EXPLORATION OF PIG REARING PRACTICES IN RELATION TO ANIMAL WELFARE AND MARKETING CHANNELS FOLLOWED BY FARMERS IN PUNJAB

Thesis

Submitted to the Guru Angad Dev Veterinary and Animal Sciences University
in partial fulfillment of the requirements for the degree of

MASTER OF VETERINARY SCIENCE
in
VETERINARY AND ANIMAL HUSBANDRY EXTENSION EDUCATION
(Minor Subject: Veterinary Gynaecology and Obstetrics)

By

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2019

CERTIFICATE – I

This is to certify that the thesis entitled, "**Exploration of pig rearing practices in relation to animal welfare and marketing channels followed by farmers in Punjab**", submitted for the degree of **M.V.Sc.,** in the subject of **Veterinary and Animal Husbandry Extension Education** (Minor subject: **Veterinary Gynaecology and Obstetrics**) of the Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, is a bonafide research work carried out by **Harmanjeet Singh Sidhu (L-2017-V-26-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

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CERTIFICATE – II

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ACKNOWLEDGEMENT

First and foremost, I express my deepest gratitude to ***The Almighty*** *for being with me right from the beginning, until the end.*

I express my sincere heartfelt gratitude and indebtedness to my major advisor, ***Dr. S K Kansal ,*** *Professor-cum-Head, Department of Veterinary and Animal Husbandry Extension Education, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, who made an ever fading impact on me through his meticulous guidance, constant vigil, positive criticism and ready help rendered in research and personal care with a doting heart. I will be ever grateful and obligated to him for all his cooperation and timely advice.*

I express my heartful gratitude to ***Dr. Parminder Singh****, Professor (Dean PGs Nominee), Department of Veterinary and Animal Husbandry Extension Education for his ever helping attitude and providing necessary facilities to execute my research work.*

Indeed words at my command are inadequate to acknowledge my gratitude to ***Dr. Sumit Singhal*** *(Minor Advisor), Assistant Gynaecologist, Department of Veterinary Gynaecology and Obstetrics for his excellence guidance, ever encouraging, friendly attitude, keen interest, constant supervision, expert opinion, complete involvement and untiring efforts in the fruitful completion of this study.*

I feel privileged to express my gracious thanks to the respected member of my advisory committee, ***Dr. Jaswinder Singh****, Assistant Professor, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana for his valuable suggestions, encouraging attitude and everlasting guidance.*

The guidance and help rendered by a galaxy of my loveable teachers ***Dr. Harish Kumar Verma (Director Extension Education),***

Special thanks to ***Dr. Harish Kumar Verma (Director Extension Education),*** *GADVASU, Ludhiana for his unconditional help and guidance all the time.*

The guidance and help rendered by a galaxy of my loveable teachers ***Dr. Harish Kumar Verma (Director Extension Education), Dr. Y.S. Jadoun, Dr. Rajesh Kasrija, Dr. Ravdeep Singh, Dr. Khushpreet Singh, Dr. Bilawal Singh****, Dr. Kulwinder Singh Sandhu and* ***Dr. Bharti Deshmukh*** *are highly appreciated. I will definitely remember their helping attitude and kindness forever.*

I am extremely thankful to ***Dr. J.P.S Gill****, Director Research, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana and* ***Dr. Sanjeev Kumar Uppal****, Dean Postgraduate studies, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana for their timely technical and academic support throughout the course of my study.*

I am really grateful to my all seniors, ***Dr. Dhananjay Deshmukh, Dr. Nimbalkar Vidya Gajanan, Dr. Insha Mir, Dr. Niharika Thakur, Dr. Yerramareddy***

Roopa, Dr. Prateek Dhaliwal *and* ***Dr. Sumanpreet Kaur*** *especially for their encouragement and timely help throughout my studies.*

A special mention of thanks to my colleagues, ***Dr.Harmandeep Singh, Dr. Akshita Chadda*** *and* ***Dr. Sukhwinder Singh.***

I feel really short of words to thank my friends ***Dr. Sandeep Singh Dhaliwal, Dr. Rana Partap Singh Brar, Kamalpreet Jassal, Amarveer Singh Chahal, Simerpreet Singh Sandhu*** *and* ***Navdeep Singh,*** *for always standing by my side and sharing a great relationship as compassionate friends. I will always cherish the warmth shown by them. It was a great pleasure to be a part of this friend circle and homely atmosphere in the PAU Campus during my studies.*

I would also like to thank all the Pig farmers involved in the study for providing necessary information and sharing their pig farming experiences which acted as the key point in research analysis.

Timely help and cooperation extended by technical and non-teaching staff of the department is highly acknowledged namely ***Mr. Chaman, Mr. Dharminder, Mr. Jassi, Mr. kartar, Mr. Mattu, Mr. Rana, Mr. Shiv, Mr. Surjit, Mr. Harjinder and Mr. Dinesh.***

No words can adequately express my indebted feelings to the most affectionate and caring Mother ***Mrs. Mandeep Kaur*** *for her selfless love and contribution, Father* ***S. Jagpreet Singh,*** *Taya ji* ***S. Rajdevinder*** *Singh, Tayi ji* ***Mrs. Jasvir Kaur, cousin Preet Rattan Singh Sidhu*** *for their constructive ideas, valuable guidance and incessant encouragement and altruistic help throughout the period of research.*

Last but not the least I would like to express my thanks and appreciate the efforts of all those who have helped, guided and supported me in one way or the other but have been inadvertently left out. In other words, all may not have been mentioned but none have been forgotten.

Place: Ludhiana
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Title of the Thesis	:	Exploration of pig rearing practices in relation to animal welfare and marketing channels followed by farmers in Punjab
Name of the student and Admission No.	:	Harmanjeet Singh Sidhu (L-2017-V-26-M)
Major Subject	:	Veterinary and Animal Husbandry Extension Education
Minor Subject	:	Veterinary Gynaecology and Obstetrics
Name and Designation of the Major Advisor	:	Dr. S. K. Kansal Professor-cum-Head
Degree to be Awarded	:	M.V.Sc.
Year of award of Degree	:	2019
Total pages in Thesis	:	61 + VITA
Name of University	:	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 004, India

ABSTRACT

Pig farming is gaining popularity among Punjab farmers in the recent years, shedding old traditions. A cross-sectional study was conducted to assess the pig rearing practices in relation to animal welfare & marketing channels followed by farmers in Punjab. A total of 150 pig farmers from different agro-climatic zones of Punjab, India were selected purposively and interviewed at their farms. Data was analyzed using logistic regression model and descriptive statistics. The results revealed that a majority of farmers (57%) were having low knowledge score regarding animal welfare. Inadequate space was provided by majority of the farmers to different category of pigs. Training of pig farming, pig farming experience and herd size has significant ($p \leq 0.05$) relation with the knowledge score of farmer about animal welfare. Off fed, lethargic, isolated and bilateral eye discharge were the rank wise behavioural and psychological indicators of pain observed by farmer in pigs. Majority of farmers perceived no pain during docking (99.33%), needle teeth cutting as slightly painful (89.33%) and castration as painful procedure (92.67%). The major channel for sale of live pig was through middleman followed by directly to the farmers especially to new entrants. The price of pig was decided only on the basis of live weight and further price of the animal remain same for farmers who were rearing them exclusively on feed or on waste. North-east and South is the main hub for the sale of live pig through middleman in Punjab. Only 2% of farmers were engaged in value addition of pork. Study concluded that low pig welfare practices were followed by farmer. Presently pig market is solely in the hand of brokers. The study suggested immediate need to establish proper pig market/processing plant to safe guard the interest of pig farmers in Punjab.

Keywords: Animal welfare, marketing channels, pig farmer, price

Signature of Major Advisor **Signature of the Student**

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LIST OF ABBREVIATIONS USED

%	:	Percentage
&	:	And
,	:	Comma
;	:	Semi colon
<	:	Less than
>	:	Greater than
DF	:	Degree of Freedom
et al	:	And others
Etc.	:	Et cetera
FAO	:	Food and Agriculture Organization
Fig.	:	Figure
GADVASU	:	Guru Angad Dev Veterinary and Animal Sciences University
Govt.	:	Government
i.e.	:	That is
m^2	:	Square meter
No.	:	Number
SD	:	Standard Deviation
SE	:	Standard Error
Sig.	:	Significant
Viz.	:	Videlicet
w.r.t	:	With respect to

CHAPTER – I

INTRODUCTION

In India majority of pigs are reared in traditional small scale subsistence-driven production system. Pig is traditionally a scavenger, having been raised as a means of utilizing human food wastes in early domestication. However current production involves the use of foodstuff or waste product of human food as feeds. In addition to providing protein for human consumption, pigs are often one of the main sources of cash income in rural areas and provide manure for cropping (Chauhan *et al* 2016). Pig farming generates income through the sale, manure production and slaughter (Kimbi *et al* 2015). This income meets essential household expenses and provides some financial capital to carry out other agricultural investments (Kimbi *et al* 2003, Ngowi 2005). Pig farming is becoming famous in smallholder systems as an important risk reduction strategy for vulnerable communities (Phiri *et al* 2003, Mutua *et al* 2011).

Pig is the most efficient animal in converting feed to meat. About 70 - 75 per cent of the total production cost of the pig farm is due to the feed cost. Generally farmers want to rear pigs with zero inputs like kitchen waste as well as vegetable waste mixed with rice polish/ wheat bran only. However, day to day variation does not guarantee balanced nutrient intake thereby influence growth. It is therefore essential to feed the animals with economical but balanced feed which will ensure appropriate nutrients intake and growth.

Continuous fragmentation of farm size among the households had forced the farmers to leave traditional farming and look for better sustainable and remunerative opportunities. From the last couple of years, the demand of pork has gradually increased among the northeastern states and southern part of country owing to growth of the hotel industry. This has motivated the farmers of Punjab to go for pig farming in a commercial way.

Pig farming once had a bad image in the society, and was raised by socially back warded down-trodden class Indian people only. But at present, the scenario has changed tremendously and commercial pig farming in India is no more restricted to certain classes. Shedding the age old taboo, pig industry in Punjab is showing an upward trend in last few years with a population around 0.32 Lakh (Livestock Census 2012). Now people realized economic value of pigs like other domestic livestock

animals. People from all social arena and status are coming forward to adopt this farming as their livelihood mean. This is evident from the response received from pig farming training programmes in Dept. of Veterinary and Animal Husbandry Extension Education.

