nutritional program and diseases status (Dedecker, 2000). Whittemore and Green (2002) mentioned that, the driver for post-weaning growth is feed intake, and this is inevitably curtailed by the limitation of the gut capacity on diets.

Gerald (1994) however distinguished factors influencing the performance of the animal into external (environmental) and inherent (genetic). Aherne *et al.* (1992) on the other hand, realized that management and environment were the limiting factors rather than genetics to optimize performance of pigs post weaning. A successful weaning programme depends on choosing an age at weaning that suits the facilities, nutritional programme and management skills of the producer.

Baffour-Awuah *et al.* (2005) reported that year of birth, sex of piglet, parity of sow and litter size had significant influence on pre-weaning growth performance of the piglets.

Weight of piglets at birth and weaning

A close relationship exists between birth weight and survival. An increase in litter size (number of live pigs) at birth reduces the chance of survival due to the increase relationship between litter size and individual piglet weight. Likely factors explaining the lower survival rate are: (i). low body energy stores; (ii). differences in the placental supply of nutrients; (iii). uterine crowding, in turn, related to endocrine or spatial constraints on development; (iv) relative physiological immaturity (McGlone and Pond, 2002).

Pond and Maner (1974) observed that first born piglets tend to have larger birth weights than last-born piglets within the same litter; and therefore have higher chances of survival post-natal with subsequent better performance pre- and post-weaning. Lecce (1971) showed that the survival rate of small pigs can be improved greatly by raising them in individual cages, thereby eliminating the stress of competition with larger littermates.

Weaning weight may be a large factor in early-weaned pigs as it has been shown to have a significant effect on subsequent growth performance (Himmelberg *et al.*, 1985; Wolter *et al.*, 2002). A heavier pig at weaning, has a higher rate of gain post-weaning compared with lighter pigs, due to its ability to better cope with the stresses of weaning and having a more developed digestive and immune systems the better its post-weaning growth rate (Aherne *et al.*, 1992). Heavy piglets at weaning have more body fat and hence a better ability to withstand the period of under feeding following weaning and a more developed digestive tract and therefore a better ability to cope with transition to the post-weaning diet (Sloat *et al.*, 1985) Among a group of pigs weaned within a litter,

there are variations in body weight. Campbell and Dunkin (1982) suggested that weaning weight at a constant age is affected by birth weight and not due to the ability to compete for food or due to muscle DNA content. However, Powell and Aberle (1980) suggested that lower birth weight pigs grow slower because feed utilization is much less than heavier pigs, and low birth weight pigs have lower muscle development potential and deposition of fat. Cahill *et al.* (2005) stated that the reproductive performance (litter size, pigs per sow per year) greatly influences the profitability of commercial swine production. However, bigger litters tend to have lower and more viable individual weights that would ensure their survivability.

The higher the piglet birth weight and weaning weight, the greater it's potential for growth through to slaughter. Lighter pigs at weaning showed inferior growth performance up to the finisher period. They did compensate for some of this inferior growth performance towards the time of slaughter; however they never reached the weights of the heavy birth-weight animals (Cahill *et al.*, 2005).

The post-weaning growth of pigs has been influenced by weaning weight and that gains of heavier-weight pigs have been higher after weaning. Weaning weight has been suggested by Dedecker (2000) to affect the rate of gain and daily feed intake of piglets immediately post weaning, however, studies have shown that weaning weight has no significant effect on weight gains post weaning (Miller *et al.*, 1999). It has been demonstrated that lighter pigs at weaning have lower post weaning growth rate and are slower to reach a common slaughter weight (Kavanagh, 1994). Wolter *et al.* (2002) also reported

that lighter pigs at weaning had slower post-weaning growth rates and thus required a greater number of days to reach a common slaughter weight.

Age at weaning of piglets

Whittemore (1980) observed that weaning age depends much upon the degree of sophistication of diet, housing, disease control and management available. Weaning is very much less traumatic for the mother than for the young. Weaning at any age is stressful for piglets, the younger the pig is at weaning, the higher its temperature requirement, the lower the ability to digest cereal and vegetable proteins, the lower its appetite and the lower its resistance to disease (Aherne *et al.*, 1992). As pigs age and grow the optimal ambient temperature for maximum live weight gain and efficiency of food conversion change (Payne, 1990). The sow productivity has influence on the suckle period of piglets. Dritz *et al.* (1996) reported that early weaning resulted in higher growth rates and the potential for improved lean growth as well as increased number of litters per sow per year. However, inconsistent growth performance throughout the finishing phase, abnormal feed intake and lighter weaning weights and more individual pig variation were some of the disadvantages of early weaning reported by Hohenshell *et al.* (2000).

Studies that compared the performance of pigs at different weaning ages showed that all pigs, independent of weaning age, encountered a post-weaning growth lag period for approximately one week (Lucas and Lodge, 1961; Leibbrandt *et al.*, 1975; Shields *et al.*, 1980; Fenton *et al.*, 1985; Carroll *et al.*, 1998). For example, Leibbrandt *et al.* (1975) compared pigs weaned at 2, 3 or 4

weeks of age and Carroll *et al.* (1998) compared pigs weaned at 2 and 3 week of age and the results of both studies were similar in that each age groups of pigs resumed weight gain after a one-week lag period. It was also detected that weight gain and feed intake tended to recover more slowly as weaning age decreased, which implied an effect of age on the ability to adapt to post-weaning diets, but at 42 days weaning, body weights were similar regardless of weaning age. Bark *et al.* (1986) observed a reduction in performance post weaning as a result of low intake of feed during this critical period at weaning.

Therefore age does have an impact on digestive physiology and performance of the weaner pig. According to Dedecker (2000) composition of the diet as well as feed intake, could be factors that affect the performance of the weaned pig, regardless of age of weaning.

Litter Size at weaning

Litter size is measured as the number of piglets born or weaned (Ahunu *et al.*, 1995). Litter size at weaning depends on a number of factors. Primary among these is the mothering ability of the sow to ensure the survival of the piglets.

Feeding regimes have a substantial effect on performance in the nursery stage and throughout the grower-finisher phases (Mahan and Lepine, 1991). This determines survivability of the piglets and consequently the number that will be weaned. The number of piglets weaned is also affected by the number at birth as higher pre-weaning mortalities have been reported to be associated with higher litter size at birth (Baffour-Awuah *et al.*, 2005).

Good management keeps mortality low resulting in the maximum number of pigs being weaned per sow per year (Devendra and Fuller, 1979). The litter size at weaning ensures the number of animals that would reach market weight could be high in order to obtain maximum returns on investment. It forms the basis to achieve the growth parameters post-weaning.

Sex of pigs

The ability of an animal to grow depends upon its breeding, sex and most important, the level of nutrition offered (Payne, 1990).

At the same age in pigs, gilts put on more fat than boars. This is because male animals grow faster, have a higher energy conversion rate, higher protein deposition rate and hence lower excess energy that will be stored as fat (Baffour-Awuah *et al.*, 2005). According to Payne (1990), boars convert food to carcass gain more efficiently than gilts.

Males on the average weigh heavier at birth than females (Velardo, 1958; Bell *et al.*, 1970; Bereskin *et al.*, 1973). Superiority of male animals over female animals in areas of growth and weight gain consistently have been recorded. This is as a result of hormonal differences between the sexes and their effect on growth. Baffour-Awuah *et al.* (2005) observed a significant sex differences for post weaning growth in the ABP. Hormones (thyroid hormones, growth hormones) affect growth of animals. The effects of the endocrine system on growth are mediated through effects on enzymes system that control anabolic and catabolic reactions of nutrients and their metabolites (Pond and Maner, 1974). But Kavanagh (1994) observed that at birth female and male animals

were not significantly different in body weight. Thereafter males were significantly heavier than females but at slaughter weight among sexes were not significantly different. Sex, according to Serres (1992) has little effect on growth rate until puberty. But males with higher body size have slightly greater growth rates than females. Sex can influence the composition of live weights of animals.

Cahill *et al.* (2005) observed in their study that males were either significantly heavier or tended to be heavier than the females

Year of Birth

Baffour-Awuah *et al.* (2005) reported that the year of birth effect on performance levels of pigs is based on the differences in the management and husbandry practices adopted year after year, resulting in variation in the health and nutritional status of the animals. It has been reported that sow nutrition during pregnancy influences pre-weaning growth of piglets (Maryrose *et al.*, 1966). Varied management and husbandry practices, therefore, between and within years can create performance levels differences (Gerald, 1994).

Post-weaning nutrition

Without human intervention, the pig would become nutritionally independent of its dam at 15-20kg live weight (Whittemore and Green, 2002). Natural weaning would occur at 70 days or so of age. Earlier weaning than this creates a disruption to the growth and development of the weaned pig. The general performance of the pig after weaning is determined by genetic potential

for growth, quality of management and environment, nutritional programme and disease status (Aherne *et al.*, 1992).

The pig requires access to feedstuffs which will provide adequate amount of the essential nutrients, notably protein, energy, minerals and vitamins, for adequate growth and productivity to generate an end-product which can be sold (Holness *et al.*, 2005). Factors of importance are the quality of the protein, that is, make-up of the amino acids in the protein which determines the pig's ability to convert the protein into meat, and the digestibility and quantity of the fibre in the diet, which will affect intake and utilisation of the total ration. Formulation of diets to contain the optimum blend of nutrients (energy, amino acids, minerals and vitamins) is essential for rapid growth of pigs and efficient conversion of feed to meat.