In contrast to other livestock rearing, pig farming is extremely advantageous. The pigs are the most prolific breeders. A sow can be bred as early as 8-9 months of age, can farrow twice a year, short gestation period of 114 days and able to produce 6-12 or even more piglets in each farrowing. Pig has the highest feed conversion efficiency and dressing percentage (60 to 80%) after broiler, as they produce more live-weight.

In general, pig farmers are smallholders practicing traditional methods of pig farming for both breeding and pork production in past. In order to make handsome profit from this enterprise, farmer should switch off from traditional pig farming to commercial pig production. Initial capital required for constructing the pig housing, purchasing the breeding stock, purchasing stock feeds and other costs will depend on the size of the piggery farm project but it is comparatively less than same unit dairy farming. This is why commercial pig farming in Punjab is one of the most lucrative business ventures. Small and large scale pig farmers who have started pig farming business few years back are currently producing high-quality pork and earning huge profits from their established venture.

The issue of farm animal welfare has become increasingly gaining ground these days owing to activation of many animal welfare organizations and formation of law and policy by governments in many countries including India. Animal welfare reflects the wellbeing of an animal and comprises an animal's physical and mental health. Animal welfare can be defined in a number of different ways, but there is a growing consensus that whatever the definition, it has to include three elements: the emotional state of the animal, its biological functioning and its ability to show normal patterns of behaviour. These three elements are by no means contradictory; in fact they are closely interrelated. The Five Freedoms developed by the Farm Animal Welfare Council (1992) combine elements from the three approaches to welfare explained above and are a very useful framework to identify the main welfare problems.

The OIE definition of animal welfare refers to how animals adapt to their environment to meet their basic natural needs. Furthermore, this definition usually

covers five aspects, including physical, environmental, health, psychological, and behavioural characteristics.

The scientific assessment of animal welfare is based on four dimensions, namely good housing, good feeding, good health and appropriate i.e. species-specific, behaviour of animals (Botreau *et al* 2009). Certain behaviors appear to be indicators of good animal welfare and health in pigs such as play and specific vocalizations (Boissy *et al* 2007, Reimert *et al* 2013). In growing animals, body weight changes outside the expected growth rate, especially excessive sudden weight loss, are indicators of poor animal welfare and health (Coffey *et al* 1999).

Pigs are social animals that usually live in groups under free-ranging conditions.Social behaviour is affected by environmental factors as well as management of the farm. Competitive situation is raised due to limited access to resources such as food and water that leads to aggression, which is considered as negative social behaviour. Space allowance has a strong effect on social behaviour, so it is considered as major indicator of animal welfare. The human-animal relationship (HAR) is important factor which influences both animal production and welfare. Therefore, fear of humans is also the indicator of animal welfare, since sudden and prolonged fear may severely harm animal welfare and have negative consequences on productivity and product quality.

Successful marketing is a necessary part of any profitable enterprise and alternative marketing is often necessary for pig farmer to survive. But majority of pig farmers especially new entrants often face difficulty in marketing the live or processed pig. Established pig farmers are managing their farm by selling their piglets to new entrants. A hearsay channel to send the live pigs to North Eastern states or to NCR also exist, but majority farmers remain ignorant to it as no proper information is available on this aspect of pig farming. Moreover, indigenous marketing systems in developing country are generally exploitative, collusive and economical inefficient (Mellor, 1970).

Keeping in view the above ground, the present study was planned with the following objectives:

1. To assess the pig rearing practices in relation to animal welfare.

2. To study marketing channels followed by Pig farmers in Punjab.

CHAPTER – II

REVIEW OF LITERATURE

By keeping objectives in view the objectives of the study, review of literature has been divided into two following sections:

2.1 Animal welfare issues

Animal welfare is a state within the animal and a scientific perspective provides methodologies for evidence-based assessment of an animal welfare (Hemorth *et al* 2015).Animal Welfare can also be assessed by various indicators like production measures, health outcomes, skin lesions, physical injury, broken bone, bruising and mortality (Asmare 2014).

Animal-based measurements, such as abnormal behavior, body condition score, skin and hair condition, lameness and injuries, and human animal interaction, provide more detailed information on the state of welfare of the animal (Keeling 2005). Bock *et al* (2007) conducted a study on behavior and attitudes of European pig producers towards animal welfare. They highlight that different attitudes of farmers towards the animal welfare issue are underpinned by differences in farming style or production logic.

Environmental enrichment means increasing the complexity (e.g. foraging opportunities, social housing) of the animal's environment to foster the expression of normal behavior, provide cognitive stimulation and reduce the expression of abnormal behavior. The aim of providing enrichment should be to improve the physical and psychological mental state of the animal (New berry 1995, Mellor 2016).

Certain behaviors appear to be indicators of good animal welfare and health in pigs such as play and specific vocalizations (Boissy *et al* 2007, Reimert *et al* 2013). In growing animals, body weight changes beyond the expected growth rate, especially excessive sudden weight loss, are indicators of poor animal welfare and health (Coffey *et al* 1999).

All pigs should have access to an adequate supply of drinkable water that meets their physiological requirements and is free from contaminants hazardous to pig health. Water flow rates in drinkers should be set according to the age of the animal, stage of production and environmental conditions (Patience 2014).

Wahlang *et al* (2014) reported that the adoption of scientific pig management practices were found to be positive and highly significant with the independent variables like education, annual income from piggery, farming experience, land holdings, herd size, extension agency contact and information source utilization in Ukhrul district of Manipur. There was negative correlation between adoption of scientific pig management practices and the independent variables like age, sex and martial status. Occupation and family size were positively correlated with the adoption of scientific management practices. The majority of the respondents (89%) had low to medium level of adoption followed by 11 per cent of the respondents having high adoption level. Stall feeding, twice feeding in a day and boiling of feeds were adopted by all the farmers. With regard to breeding, a very high majority adopted the practice of twice farrowing in a year followed by majority of the respondents adopting the practice of rearing cross bred respectively. Castration of piglets after weaning was adopted by majority of the respondents followed by about two third of the respondents adopting regular cleaning of pig sty. With respect to marketing, 43 per cent of the respondents adopted the practice of selling the animals and produce directly to local market.

According to Zanu *et al* (2012), the adoption of the improved technologies were associated with age, education, operational land holding, farm size, income from piggery, social participation, extension contact, farming experience, farm education exposure, scientific orientation, knowledge level, training and financial help received.

Kannan *et al* (2008) found that the scientific management practices adopted by the pig farmers showed that they lacked awareness in vaccination and control of ectoparasites in Kerela, but deworming, iron injection, sanitation, waste disposal and castration were scientifically followed in higher proportion among the respondents.

Naval cord enables the piglets to obtain nutrients from dam and removal of waste from its body during gestation. The condition of naval cord at farrowing is very important for the viability of the piglets. It is possible that some bacteria and viruses may enter the body of piglets by travelling through this cord and may cause infection. Piglets may bleed excessively through this cord if gets broken accidently. Generally umbilical cord tears up within seven minutes of birth. Piglets may suffer irreversible brain damage if umbilical ruptures five minutes prior to farrowing (Alonso-Spisbury *et al* 2005).

The umbilical cord must be tied off tightly after application of iodine over it. The scissors or blade employed for this purpose must be sterilized properly. If the cord has already dried up or get shriveled it should not be treated at all. It should be left as such. Piglets born with naval cord injury have less chance of survival (Mota-Rojas *et al* 2012).

Piglets are born with eight sharp teeth including three incisors and one canine. Presence of these can lead to injuries on the teats of dam. Littermates as well farm staff may also get injured (Hutter *et al* 1993). So, these teeth must be clipped or grinded immediately after birth. Adoption of this practice may warrant reduction of various teat injuries (Estienne *et al* 2003).

Iron is the vital nutrient of piglet diet. Deficiency of iron leads to piglet anaemia. Rapidly growing young ones get deprived of iron in their diet. This problem is usually faced by confined animals having least access to the soil (Victor and Mary 2012). Normally piglet is born with blood haemoglobin level of 12-13 g %. Thereafter, haemoglobin drops down rapidly to 6-7 g % by 10^{th}day of life. Piglets weighing 1-5 Kg require daily iron intake of 25 mg (National Research Council 1998). Piglets suffering from anaemia are usually listless and have wrinkled skin with rough hair coat and mucous membrane are usually de-pigmented (Victor and Mary 2012).

Castration is routinely performed in male piglets in first week in order to make them docile and to prevent boar taint which is a distinctive odour that comes during cooking. Main substance that produces boar taint is androsterone synthesized in testicular tissue (Thuni *et al* 2006). Castration is usually performed at organized piggery farms. Generally castration is performed without analgesia (McGlone *et al* 1993). Castration results in better growth rate and docile behavior (Rydhmer *et al* 2006) and better feed conversion ratio (Pauly *et al* 2008).

Hanson *et al* (2011) conducted a study for evaluation of the effect of local anaesthesia and analgesia on vocal, physiological and behavioural responses during and after castration. Piglets castrated with lidocaine produced calls with lower intensity and less resistance movements during castration. Piglets that were given meloxicam displayed less pain-related behaviour (huddled up, spasms, stiffness and prostrated) on both the castration day and the following day. The study concludes that

lidocaine reduced pain during castration and that meloxicam reduced pain after castration.

Bonastre *et al* (2016) and Hansson *et al* (2011) revealed that procedures such as surgical castration, tail docking, teeth clipping, identification, procedures should only be performed by trained personnel, when necessary to facilitate management, and safeguard of animal welfare. As these procedures are painful, so they should be performed in such a way as to minimise any pain, distress or suffering to the animal. Three internationally recognized 'R's i.e. replacement (e.g. using entire males or immune castrated males rather than surgically castrated males), reduction (e.g. tail docking and teeth clipping only when necessary) and refinement (e.g. providing analgesia or anaesthesia under the supervision of a veterinarian) are the options for enhancing animal welfare in relation to these mentioned procedures..

Noonan *et al* (1994) investigated behavioural responses to teeth clipping, tail docking and ear notching and found that there was a behavioural difference between control piglets and piglets that were administered treatment. This suggests that the pain involved in the application of the procedures, is only demonstrated for a short period of time, which disappears approximately 2 min post procedure. Therefore it is reasonable to suggest that these procedures are only slightly painful and that pain relief may not be warranted.

Wilson *et al* (2014) conducted a study to gather information on producer's perceptions and management strategies towards the detection, alleviation of pain and management of sick, injured and heat-stressed pigs and identified 15 behavioural and physiological indicators of pain and heat stress. Treatment records were kept more often for weaned progeny and lactating sows than for piglets and mated sows. Most of producers felt that pigs suffered little pain from routine husbandry procedures and that pain relief was not warranted in those situations. Castration at 10 days of age was the only procedure considered by producers to be very painful. Meloxicam was stated as the most common anti-inflammatory drug used on-farm. A small proportion of farmers incorrectly identified antibiotics as anti-inflammatory drugs. All producers had at least one cooling system in place for preventing heat stress in pigs.

Mcglone *et al* (1993) conducted four experiments to examine the development of castration-induced behavioral changes, the effects of castration age on pig weight

gain, and the efficacy of common analgesics used in castrated pigs. In Experiment one, behavioral changes associated with castration of pigs at 1, 5, 10, 15, or 20 days of age were evaluated. Castration causes reduced suckling, standing, and increased lying times in the behavior of young pigs compared with that of intact pigs at all ages tested. In Experiment second, the performance of pigs castrated at 1 day age was compared with the performance of those castrated on day 14 and female littermates. Pigs that were castrated on day 14 were heavier at weaning and had a higher weight gain during lactation compared to pigs castrated on day 1 age. Pig mortality was similar among the treatments. In Experiment third and fourth, the efficacies of pain-reducing drugs were evaluated for effectiveness in reducing castration-induced behavioral changes in 8-wk-old pigs. Although castration reduced feeding time and weight gain, neither aspirin nor butorphanol influenced behavioral changes associated with castration. It was concluded that pigs show similar behavioral changes when castrated from 1 to 20 days of age, however pig performance data favored castration at 14 day rather than at 1 day of age.

Hay *et al* (2003) conducted an experiment to assess whether behavioral and physiological signs of pain persist over the 5 days following castration of piglets. Behavior observed from castrated piglets after 5days of castration revealed that castrated piglets displayed reduced suckling activity at the udder and remained more inactive while awake during the first 2.5 hours following castration compared to their non-castrated littermates. Castrated piglets tended to show significantly more pain/castration related behaviors during the first hours following treatment. Tail wagging was the significant difference observed between two groups after 4 days of castration. The study found that piglets suffer from pain for more than a few hours following castration and emphasizes the necessity to develop analgesic protocols or alternative methods to castration

Stocking density depends on shed or paddock conditions (i.e. flooring, temperature, ventilation and general farm conditions). Stocking density should allow sufficient space for exercise and for expression of sexual behavior. Once stable groups have been formed, the mixing of unfamiliar pigs should be minimized wherever possible. Stocking density should be taken into consideration whenever there is any incidence of disease, injury, aggression or any other complication. Stocking density for indoor housing is calculated on the basis of the usable floor area

available for pigs to lie down and does not include the area taken up by feeding, watering or other equipment. For dry/gestating gilts/sows, a minimum lying area of 1.50m² and minimum total area of 3.50m² must be provided per sow. For farrowing or lactating sows, a minimum covered area of 7.50-9.00m² and open area of 8.80-12.0m² must be provided per sow. Creep area with dimensions 2.40 m length and 0.75m width is also provided in the farrowing pen. For boars, a minimum lying area of 7.50m² and minimum total area of 10.5m² must be provided per boar. For growers/ fattener a covered area of 0.60-0.80m² per grower and 0.80-1.00m² per fattener is provided where a maximum of 20 growers or 15 fatteners can be kept (Anon 2011). The floor should preferably be pucca concrete. Open area meant for exercise should be double than that of covered area (Warris *et al* 1998).

Floor space may interact with a number of factors such as temperature, humidity, floor type and feeding systems to affect pig welfare (Marchant–Forde 2009, Verdon 2015). All pigs should be able to lie down simultaneously and to stand up and move freely. Therefore sufficient space should be provided to enable animals to have access to feed, water, to separate lying and elimination areas and to avoid aggressive animals. Group housing systems should provide sufficient space and opportunities to avoid or escape from potential aggressors. Insufficient and inadequate space allowance may increase stress, the occurrence of injuries and have an adverse effect on growth rate, feed efficiency, reproduction and behaviour such as locomotion, resting, feeding and drinking, agonistic and abnormal behaviour (Gonyou *et al* 2006, Ekkel 2003, Turner 2000).

Tawse (2010) evaluated the prevalence of consumer attitude towards pig welfare. The results indicated prevalence of high level ignorance regarding pork production methods among UK consumers. You *et al* (2014) conducted a survey on public opinions toward farm animal welfare in China, based on pigs, domestic fowls and their products. Two thirds of the respondents had never heard of ‘animal welfare’ and concluded that farm animal welfare is still in its early stage of development and more efforts are needed to improve the public conception to animal welfare.

Li *et al* (2017) conducted a comprehensive evaluation of pig welfare levels among farmers and revealed that only 2.9% of pig farmers who breed pigs are at the optimal level in terms of welfare, and their production efficiency is relatively high. In contrast, 49.34% of the farmers are at the medium welfare level, and compared with

the farmers at the optimal welfare level, these farmers' pig production efficiency is low. Additionally, farmer's age, gender and no of years of experience with pig breeding have a significant effect in terms of welfare level and production efficiency.

Proper ventilation, without draughts, particularly for young pigs, is important for effective heat dissipation in pigs and to prevent the build-up of effluent gases (e.g. ammonia and hydrogen sulphide), including those from manure and dust in the housing unit (Scheepens *et al* 1991).

Improper handling or lack of human contact can result in fear and distress in pigs. Fear of humans may be an indicator of poor animal welfare which includes indicators as poor human-animal relationship, such as marked avoidance of handlers and abnormal or excessive vocalisation when being moved or when animal handlers interact with pigs, animals slipping or falling during handling (Hemsworth and Coleman 2011).

Animal handlers with positive attitudes to handling and caring for pigs can lead to positive welfare outcomes, which may be shown by the length of time taken for the animals to approach a human, a short flight distance, or a willingness to interact with humans (Hemsworth and Coleman 2014).

Exposure of pigs to sudden or prolonged loud noises should be avoided to prevent increased aggression, stress and fear. Ventilation fans, feeding machinery or other indoor or outdoor equipment should be constructed, placed, operated and maintained in such a way that they cause the least possible amount of noise (Algers and Jensen 1991, Parker *et al* 2010).

Timely humane euthanasia is recommended for pigs when "death is welcome event and continued existence is not an attractive option for the animal." Inadequate or minimal improvement after two days of intensive care, pigs exhibiting extreme weakness or inability to eat or drink, suffering from any infection or disease which fails to respond to treatment are "rule of thumb" that may help stockpersons to recognise when euthanasia should be considered (Linden 2015).

The study was conducted to know the different pig production management practices, pig performance under different farm sizes and effect of management practices and their effect on production and reproductive efficiency in two agro climatic zones of Punjab and concluded that higher the education of farmer better

were the management practices and higher was production as well as reproductive performance of the animals (Singh 2012).

Lahoria (2013) conducted a study on 186 pig farmers who attended specialized training course on pig farming at Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana organized during 2013-2014 and 2014-2015 and revealed that 84% of trainees could not start this venture due to loan related problems and lack of organized sector. All the recommended practices were adopted by farmers except foster mothering and identification of piglets which could be either due to smaller litter size and All-In-And-All-Out respectively.

Nantima *et al* (2016) conducted a study to understand smallholder farmer's knowledge, practices and awareness of bio security measures. The outcome suggested that there was a very low level of awareness of bio security practices amongst smallholder farmers and was concluded that adoption of specific bio security practices by smallholder farmers is feasible but requires institutional support.

2.2 Marketing

Efficient marketing involves various factors such as distance, problems in transportation, methods of grading, handling and selling charges. Presently there is no pork processing plant in Punjab, which explains future prospect and market potential of pig farming in Punjab (Chandrahas and Saini 2013).

The profitability and efficiency of pig marketing was studied in Nigeria which revealed that pig marketing is though profitable but inefficient due to lack of capital, high cost of transportation, lack of abattoir, lack of standardization, fluctuating price, and lack of price information etc. (Ajala and Adesehinwa 2008).

Brokers after buying live pigs from different channels and transport them either in specially designed trucks or by hiring bogies of train to Dimapur, Nagaland or other North-East destination and few progressive farmers of Punjab have flourished their business to export the pork to other countries also. Some farmers are also engaged in value addition of pork in form of bacon, ham, sausages, salamis, pickles etc. (Bhadauria *et al* 2019).

Suchiang *et al* (2017) conducted a study in two purposively selected districts of Meghalaya to find out the marketing channel of pigs, mode of marketing of pork

and the source of piglet supply and revealed that majority (72.5%) farmers disposed their pigs through local traders followed by 25 percent through retailers and only a 2.5 percent disposed their pigs directly to consumers. In case of pork majority farmers (68.3%) disposed to the local traders followed by 10% at the local market, 9.17% at home, 6.67% during social occasion and only 5 percent disposed their pork to the butchers. In case of piglets, majority (77.5%) respondents bought piglets from co-farmers and 22.5% bought piglet from market.

Kang *et al* (2014) found the distribution channel of meat by-products from the pig farm to the final consumer can include a meat processor, wholesale market, wholesaler, retailer, and butcher shop. Meat processors (65.8%) and the wholesale market (34.2%) were found the two major channels that supply meat by-products from the farm to the wholesaler. The distribution to the final consumer is 4-5 step process consisting of wholesaler supplying to retailer or chain store and then retailer supplies to chain store, butcher shop, and restaurant. Most meat by-products were distributed by wholesalers in bulk packaging with wrap and polystyrene boxes.

CHAPTER – III

MATERIALS AND METHODS

This chapter has been devoted to explain various methods, procedures, tools and statistical tests followed in study. The chapter has been organized under the following heads:

3.1 Location of the study

3.2 Construction of research instrument

3.3 Pre-testing of questionnaire

3.4 Selection of respondents

3.5 Sample size determination

3.6 Collection of data

3.7 Selection of study variables

3.8 Statistical analysis of data

3.1 Location of the study

The study was conducted in the state of the Punjab (Latitude of 30°4'N and Longitude of 75°5' E) which is an agrarian state. Respondents were selected from five different agro climatic zones of Punjab.