Nutritional requirements of early weaned piglets change rapidly during the early post-weaning period therefore incorporating highly digestible and palatable ingredients in the diet is to aid in digestive enzyme transition, which occurs in young pigs between 2 and 8 weeks of age (Mahan and Lepine, 1991). It had been observed that immediately after weaning, the pig's ability to cope with stress and secrete digestive enzymes depends on weaning weight and age (Dedecker, 2000). The nutrient requirements of the weaned pig depend on its weight at weaning and its subsequent level of performance (Aherne *et al.*, 1992). The provision of dry and balanced diet immediately after weaning piglets from the sow can negatively affect the ability of the piglets to digest the fibrous feed which can lead to a period of poor performance immediately after weaning. The period immediately after weaning is characterised by low feed intake, and the

effect of this depends on the palatability and digestibility of the feed, the management system under which weaned pigs are raised. The digestibility of the post-weaning diet is the key factor in improving feed intake and achieving higher growth rates without increasing the incidence of diarrhoea (Aherne *et al.*, 1992). Feed intake therefore becomes the driving force behind growth and must be considered the most important factor. Reduced feed intake contributes to the post-weaning “lag”. Feed intake is closely related to growth rate, feed conversion efficiency, carcass value and profitability. Feed intake is affected by a whole range of factors, associated with the animal (body weight, sex, genotype and health), the feed (energy density, large nutrient imbalances, freshness, presence of toxins, processing) and the environment (effective environmental temperature, pig density, feeder design location and management, quality and availability of water etc.) (NRC, 1987).

Carcass Yield and Quality of Pigs

The popularity of pig meat differs widely throughout the world. Of all meat eaten in Scandinavia 60% is pig meat, in the European Community 50%, in Japan 45% and North America 35%. World-wide, pig meat is the most popular of all available meats (Whittemore and Kyriazakis, 2006). But Barnes (1994) reported that in Ghana, pigs are treated with contempt even by people who consume the pork. The major problem militating against consumption of pork and apparent decrease demand for it is the dislikeness of the animal eating habits. Teye *et al.* (1996) stated that the quality of meat product depends mostly on the meat used. Good quality carcasses (low fat content, typical colour and optimal

pH) for processing could be obtained from farms where the factors (age, sex, health and conformation of the animal selected for fattening, system and level of feeding, management and handling practices) are duly considered in raising the animal. The desire of lean meat therefore became the dominant factor in defining carcass quality as parameters such as colour, tenderness and eating quality became less important. The tenderness of meat decreases as an animal advanced in age. The level of fatness tends to increase with increasing age particularly in pigs. The back fat thickness widens with age. The preference of processors of meat is for young animals with much lean to over aged fatty animals. Lawrie, (1991) observed that sex is an important determinant of muscle growth which becomes meat. Male carcasses weigh heavier than that of female at the same age. Boars were reported as the leaner carcasses than hogs and the problem of boar taint (smell in the meat) could be overcome by slaughtering at early age or lighter weight (Okai and Bonsi, 1994). McGlone and Pond (2002) observed that boars were leaner than gilts in any given weight during growth and both were leaner than castrates males.

In developing countries, pork from indigenous pigs such as ABP forms about 42% of the total meat production (FAO, 1982). In a study by Manyo-Plange and Barnes (1996), ABP carcass quality compared well with that of the exotic breed under the free range system of production. They observed that despite the heavy live weight of the Large White its mean dressing percentage was slightly low 69.4% although not significantly different from 70.16% value of the ABP. It was expected that the genetically superior the Large White would performed better than the indigenous pig. It could be explained probably that the ABP and

Large White under harsh conditions become adapted primarily for survival to the suppression of productive functions (Manyo-Plange, 1996). But, Chigaru *et al.* (1981) in a study over a range of age at slaughter (4, 6 and 8 months) observed that dressing percentage was consistently 2-3 units higher and the percentage of fat in the carcass 4 units lower in the Large White compared to the indigenous pigs of Zimbabwe.

Teye *et al.* (2009) in a study of carcass characteristics of ABP observed a positive correlation between the carcass yield and corresponding live weight. As the live weight increases the carcass yield tends to be higher. However, there appears to be an upper limit for this positive correlation between the live and carcass weights. A similar observation was made by Manyo-Plange and Barnes (1996) in their study. Lean growth, or lean meat deposition, represents the gain of the valuable parts in the pig's body. Lean growth rate is the single most important factor that determines the daily requirement for amino acids (protein) and one of the main factors determining the requirements for energy in grower-finisher pigs. Lean growth potentials of pigs are largely determined by genotype and sex (Lange and Baidoo, 2005). The presence of disease can significantly reduce lean growth rates in pigs (Williams *et al.*, 1993).

CHAPTER THREE

METHODOLOGY

Study Area

The study was carried out on a herd of Ashanti Black Pigs (ABP) at the National Pig Breeding Station of the Animal Production Directorate (APD) of the Ministry of Food and Agriculture at Babile in the Lawra District of Upper West Region of Ghana. The station was mandated in 1993 under the National Livestock Services Project to be responsible for the improvement of the ABP, an indigenous breed of pig in an ex-situ conservation strategy. The station is about 2km from the Babile township. Babile is located within the Guinea Savannah agro-ecological zone and the climate is hot and dry from November to March with annual range of temperature of between 17°C and 34°C and a mean annual rainfall of 1100mm. Babile is located at about latitude 10° 31'N and longitude 02° 49'W (Baffour-Awuah *et al.*, 2005).

Source of Data

The study covers a period of seven (7) years from 1999 to 2005 on pigs that were performance-tested on the station. A total of 211 weaner pigs were used. These were selected for performance testing based on body colouration (black) and weaning weights above the average of the litter from which they were

selected. The monthly weights of individual pigs were taken until attaining eight months of age or about 240 days.

Performance Testing

Performance Testing is the testing of an animal under a standard environment so as to assess such traits as rate of growth, efficiency of feed conversion and thickness of the back fat at various points *in vivo* (MAFF, 1977). Performance testing, according to Pond and Maner (1974) measures the individuals merit for growth rate, feed efficiency and carcass quality.

The basis of a performance testing was that an animal's own performance is taken as a measure of its genetic merit and with traits of high heritability like growth traits being used as a guide to how its progeny will perform (Holness, 1991). The great asset of the performance test is that an indication of the animal's worth is available before it is used for breeding and many animals can be tested allowing a high intensity of selection (MAFF, 1977).

The aim of performance testing on the station was based on the above assertions. The piglets that were above the average weaning weight of the litter went through this process. They were allowed 14 days to come out of 'weaning shock' after which their initial weights were taken. They were fed the same diet up to 8 months. Their final body weights at the end of this period were taken and then entered into the selection index (see Appendix 2) to determine each animal's breeding value according to Ahunu *et al.* (1995). The animals are then to be ranked according to their index values. The top 10% of the group are to be selected as replacement shock for use on the station. The next 40% which are

considered as good breeding animals are to be given to participating breeders for multiplication and subsequent distribution to other farmers not classified as participating breeders. The remaining 50% are to be slaughtered.

Data Collection and Analysis

The pigs were weaned at 42 days of age and their weights were recorded. After weaning, their liveweights were recorded and those selected for performance testing were allowed two weeks to acclimatise in the performance testing pens. Monthly weights were then recorded. Subsequently, body weights at 120 days, 180 days and 240 days were measured. Post-weaning growth (PWG) from weaning to 120 days (PWG1), from weaning to 180 days (PWG2) and from weaning to 240 days (PWG3) were calculated for pigs surviving to those ages (see Appendix 1).

The data analysed were those on the growth traits of pigs born on the station from 1999 to 2005 (inclusive) over a 7-year period. These were weaning weight of piglets, live weight (kg) at 120 days, 180 days and 240 days and post-weaning average daily gains (g/day) at the various ages of growth. Data were edited to remove all inconsistencies such as those with missing records or duplication of animal identification numbers.

Data were analyzed using the Generalized Linear Model (GLM) procedure of the Minitab Statistical package (Minitab, 1996). The factors considered to affect the post-weaning growth performance of pigs were year of birth, sex and litter size at weaning.

CHAPTER FOUR

RESULTS

Introduction

The results show the magnitudes of the post-weaning growth traits of ABP raised under an intensive management system which were measured as live weight at weaning (42days), 120 days, 180 days and 240 days as influenced by the year of birth (Table 2), sex (Table 3) and litter size at weaning (Table 4) of pigs. The post-weaning growth rates (PWG1, PWG2 and PWG3) as influenced by these factors (year of birth, sex and litter size at weaning) are also shown in Tables 5, 6 and 7 respectively.

Year of Birth

There were significant differences in the growth performance of pigs due to the year of birth for all traits studied (Tables 3 and 5). The highest mean weaning weight of 6.9kg was recorded in the year 2001 whereas the lowest of 5.3 kg was recorded in 2003.

A similar trend was observed for the subsequent live weights post-weaning with the lowest at 120-day, 180-day and 240-day live weight recorded in 2002.

The lowest post weaning growth rates were also recorded in 2002 (Table 5).