3.2 Construction of research instrument

The interview schedule was designed for the purpose of collecting data from the respondents. The items in the interview schedule were compiled using literature and in consultation with subject matter specialists and concerned expert. The interview schedule was divided into three sections:

3.2.1 Socio-demographic characteristics of respondents

It includes age, family type, education, main occupation, land holding, experience, training, other animals kept, herd size, ratio of boar to sow, location of farm.

3.2.2 (a) Pig rearing practices related with animal welfare were evaluated under following headings

1. Feeding practices
2. Housing practices
3. Management practices
4. Breeding practices
5. Biosecurity measures

3.2.2 (b) At the end of pig rearing practices section, respondents were asked to rank four behavioral and physiological indicators to identify pigs in pain on a scale of 1 to 4, 1st being the initial observatory indicator and 4th being last indicator perceived by farmers to identify pigs in pain.

3.2.2 (c) In this part the respondents were asked about three management practices i.e. needle teeth cutting, docking and castration and to rank them separately as not painful, slightly painful and painful procedure as perceived by farmers.

3.2.3 Marketing channels followed by pig farmers in Punjab

Different Marketing channels followed by pig farmers in Punjab were documented along with animal preferred for sale, source of market price information, seasonal effect on price of pigs and rearing cost of the animal.

3.3 Pre-testing of interview schedule

The interview schedule was pre-tested by personally interviewing the 20 pig farmers during visit to different pig farms around Ludhiana district. On the basis of information obtained through pre-testing, necessary modifications were made in the body of interview schedule so as to make it more convenient and easy for respondents to access the knowledge score of farmer.

A Cronbach's alpha scale was used to study internal consistency of the variables. A value above 0.70 indicates high reliability or low response variance. The Cronbach's alpha value of the final interview schedule on animal welfare rearing practices was 0.839.

3.4 Selection of Respondents: Those respondents were selected who were having at least 5 adult pigs, having age > 18 years and were willing to participate in the survey. Pig farms were categorized on the basis of adult animals into following categories:

- Small : < 12 pigs
- Medium : 12-25 pigs
- Large : > 25 pigs

As per the census of India (2011) there are 12,581 villages in 22 districts of Punjab state, India. The study was conducted in five Agro-climatic zones namely as:

- Zone 1: Sub-mountain undulating region: comprising of three districts namely Pathankot, Roopnagar, and SAS Nagar.
- Zone 2: Undulating plain region: comprising of two districts namely Gurdaspur and Hoshiarpur
- Zone 3: Central plain region: comprising of nine districts namely Amritsar, Kapurthala, Jalandhar, Ludhiana, Fatehgarh sahib, Patiala, Sangrur, Tarn Taran and S.B.S Nagar
- Zone 4: Western plain region: comprising of four districts namely Ferozpur, Moga, Faridkot and Barnala
- Zone 5: Western region: comprising of four districts namely Muktsar, Bathinda, Fazilka and Mansa

3.5 Sample size determination

There are approximately 1500 pig farms in Punjab and there by assuming 10 % of farms we selected 150 farms from different agro-climatic zones of Punjab where these were available.

3.6 Collection of data

The data was collected by interviewing the pig farmer, by observing provision of various facilities at farm and by measuring space provided to different categories of age groups, number of animals per pen. All the farmers were informed about the purpose and methods of study that the data was handled anonymously and that participation was as per sampling plan.

3.7 Selection of study variables

The following variables were selected to meet the objectives of the study viz. Independent variables and Dependent variables.

3.7.1 Operationalization of variables and their measurement

3.7.1.1 Independent Variables

The independent variables selected for the study were:

1. Agro-climatic zones
2. Age
3. Family type
4. Education
5. Main occupation
6. Land holding
7. Experience of pig farming
8. Pig farming training
9. Other animal kept
10. Pig herd size
11. Boar: sow ratio
12. Location of farm

1. **Agro-climatic zones:** The state is divided into following five different agro climatic zones of Punjab

   Zone 1: Sub-mountain undulating region

   Zone 2: Undulating plain region

   Zone 3: Central plain region

   Zone 4: Western plain region

   Zone 5: Western region

2. **Age:** It referred to the chronological age of the respondents at the time of collection and determined by direct questioning. These respondents were categorized as follows:

   - < 35 years
   - 36-45 years
   - > 45 years

3. **Education:** It refers to the academic qualification of the respondents acquired through formal education.

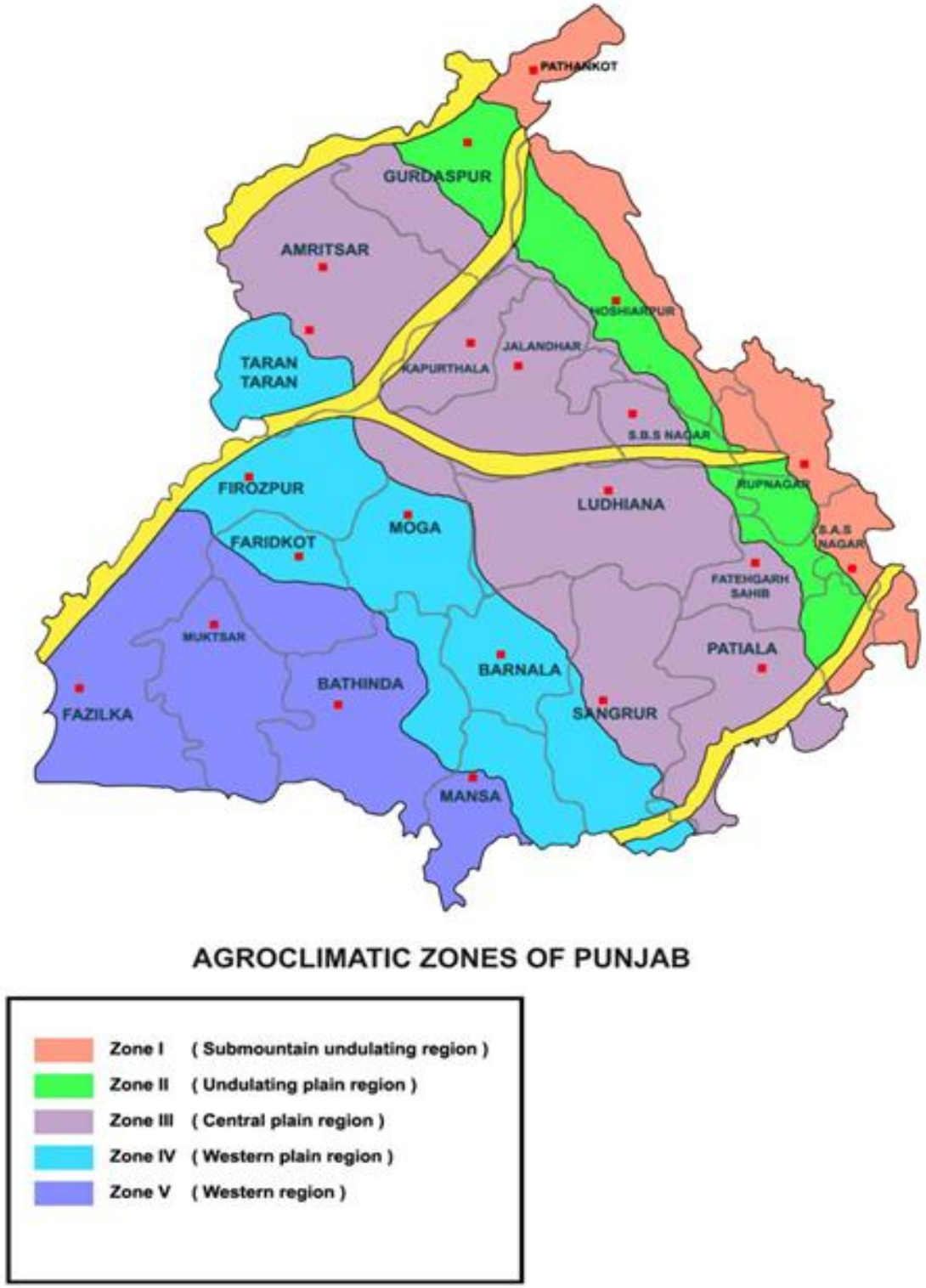


Image 1: Agro-climatic zones of Punjab

Photographs of various pig farmers in different places of Punjab taken during the survey

- Illiterate
- Primary school
- Matriculation
- Graduate

4. **Family type:** Family type of the respondents was defined as members of the family residing in the same house. The respondents were categorized according to the family status they have.
    - Joint family – Mother, father, uncle, aunt, siblings and grandparents living together in a same house
    - Nuclear family – Mother, father and their siblings living in different houses
5. **Main occupation:** It referred to the enterprise, which is the major source of income to the family. The respondents were asked on to whether they consider pig farming or agriculture as their major source of income. The respondents were categorized as:
    - Piggery
    - Agricultural
6. **Land holding:** It referred to number of acres of land a farmer was having.
    - Landless
    - Small (< 5 acres)
    - Medium (5-10 acres)
    - Large (> 10 acres)
7. **Experience of pig farming:** Experience referred to the years spent in the pig farming by the respondents.
    - < 1 years
    - 1-5 years
    - > 5 years
8. **Pig farming training:** It described whether the pig farmer has taken the training of pig farming from various govt. institutes or not.
9. **Other animals kept:** It referred to the other animals i.e. pet, livestock, fish, poultry are kept along with pigs at their farms.

10. **Pig herd size:** Herd size of the respondent was defined as total number of boar, sow, pregnant animal, grower, finisher and piglets were having by the respondents at the time of interview. Respondents were categorized into the following:
    - Small : < 12 pigs
    - Medium : 12- 25 pigs
    - Large : > 25 pigs
11. **Boar: Sow ratio:** It refers to the ratio of boar to sow and was categorized as:
    - 1: 10
    - 1: > 10
    - 1: < 10
12. **Location of farm:** It refers to the location of the pig farm in context to the human population living in that area. It was categorized as:
    - Within village
    - Away from village
    - At periphery of village

3.7.1.2 Dependent variables

A) Knowledge score of farmer regarding various animal welfare practices

Knowledge is familiarity, awareness, or understanding of someone or something, such as facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning. The knowledge score of each farmer was calculated by summing up the score obtained regarding various (n) =52 animal welfare practices viz. feeding (n) =8, housing (n) =11, management (n) =19, breeding (n) =8 and bio security (n) =6. If the respondent answered correctly. A total 52 score was awarded for different practices and was calculated by assigning 1 and 0 score for correct and incorrect responses, respectively. Besides this, related information was also sought from respondents for better understanding and explanation.