Table 2: Means and standard errors (se) of weaning weight, 120-day weight, 180-day weight and 240-day weight as influenced by the year of birth

YOB	Weaning Weight kg			120 - day Weight, kg			180 – day Weight, kg			240–day Weight, kg		
	N	Mean	se	N	Mean	se	N	Mean	se	N	Mean	se
1999	28	6.12c	0.26	28	13.81d	0.65	28	20.70f	1.06	28	29.16f	1.21
2000	41	5.93c	0.14	41	13.07c	0.53	41	20.63f	0.67	40	29.22f	0.68
2001	33	6.86d	0.19	33	14.58e	0.42	33	16.78d	0.54	33	22.06d	0.98
2002	19	6.04c	0.22	16	10.94a	0.67	16	12.79a	0.90	16	14.34a	0.83
2003	27	5.28g	0.20	27	11.28a	0.23	27	14.53b	0.27	27	18.64b	0.58
2004	24	5.37a	0.21	24	12.04b	0.35	24	15.34c	0.47	18	20.70c	0.82
2005	39	5.77b	0.16	38	12.16b	0.47	38	19.43e	0.44	38	27.24e	0.63

Source: Field data (Babile National Pig Breeding Station, 1999-2005).

Means with a common letter in a column for each subclass for the same traits are not significantly different ($p < 0.05$).

N = Number of observations.

Table 3: Means and standard errors (se) of weaning weight, 120-day weight, 180-day weight and 240-day weight as influenced by sex

	Weaning Weight kg			120 - day Weight, kg			180 – day Weight, kg			240–day Weight, kg		
	N	Mean	se	N	Mean	se	N	Mean	se	N	Mean	se
Male	79	6.24b	0.12	78	13.32b	0.38	78	18.90b	0.59	75	25.25b	0.89
Female	132	5.75a	0.10	129	12.37a	0.23	129	17.04a	0.33	125	23.53a	0.54
Overall	211	5.9	0.08	207	12.7	0.20	207	17.7	0.31	200	24.2	0.48

Source: Field data (Babile National Pig Breeding Station, 1999-2005).

Means with a common letter in a column for each subclass for the same traits are not significantly different ($p < 0.05$).

N = Number of observations.

Sex

There were significant sex differences for the various post-weaning growth traits (Table 3). The males were heavier at weaning and showed higher mean body weights at the various post-weaning ages at 120 days, 180 days and 240 days compared to the females (Table 3). The males and females pigs showed similar trend with the males exhibiting faster growth rates than their females counterparts (Table 6).

Litter size at weaning

The largest litter size at weaning was 13 and this had pigs with the lowest weight at weaning of 4.2kg. Subsequently, pigs in the litter size at weaning of 11 had the lowest live weights at 120 days, 180 days and 240 days (Table 4). Conversely, pigs with the low litter size at weaning of 2 to 3 had the highest live weight at weaning and at subsequent post-weaning ages (Table 4).

Post-weaning growth rates as influenced by litter size at weaning (Table 7) showed that pigs from litter size of 11 exhibited the lowest post-weaning growth rates. It was however apparent that the post-weaning growth traits studied were rather variable showing no clear trend as to the effect of litter size at weaning of pigs.

Table 4: Means and standard errors (se) of weaning weight, 120-day weight, 180-day weight and 240-day weight as influenced by litter size at weaning.

Litter size at Weaning	Weaning weight, kg			120 -day weights, kg			180 -day weight, kg			240 -day weight, kg		
	No	Mean	se	No	Mean	se	No	Mean	se	No	Mean	se
2	1	8.00g	-	1	18.00e	-	1	27.50f	-	1	38.00g	-
3	2	8.50g	0.00	2	18.00e	0.00	2	17.00d	0.00	2	21.00b	0.00
4	6	7.13f	0.46	6	13.33d	1.11	6	18.46d	1.16	6	26.58e	2.63
5	19	7.12f	0.26	19	13.96d	0.86	19	20.36e	1.58	19	27.66e	1.80
6	41	6.40e	0.14	38	12.81c	0.44	38	18.02d	0.76	38	23.92d	1.09
7	47	6.07d	0.14	46	12.89c	0.43	46	18.13d	0.56	46	25.10e	1.03
8	47	5.27c	0.13	47	11.95b	0.37	47	16.60c	0.60	44	21.99bc	0.95
9	20	5.28c	0.19	20	12.16b	0.70	20	15.59b	0.84	20	21.55bc	1.14

Table 4 continued: Means and standard errors (se) of weaning weight, 120-day weight, 180-day weight and 240-day weight as influenced by litter size at weaning.

Litter size at Weaning	Weaning weight, kg			120 -day weights, kg			180 -day weight, kg			240 -day weight, kg		
	N	Mean	se	N	Mean	se	N	Mean	se	N	Mean	se
10	21	5.35c	0.21	21	12.73b	0.47	21	18.13d	0.51	17	25.00e	1.31
11	2	4.88b	0.13	2	9.50a	0.50	2	12.00a	1.00	2	18.50a	1.50
12	3	5.75c	0.43	3	12.00b	1.73	3	18.50d	3.55	3	29.67f	4.33
13	2	4.25a	0.25	2	14.25d	5.25	2	19.00d	0.00	2	29.50f	0.50
Overall	211	5.9	0.08	207	12.7	0.20	207	17.7	0.31	200	24.2	0.48

Source: Field data (Babile National Pig Breeding Station, 1999-2005).

Means with a common letter in a column for each subclass for the same traits are not significantly different ($p < 0.05$).

N = Number of observations.

Table 5: Means and standard errors (se) of post-weaning growth rates as influenced by year of birth (YOB)

YOB	PWG 1, g/day			PWG 2, g/day			PWG 3, g/day		
	N	Mean	se	N	Mean	se	N	Mean	se
1999	28	98.65f	6.29	28	105.65e	6.28	28	116.39e	5.32
2000	41	91.53e	6.60	41	106.34e	4.81	40	117.52e	3.35
2001	33	98.97f	5.82	33	71.86c	4.45	33	76.75c	4.98
2002	16	63.10a	9.61	16	49.11a	7.07	16	41.93a	4.65
2003	27	76.92b	4.23	27	67.03b	2.41	27	67.47b	3.02
2004	24	85.60d	5.44	24	72.46c	3.84	18	77.27c	4.53
2005	38	81.65c	6.10	38	98.83d	3.40	38	108.62d	3.15

Source: Field data (Babile National Pig Breeding Station, 1999-2005).

Means with a common letter in a column in each subclass for the same trait are not significantly different ($p < 0.05$).

N – Number of observations.

PWG 1–Average daily gain from weaning to 120 days.

PWG 2- Average daily gain from weaning to 180 days.

PWG 3- Average daily gain from weaning to 240 days.

Table 6: Means and standard errors (se) of post-weaning growth rates as influenced by sex

	PWG 1, g/day			PWG 2, g/day			PWG 3, g/day		
	N	Mean	se	N	Mean	se	N	Mean	se
Male	78	90.97b	4.46	78	91.74b	4.11	75	95.81b	4.37
Female	129	84.72a	2.93	129	81.73a	2.49	125	89.69a	2.75
Overall	207	87.07	2.48	207	85.50	2.21	200	91.99	2.38

Source: Field data (Babile National Pig Breeding Station, 1999-2005).

Means with a common letter in a column in each subclass for the same trait are not significantly different ($p < 0.05$).

N – Number of observations.

PWG 1 - Average daily gain from weaning to 120 days.

PWG 2 - Average daily gain from weaning to 180 days.

PWG 3 - Average daily gain from weaning to 240 days.

Table 7: Means and standard errors (se) of post-weaning growth rates as influenced by litter size at weaning

Litter size at weaning	PWG 1, g/day			PWG 2, g/day			PWG 3, g/day		
	N	Mean	se	N	Mean	se	N	Mean	se
2	1	128.21f	-	1	141.30h	-	1	151.52f	-
3	2	121.19e	0.00	2	61.59b	0.00	2	63.13a	0.00
4	6	79.60b	17.00	6	82.10d	13.2	6	98.30c	14.90
5	19	87.72d	9.71	19	95.90f	10.90	19	103.72d	8.69
6	38	81.88bc	6.23	38	84.19d	5.90	38	88.42b	5.79
7	46	87.03d	4.83	46	87.19e	4.26	46	96.07c	5.25
8	47	85.64c	4.80	47	82.23d	4.32	44	84.60b	4.71
9	20	88.30d	7.94	20	74.66c	5.40	20	82.20b	5.38
10	21	94.63e	7.21	21	92.65f	3.58	17	98.48e	6.76

Table 7 continued: Means and standard errors (se) of post weaning growth rates as influenced by litter size at weaning

Litter size at weaning	PWG 1, g/day			PWG 2, g/day			PWG 3, g/day		
	N	Mean	se	N	Mean	se	N	Mean	se
11	2	59.29a	8.01	2	51.63a	8.15	2	68.81a	8.21
12	3	80.10b	16.70	3	92.4f	22.80	3	120.80e	19.70
13	2	128.20f	70.50	2	106.88g	1.81	2	127.53e	3.79
Overall	207	87.1	2.21	207	85.5	2.21	200	92.0	2.38

Source: Field data (Babile National Pig Breeding Station, 1999-2005).

Means with a common letter subscript in a column in each subclass for the same trait are not significantly different ($p < 0.01$).

N – Number of observation.

PWG 1–Average daily gain from weaning to 120 days.