B) Marketing channels followed by pig farmers

Different marketing channels followed by pig farmers were documented. This was done with the help of a total of eleven questions regarding market information.

3.8 Statistical analysis of data

Data was entered and analyzed using statistical package for the social science (SPSS) version 20. Descriptive statistics including frequencies, percentages and means were run for continuous/categorical variables. Logistic regression model was applied to determine difference in farmer's knowledge about animal welfare rearing practices along the different levels of independent variables. Garret's ranking technique was used to quantify ranks.

Garrett's formula used for converting ranks into percent is given below:

$$100(Rij– 0.5)/Nj$$

Where,

Rij- rank given for the i^{th} factor by the j^{th} respondent.

Nj- Number of factor ranked by the jth respondent

The percent position was converted into scores by referring to Garrett's scale conversion table.

To describe the different marketing channels statistical analysis was done through descriptive analysis including mean, frequency, number and standard deviation were used in market related parameters.

CHAPTER – IV

RESULTS AND DISCUSSION

This chapter presents the findings of the study and the relevant discussion. The contents include a study on the exploration of pig rearing practices in relation animal welfare and marketing channels followed by farmers of Punjab, the relation of socio-personal characteristics with knowledge score.

The major findings of the study have been discussed under the following sections:

4.1 Socio-personal characteristics

4.2 Exploration of pig rearing practices in relation to animal welfare

4.2.1 Feeding

4.2.2 Housing

4.2.3 Management

4.2.4 Breeding

4.2.5 Biosecurity

4.3 Relationship of knowledge score with independent variables

4.4 Exploration of marketing channels followed by pig farmers

4.1 Socio-personal characteristics: The results of this section have been presented in (Table 1).

4.1.1 Agro-climatic zones

The study revealed that maximum farmers 45 (30%) were found in Zone 3, followed by 32 (21.34%) in Zone 4, 26 (17.34%) in Zone 5, 25 (16.66%) in Zone 1 and 22 (14.66%) from Zone 2.

4.1.2 Age of farmer

The respondents were categorized as less than 35 years, 36-45 years and more than 45 years old. The number of respondents in each category was 49 (32.67%) in less than 35 years age group, 92 (61.33%) in 36-45 years age group, 9 (6%) in more than 45 years age group respectively. Previously majority pig farmers were found in young age group(less than 35 years) in Punjab (Lahoria 2013), middle age (36-45

years) in Mizoram (Tochhawng and Rewani 2013) and in Assam (Payeng *et al* 2013) and in older age group in Tamil Nadu (Sasikala *et al* 2012).

4.1.3 Family type

The data showed that 11 (7.33%) respondents were living in the joint families. Whereas, 139 (92.67%) respondents had nuclear family. Similar results were quoted by Lahoria (2013).

4.1.4 Education

The distribution shows that out of 150 pig farmers, 3 (2.00%) respondents were illiterate, 14 (9.33%) respondents had education up to primary school, 120 (80%) respondents had education up to matriculation, 12 (8%) respondents had education up to senior secondary and only 1 (0.67%) respondent was having graduation level education. It signifies that farmers educated up to matriculation were more adopting the pig farming than higher educated farmers. Singh (2012) studied that majority of the farmers were educated up to 12 th standard.

4.1.5 Main occupation

Majority respondents (90%) reported pig farming as their main occupation while rest (10%) reported agriculture as their main occupation. As majority of the farmers were having land less than 5 acres so they were more dependent on pig farming keeping it as their main occupation of income. Singh (2012) has earlier reported that none of the farmer was doing piggery as main occupation, rather they were doing it as a subsidiary, either to agriculture or government job or business.

4.1.6 Land holding

The data revealed that 10 (6.67%) farmers were landless, 121 (80.67%) farmers were having less than 5 acre, 14 (9.33%) farmers were having land between 5-10 acres and 5 (3.33%) farmers were having more than 10 acres of land. This indicated that small farmers having less than 5 acres of land are adopting the pig farming at comparatively higher rate than farmers having > 5 acres of land.

4.1.7 Experience of pig farming

The study revealed that 76 (50.67%) farmers were having experience of farming less than 1 year, 58 (38.67%) were having experience of 1-5 years, 16 (10.67%) were having experience of more than 5 years. Majority of the farmers had

less than 1 years of experience in pig farming indicated that from last few years pig farming has gain the influence among farmers and is growing rapidly in Punjab.

4.1.8 Pig farming training

The data showed that 80 (53.33%) of farmers had participated in training on pig farming from different govt. centers. The remaining farmers 70 (46.67%) did not attend any training on pig farming.

4.1.9 Other animals kept

The data showed that 6 (4%) farmers have dog, 5 (3.33%) farmers have livestock, 13 (8.67%) farmers have poultry and only 1 (0.67%) of farmers have fish, along with pigs at their farm.

4.1.10 Pig herd size

Majority of farmers 112 (74.67%) were found to have more than 25 animals, around $1/4^{th}$ farmers have 12-25 animals and only one farmer had less than 12 animals. Present results are in confirmation with Singh (2012) who reported that majority of farmers were having medium herd size constituting of 7-15 breedable sows. The reason might be the farmer's perception toward possessing more number of animals will provide more income.

4.1.11 Boar: Sow ratio

The data showed that 18 (12%) farmers were having 1:10 ratio of boar to sow, 13 (8.67%) were having 1: > 10 ratio of boar to sow and 119 (79.33%) were having 1: <10 ratio of boar to sow. There should be optimum ratio of boar to sow to prevent the overexploitation of the boar used for natural service. Eusebio (1980) has also recommended to rear maximum of 20 sows against one boar in tropics.

4.1.12 Location of farm

The study showed that 94 (62.67%) farmers have farm at the periphery of their village, 44 (29.33%) farmers have farm away from village and only 12 (8%) farmers have farm within village. By keeping social, public health and environmental issues in concern, majority of farmers were having their farms at the periphery of the village.

Table 1: Socio-demographic characteristics of 150 pig farmers

S. No.	Category		Frequency (n=150)	Percentage
1	**Agro-climatic zones**	Zone I	25	16.66
		Zone II	22	14.66
		Zone III	45	30.00
		Zone IV	32	21.34
		Zone V	26	17.34
2	**Age of farmer**	< 35 years	49	32.67
		36-45 years	92	61.33
		> 45 years	9	06.00
3	**Family type**	Nuclear	139	92.67
		Joint	11	07.33
4	**Education**	Illiterate	3	02.00
		Primary School	14	09.33
		Matriculation	120	80.00
		Senior Secondary	12	8.00
		Graduation	1	0.67
5	**Main occupation**	Piggery	135	90.00
		Agriculture	15	10.00
6	**Land holding**	Land less	10	6.67
		< 5 Acre	121	80.67
		5-10 Acre	14	9.33
		> 10 Acre	5	3.33
7	**Experience of farming**	<1 year	76	50.67
		1- 5 year	58	38.67
		> 5 year	16	10.67
8	**Pig farming training**	Yes	80	53.33
		No	70	46.67

S. No.	Category			Frequency (n=150)	Percentage
9	Other animal kept	Pet Animal (Dog)	Kept	6	4.00
			Not kept	144	96.00
		Livestock	Yes	5	3.33
			No	145	96.67
		Fishery	Yes	1	0.67
			No	149	99.33
		Poultry	Yes	13	8.67
			No	137	91.33
10	Pig herd Size		< 12	1	0.67
			< 25	37	24.67
			> 25	112	74.67
11	Boar: Sow ratio		01:10	18	12.00
			1: > 10	13	8.67
			1: < 10	119	79.33
12	Location of farm		Within Village	12	08.00
			Away from Village	44	29.33
			At periphery of Village	94	62.67

4.2 Pig rearing practices followed by farmer in relation to animal welfare

4.2.1 Feeding: The results of this section have been presented in (Table 2).

The study revealed that all the farmers provided feed to pigs according to recommended feed or by providing adlib feed to different category of pigs except breed able boar and sow, as they are kept on restricted feeding. Majority 148 (98.67%) farmers were feeding pigs twice a day and only 2 (1.33%) were feeding once a day. All farmers reported that feeding creep feed to the piglets was started from 2nd week of age. Creep feeding decreases the weaning stress, also increases the weaning weight of piglets. Creep feeding must be started at seven to ten days of age.

All the farmers were providing adlib fresh quantity of water to the pigs. Majority 121 (80.67%) respondents did not have knowledge about composition of feed while only 29 (19.33%) farmers had knowledge regarding composition of feed (Fig. 1). Provision of adlib cool drinking water helps the pig to relieve heat stress. There should be enough waterers available to allow adequate access (McGlone *et al* 1993). A newborn piglet consists of approximately 80% water, and a market pig consists of approximately 50% water. Pig can lose almost all its fat and half its protein and remain still live; however, when it loses one-tenth of its water, it will die. This illustrates a good balance between water and feed intake is therefore essential.

Majority 104 (69.33%) of farmers were not feeding mineral mixture to pigs whereas 46 (30.67%) of farmers were feeding mineral mixture to pigs (Fig. 2). Minerals are having diverse functions, ranging from structural functions in some tissues to a wide variety of regulatory functions. The increasing trend toward intensive rearing of pigs, without access to soil or forage, increases the importance of meeting dietary mineral requirements.

Aflatoxin is just one of many mycotoxins that can adversely affect animal health and productivity, therefore care regarding animal feed must be extended not only to the nutritional and economic value, but also to the feed quality. Only 4 (2.67%) farmers were found testing of pig feed to check aflatoxin level, while majority 146 (97.33%) farmers were not doing it. The collected data revealed that only 4 (2.67%) of pig farmers were using toxin binder in fed, while rest of them were not using toxin binder in feed. Jin *et al* (2017) studied the addition of a mycotoxin binder showed beneficial effects for weaned piglets, growth and feed intake were enhanced. Majority 147 (98%) farmers did not have knowledge about age weight ratio while, only 3 (2%) farmers had knowledge about age weight ratio. Majority 142 (94.67%) farmers did not have knowledge regarding feed conversion ratio while, only 8 (5.33%) farmers know about feed conversion ratio. Feed conversion ratio (FCR) is a reflection of performance in pig units. Feedstuffs constitutes between 60-80% of the cost of production and typically around two to three kilogram’s of feed results in a kilo of animal body weight gain.

Table 2: Distribution of 150 pig farmers according to the feeding practices followed

S. No.	Parameters	Response	Frequency (n=150)	Percentage
1	Adequate feed provided to different age groups	Yes	150	100
		No	0	0
2	Frequency of feeding	Once	2	01.33
		Twice	148	98.67
	Adequate Creep feed provided	Yes	150	100
		No	0	0
3	Knowledge about composition of feed	Yes	29	19.33
		No	121	80.67
4	Adequate water offered	Yes	150	100
		No	0	0
5	Mineral Mixture	Fed	46	30.67
		Not fed	104	69.33
6	Feed testing for aflatoxins	Yes	4	02.67
		No	146	97.33
7	Toxin binder in feed	Yes	4	97.33
		No	146	02.67

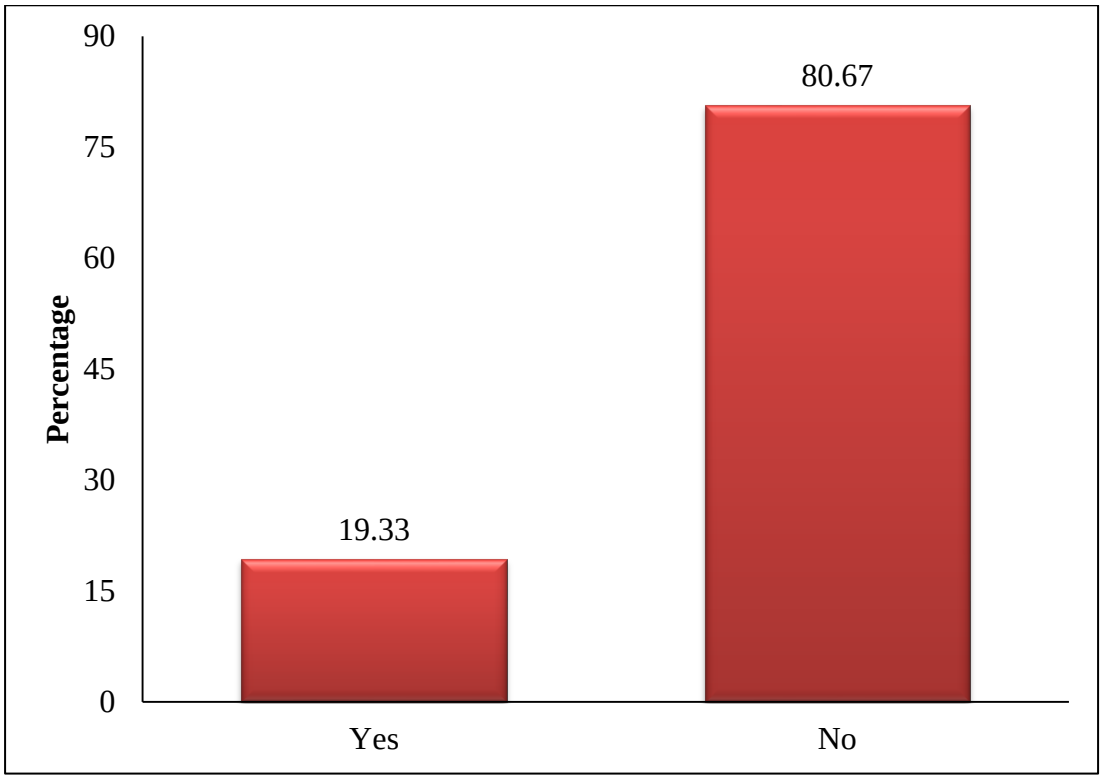


Fig. 1: Distribution of respondents (%) on the basis of knowledge about composition of feed

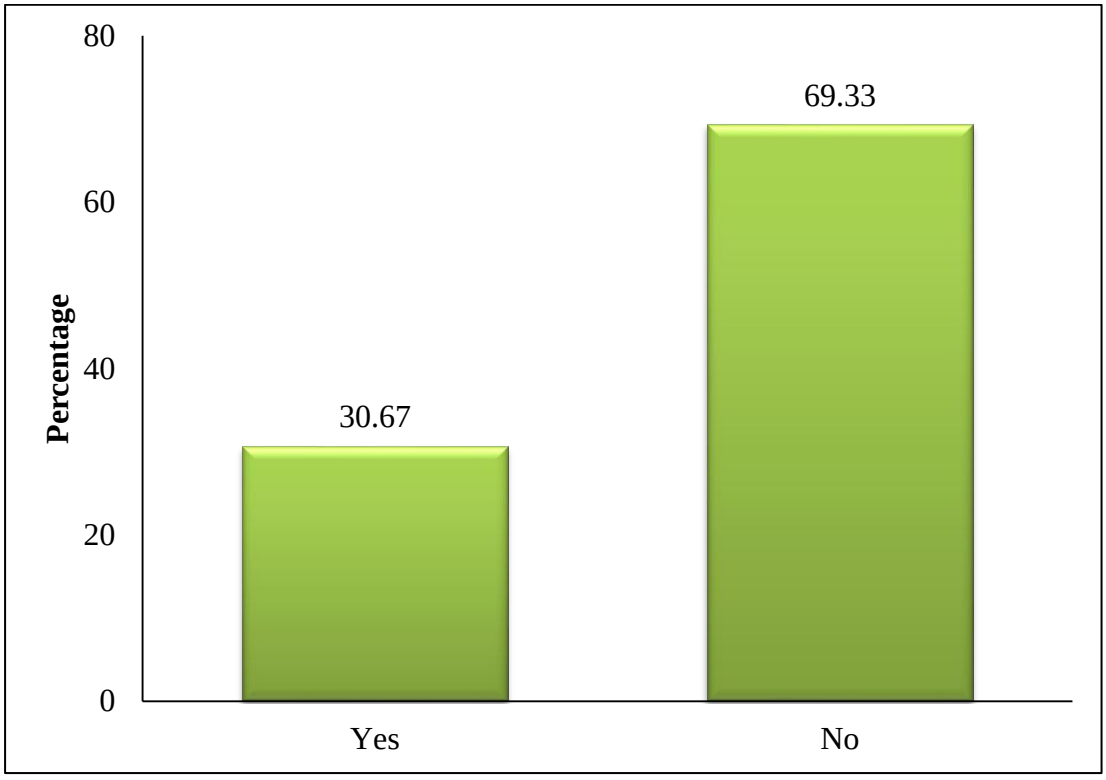


Fig. 2: Distribution of respondents (%) on the basis of mineral mixture feeding

4.2.2 Housing: The results of this section have been presented in (Table 3).

The study revealed that majority 116 (77.33%) farmers were having East-West direction of shed while rest 34 (22.67%) farmers were having North-South direction. All the farmers were having concrete floor in their farm. Majority 148 (98.67%) of farmers were having height of roof more than 12 feet and rest 2 (1.33%) were having less than 10 feet height of roof.

Ideal space enables the animals to have access to feed, water, to separate lying and elimination areas and to avoid aggressive animals. Majority 103 (68.67%) had provided inadequate space to boar, while 47 (31.33%) farmers had provided adequate space (Fig. 3). Sow was provided adequate space by 47 (31.33%) farmers, while 102 (68%) had provided inadequate space to sow (Fig. 4). Majority 97 (64.67%) farmers had provided inadequate space to grower-cum-finisher, while 53 (35.33%) farmers had provided adequate space (Fig. 5). Majority 99 (66%) farmers had provided inadequate space to dry sow/ gilt, while 51 (34%) had provided adequate space (Fig. 6). Only 2 farmers had provided the open area to pigs. The results of the study revealed that the space provided for different age groups was significantly lower against the recommended space. The results illustrated that farmers were not providing the sufficient space to express the normal behavior which is against the welfare of animal and it might raise the mortality of piglets due to crushing by sow. Therefore insufficient and inadequate space allowance may increase stress, the occurrence of injuries and have an adverse effect on growth rate, feed efficiency, reproduction and behavior such as locomotion, resting, feeding and drinking, agonistic and abnormal behavior. Further group housing systems should provide sufficient space and opportunities to avoid or escape from potential aggressors.

Majority of farmers 139 (92.67%) had provided creep area at their farm, while 11 (7.33%) did not have provision of creep area. Provision of guard rails in the farrowing pen prevents the mortality of piglets due to crushing by sow. Majority of the pre-weaned mortalities (52.1%) occur because of crushing of sow. Guard rails were provided by 113 (75.33%) farmers and 37 (24.67%) did not have provision of guard rails. All the farmers were having open sheds, which provides good ventilation in the shed. Proper ventilation prevents the formation of effluent gases in shed (Scheepens *et al* 1991). Almost all 96% farmers were not aware about animal welfare rules and regulations, while only 4% were having knowledge of the same (Fig. 7).