PWG 2- Average daily gain from weaning to 180 days.

PWG 3- Average daily gain from weaning to 240 day.

CHAPTER FIVE

DISCUSSION

Effect of year of birth on growth traits

There were wide variations in the growth traits studied as influenced by the year of birth of piglets. These variations due to year effect may be due to the level of management practices, climatic and nutritional factors as reported by Baffour-Awuah *et al.* (2005). The qualities of management and nutritional programme have much influence on the performance of the pig immediately post-weaning (Dedecker, 2000). Where feed resources were supplied on regular basis to maintain the level of feeding and provision of other nutritional requirements, it was seen that the animals performed well in that year. The highest mean weaning weight of 6.86 kg observed in 2001 (Table 2) was at start of a new project during which adequate funds were provided to ensure better management of the animals on the station. The genetic potential for growth was brought to bear on the animals during the years as the post-weaning growth performance in 1999 and 2000 compared to other years. This also reflects the level of management and environmental factors as observed by Dedecker (2000) which affect post-weaning performance of pigs.

The high mean weaning weight value and the mean 120 day weight value observed in 2001 was due to the inception of the new project taken over from the previous project. This happened at the beginning of the Agricultural Services Sub-sector Investment Programme (AgSSIP) as the NLSP has come to an end in 1999.

This advantage could not be taken into the grower-finisher stage of growth by the pigs which might be attributed to changes in the quality of management and environment mentioned by Dedecker (2000). Aherne *et al.* (1992) indicated also that management and environment are more often the limiting factors to optimize performance of pigs. Wolter *et al.* (2002) reported that the magnitude of the weaning weight has a significant effect on subsequent growth performance of pigs. It confirmed the assertion that where weaned pigs are better managed they reach maturity in short time with regard to their weaning weight and the individual's growth potential (Dedecker, 2000).

The pigs with lighter mean weights at weaning showed slower rate of growth post-weaning than the heavier weight pigs as shown in Table 2. These findings confirmed those of Kavanagh (1994) and Cahill *et al.* (2005). Longer time was therefore taken to reach market weight confirming what was reported by Mahan (1993) that lighter weight pigs take longer period to reach market weight. The study revealed that there was no compensatory gain among the lighter weaned pigs during the growth phases which confirm the observations made by Mahan and Lepine (1991) and Mahan *et al.* (1998). Variation in management during the years might have been the cause of differences in the weight. Damgaard *et al.* (2003) also observed that piglets that were lighter at weaning remained lighter throughout the grow-finish phase of production. Smith *et al.* (2007) made similar observation as low birth weight pigs continued to be light weight in subsequent phases of production.

The year of birth also had much influence on the post-weaning growth rate. This might be due to better management during those years 1999 - 2002 even

though the NLSP ended in 1999, there might have been spill over (feed and drugs) into the preceding years (2002).

In contrast, Miller *et al.* (1999) asserted that weaning weight has no significant effect on weight gains post-weaning. However, studies have shown that weaning weight is a large factor in determining post-weaning performance and that the nutrition although very important has no great impact (Dedecker, 2000). The study had proven that weaning weight has influence on post-weaning growth performance of pigs.

Effect of sex on growth traits

The males performed better than their female counterparts in almost all the traits considered (Table 3). The post-weaning growth performance of males over females which had been widely reported by some researchers as very significant (Le Cozler *et al.*, 1998; Baffour-Awuah *et al.*, 2005) was proven by the study. The differences in growth were attributed to hormonal differences between the sexes and their resultant effect on growth (Bell *et al.*, 1970). It has been reported that sex is an important determinant in muscle growth in animals (Lawrie, 1991). This was evident in the study as the males showed much better performance than the females reaching good slaughter weight. Throughout the growth periods the males were heavier or tended to be heavier than the females which confirm the observation made by Cahill *et al.* (2005).

Litter size at weaning

There was a clear trend of the size of litter influencing the growth phases of the pigs. There was a decrease in weights of individual pigs as the litter size increases. This confirmed the observation made by Okai *et al.* (1982) that as litter size increases the weights of individual pigs within the litter decreases. The litter size in which a piglet was born and weaned had impact on the post-weaning growth performance. It was observed from the study that pigs from the litter size of 2 (Table 4) showed maximum weights at the various stages of their growth as compared to those from higher litter size of 12. At weaning, they weighed 8.0kg but reached 38.0kg at 240days as compared to the litter size of 12 that weighed 5.75kg at weaning but reached 29.67kg at 240days. The study revealed that the growth rates PWG1, PWG2 and PWG3 for a litter size of 2 were 128.2g/day, 141.3g/day and 151.5g/day respectively as compared to that of the litter size at 12 of 80.1g/day, 92.4g/day and 120.8g/day respectively showed the extent to which litter size could influence growth of the animals. It showed variability in relation to the litter size but not widely as reported by Baffour-Awuah *et al.* (2005) for pre-weaning growth. The quality of management becomes paramount at this stage of the development of the pigs especially feed intake (good quality) which would enhance growth and development because it affects the length of time the pigs would take to reach market weight as expressed by Mahan and Lepine (1991) and Mahan (1993). Toplis *et al.* (1999) observed a positive correlation between increased nutrient intake and performance through increased weaning weight and post-weaning growth rates. But the study revealed that pigs with highest weaning weight (Table 4) had poor weight at various stages (120days, 180days and