Table 3: Distribution of 150 pig farmers according to the housing design followed

S. No.	Parameters	Response	Frequency	Percentage
1	**Direction of shed**	East – West	116	77.33
		North – South	34	22.67
2	**Type of floor**	Concrete	150	100
		Kucha	0	00.00
3	**Height of roof**	Accurate	148	98.67
		Non-accurate	2	01.33
4	**Space provided for Boar**	Adequate	47	31.33
		Non-adequate	103	68.67
5	**Space provided for Sow**	Adequate	48	32.00
		Non-adequate	102	68.00
6	**Space provided for grower/finisher**	Adequate	53	35.33
		Non-adequate	97	64.67
7	**Space provided for Gilt/ Dry Sow**	Adequate	51	34.00
		Non-adequate	99	66.00
8	**Creep area**	Provided	139	92.67
		Not provided	11	07.33
9	**Provision of guard rails**	Yes	113	75.33
		No	37	24.67
10	**Ventilation in farm**	Yes	150	100.00
		No	0	0.00
114	**Knowledge about animal welfare**	Yes	6	04.00
		No	144	96.00

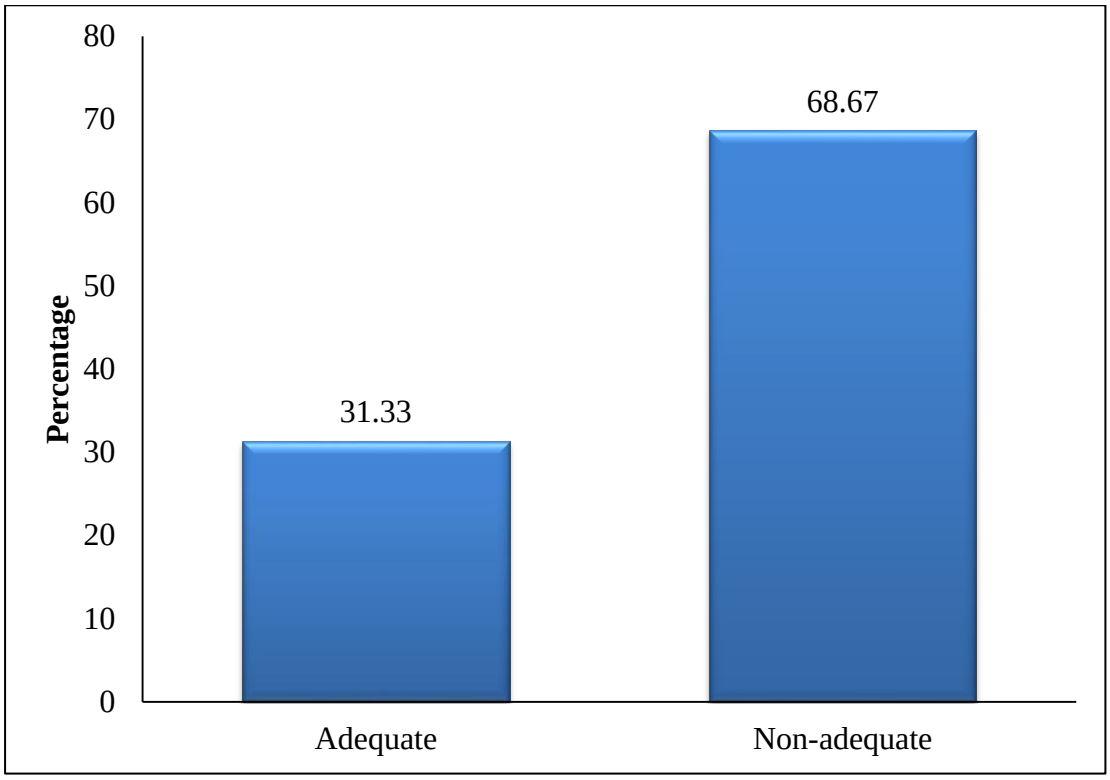


Fig. 3: Distribution of respondents (%) on the basis of space provided to boar

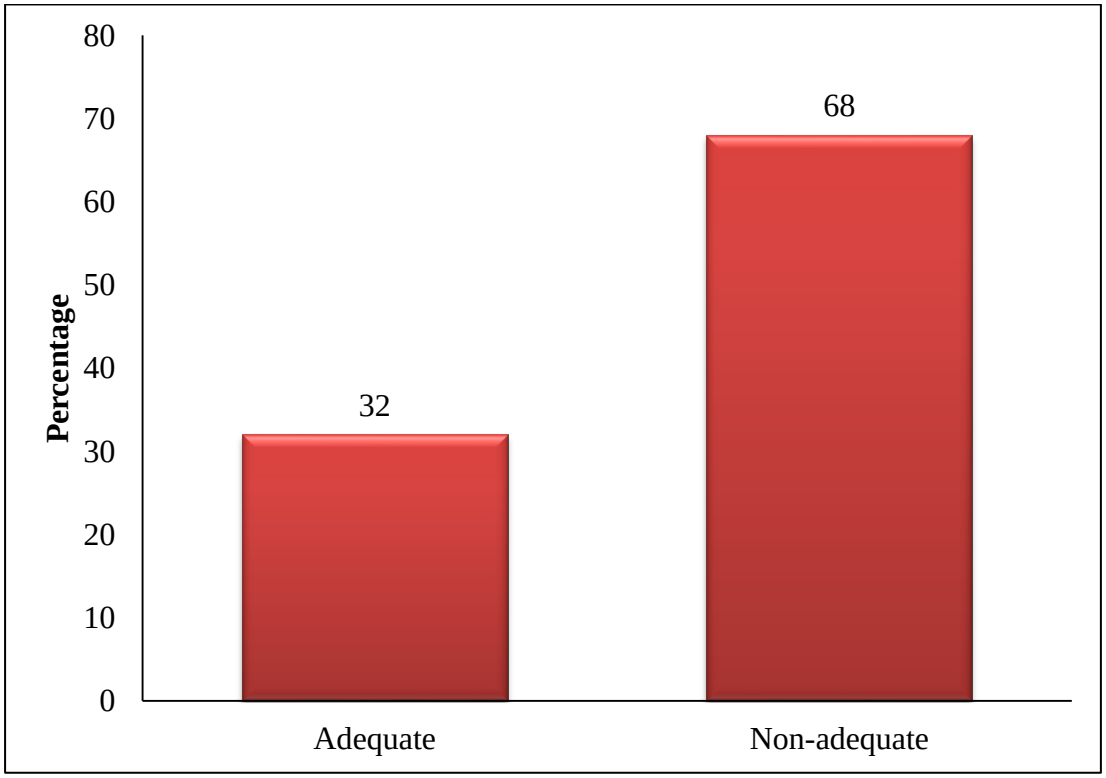


Fig. 4: Distribution of respondents (%) on the basis of space provided to sow with piglets

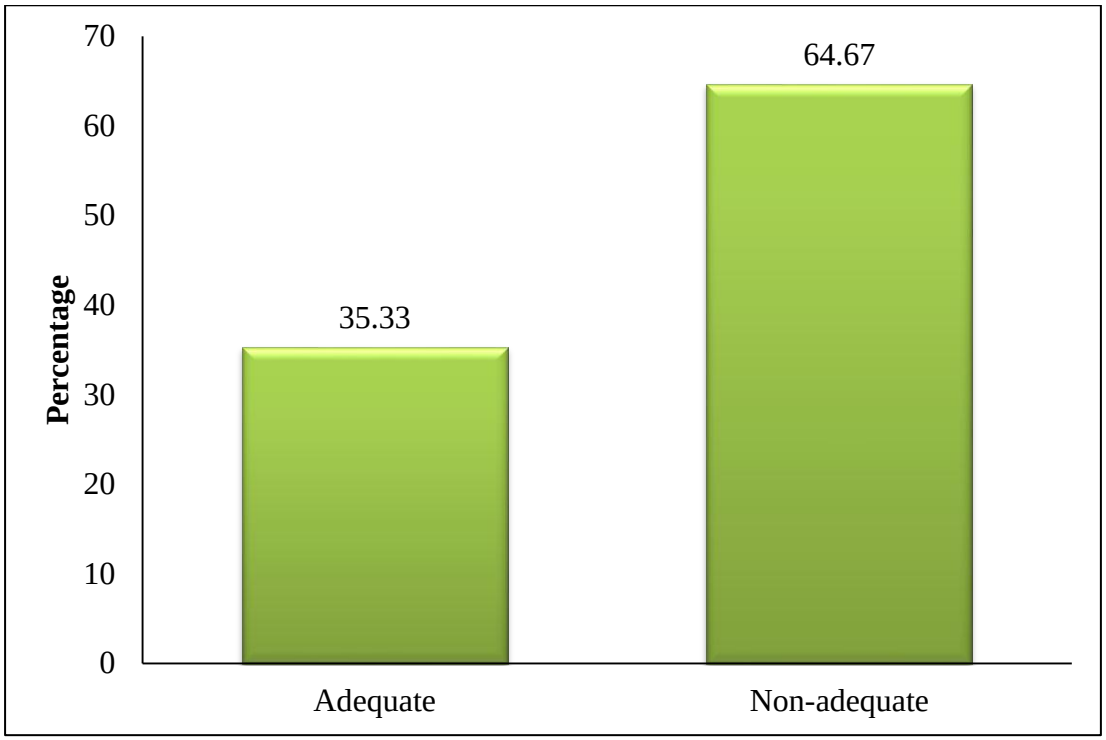


Fig. 5: Distribution of respondents (%) on the basis of space provided to grower-cum-finisher

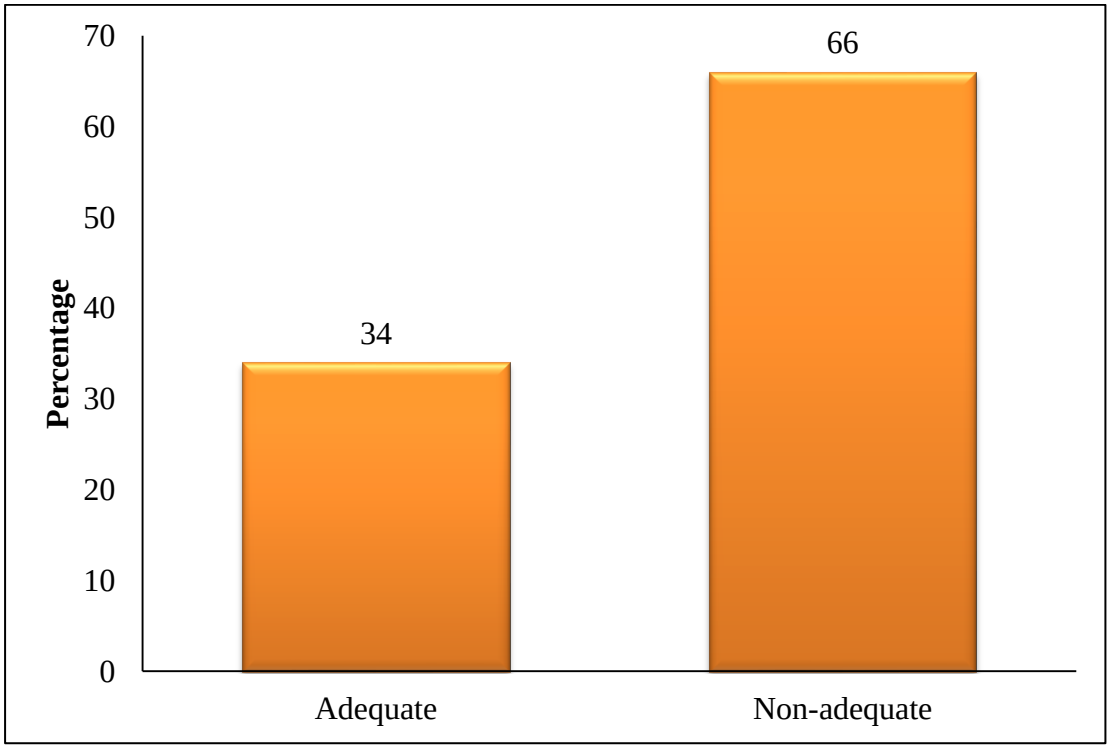


Fig. 6: Distribution of respondents (%) on the basis of space provided to gilt / dry sow