240days) of their development as well as post-weaning growth rates (Table 6). The reason for not showing this positive correlation might have been due to poor management. This observation is in contrast with what was reported by Smith *et al.* (2007) that birth and weaning weight have a positive relationship with pig weight at the end of the nursery phase. Wolter et al. (2002) reported that the impact of birth weight on growth performance after weaning was greater than that of increasing feed intake during lactation. Parity of dam influences piglet weight in subsequent phases of production, with pigs born to primiparous sows having a growth disadvantage (Smith *et al.*, 2007).

The individual growth performance becomes the determining factor in their subsequent post-weaning development irrespective of the original litter size of a piglet. It was observed that pigs from litter size of 3 had the highest mean weaning weight 8.5kg (Table 4) which could have been an advantage influencing their subsequent growth performance but rather they performed poorly for PWG2 and PWG3 of 61.6 g/day and 63.1 g/day respectively (Table 6). Conversely, the study revealed that pigs from higher litter size (12 and 13) with lower weaning weights showed much gain in weight and higher growth rates in the course of their development (Table 4). This might have been attributed to good management practices and adequate nutrition. The post-weaning growth of pigs were influenced by weaning weights and that gains of heavy-weight pigs were higher after weaning, but the study showed contrary as those with higher weights (8.2kg) performed no better subsequently.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATION

Conclusions

The study of the post-weaning growth performance of Ashanti Black Pig (ABP) under intensive management system has shown that there is more room for improvement of the breed through effective selection programmes and improving the management systems on the station. However the post-weaning growth performance of ABP obtained in this study compares well with that for other strains of indigenous pigs in Africa (Nigeria and Zimbabwe) (Holness, 1991). But the general performance of ABP is still below that of the exotic breeds under similar conditions.

There is growing interest of pig producers in Ghana to use the ABP as the preferred choice in production as a result of the improvement seen in the breed (Barnes and Fleischer, 1998).

The study had contributed to the documentation of performance (post-weaning growth rates) of the breed. There is a greater opportunity to improve upon the performance of ABP through better management practices coupled with genetic improvement strategy in line with the open nucleus breeding concept for the continuous improvement as well as the conservation of the ABP *in situ*. The study has revealed that the level of management must be stepped up to enable the breed perform better than what has been achieved up to this period.

Recommendation

It is recommended that further studies to determine genetic merits of the indigenous ABP with respect to heritabilities of reproduction and growth traits be undertaken to establish the genetic correlations among these traits for use in measuring breeding values of individual animals and design an appropriate breeding programme.

Since the breed is of national importance, there should be a continuous institutional support; such as provision of funds to the universities, CSIR and MoFA to further evaluate the ABP for the various economic traits; and maintaining the policy of developing the ABP as a national breed by stakeholders in the pig industry.

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APPENDICES

APPENDIX 1

Formulae for Post-weaning Growth rates of pigs

(i) Post-weaning Growth (g/day) $PWG\ 1 = \frac{120\text{-day weight} - \text{Weaning weight (g)}}{120 - \text{Weaning age (days)}}$

(ii) Post-Weaning Growth (g/day) $PWG\ 2 = \frac{180\text{-day weight} - \text{Weaning weight (g)}}{180 - \text{Weaning age (days)}}$

(iii) Post-Weaning Growth (g/day) $PWG\ 3 = \frac{240\text{-day weight} - \text{Weaning weight (g)}}{240 - \text{Weaning age (days)}}$

APPENDIX 2

Formula for Selection Index (BV) of pigs

It is expected that, after the performance testing, the breeding value of each animal would be computed based on the selection index using the expression below:

$$\text{Selection Index (or BV)} = h^2_1 (W_1 - W_a) + h^2_2 (W_2 - W_b)$$

Where I = index value or breeding value (BV)

h^2_1 = heritability of 180 day body weight assumed to be 0.40

W_1 = 180 day body weight of the individual animal

W_a = mean body weight of all animals at 180 days

h^2_2 = heritability of 240 day body weight assumed to be 0.45

W_2 = 240 day body weight of the individual animal

W_b = mean body weight of all animals at 240 days