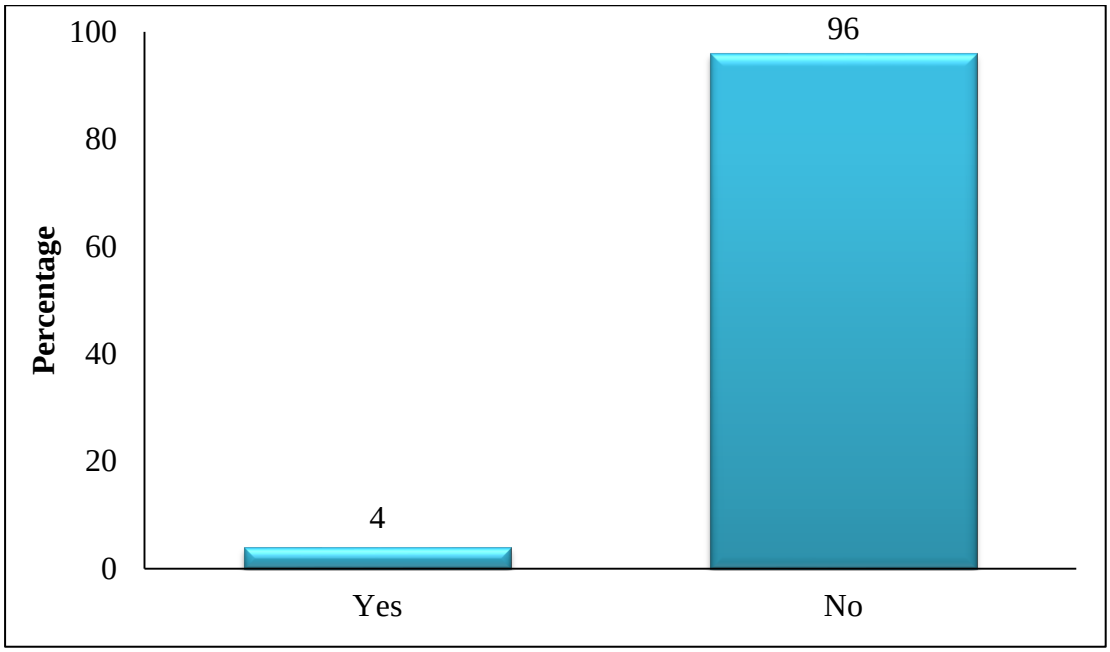


Fig. 7: Distribution of respondents (%) on the basis of knowledge about animal welfare rules and regulations

4.2.2.1. Recommended space

Recommended space for various categories of pigs is depicted in (Table 4).

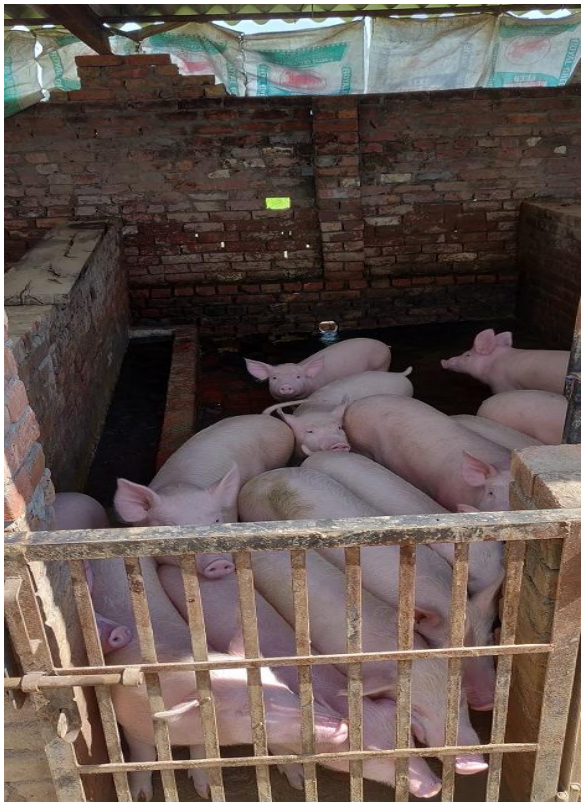
Table 4: Recommended space for various categories of pigs

Category	Space requirement (m^2)		No of animals per pen
	Covered area	Open area	
Boar	6.0-7.0	8.8-12.0	Individually
Sow with piglets	7.0-9.0	8.8-12.0	Individually
Grower-cum-finisher	0.9-1.8	0.9-1.8	30
Gilt / Dry sow	1.8-2.7	1.4-1.8	10

4.2.2.2 Mean space provided to different category of pigs

The mean space provided to boar (4.54 m²), sow with piglets (4.90 m²), grower-cum-finisher (0.55 m²) and to gilt was (1.42 m²) (Table 5). For farrowing or lactating sows, a minimum covered area of 7.50-9.00m² and open area of 8.80-12.0m² must be provided per sow. For boars, a minimum lying area of 7.50m² and minimum total area of 10.5m² must be provided per boar. Growers/fattener must be provided covered area of 0.60-0.80m² per grower and 0.80-1.00m² per fattener with maximum of 20 growers or 15 fatteners can be kept in one pen (Anon 2011).


Depiction of space calculation with measuring tape at pig farm




Depiction of stocking density at a pig farm

Table 5: Mean space provided to different categories of pigs by 150 pig farmers

	Mean	Std. Deviation	Std. Error Mean
Boar	4.54	1.175	.096
Sow with piglets	4.90	1.600	.131
Grower-cum-Finisher	.551	.2724	.0222
Gilt / Dry sow	1.422	.3158	.0258

4.2.2.3 One sample t-test: space provided to different category of pigs

Study found that farmers were providing significantly ($p< 0.05$) lower space than recommended to boar, sow with piglets, grower-cum-finisher and gilt/dry sow. The lower space may hinder the proper movement and exhibition of natural behavior. The lower space provided to different category of pigs may be due to higher cost of shed and lower availability of space (Table 6).

Table 6: One sample t-test: space provided to different category of pigs by 150 farmers

	Test Value = 6 m^2(boar), 7 m^2(sow with piglet), 0.9 m^2(grower-cum-finisher), 1.8 m^2(gilt/dry sow)					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Boar	-15.216	149	.000	-1.460	-1.65	-1.27
Sow with piglets	-16.051	149	.000	-2.097	-2.35	-1.84
Grower-cum-Finisher	-11.181	149	.000	-.2487	-.293	-.205
Gilt / Dry sow	-14.661	149	.000	-.3780	-.429	-.327

4.2.3 Management: The results of this section have been presented in (Table 7).

Naval cord disinfection and detachment should be done, as it can cause serious health threats including naval ill and joint ill etc. The umbilical cord must be tied off tightly after application of iodine over it. The scissors or blade employed for this

purpose must be sterilized properly. Iodine solution must be applied after cutting the naval cord. The study showed that all the farmers go for naval cord detachment with blade after tying with thread, but only 13 (8.67%) farmers were disinfecting the naval cord detacher before using on every piglet and rest majority 137 (91.33%) were not disinfecting the naval cord detacher. Maximum 138 (92%) farmers dispose the placenta by burial method and 12 (8%) were not disposing appropriately. 'Runt' the last piglet born is usually weaker than others, so extra care of the runt should be done. Majority 128 (85.33%) farmers do extra care of weak piglet either by assisting weak piglet in suckling of milk or by providing milk replacers or by early weaning of healthy piglets, while 22 (14.67%) were not going for extra care of weak piglet.

Sufficient colostrum feeding in the first hours after birth is one of the most important success factors for pig in performance. Colostrum provides the necessary immunoglobulins to kick start the pig's immune system. In addition to immunoglobulin's colostrum contains high levels of protein, energy and vitamin D that are vital to newborn pig. All the farmers provide colostrum to new born piglets immediately after birth. Almost all 149 (99.33%) farmers do not know the ingredients of artificial colostrum, but only 1 (0.67%) farmer knew ingredients of artificial colostrum. Iron is the vital nutrient of piglet diet.

Deficiency of iron leads to piglet anaemia. Rapidly growing young ones get deprived of iron in their diet. This problem is usually faced by confined animals having least access to the soil (Victor and Mary 2012). All the farmers were using injection of iron on day 3^{rd} followed by 13^{th} day to prevent from piglet anemia. Needle teeth should be clipped off immediately after birth to prevent the injuries to dam, littermates and handler.

Needle teeth cutting was done by all the farmers as it reduces the teat injuries to dam (Estienne *et al* 2003), but only 11 (7.33%) farmers were disinfecting the needle teeth cutter either with spirit or dettol before using on every piglet and rest majority 139 (92.67%) were not disinfecting the needle teeth cutter. The study showed that majority 116 (77.33%) farmers go for docking by rubber band method to prevent the tail biting in future period and 34 (22.67%) were not doing docking. Castration is done in male piglets to prevent boar taint and to make them docile. The data revealed that only 6 (4%) farmers were not castrating their pigs and rest 144

(96%) castrated their pigs at their own by open method of castration and without giving analgesia (McGlone *et al* 1993). Only 10 (6.67%) of farmers were found giving painkiller after castration of pigs (Fig. 8) as it reduces the pain after castration (Hanson *et al* 2011). Analgesic protocols or alternative methods should be utilized to alleviate pain in piglets after castration (Hay *et al* 2003).

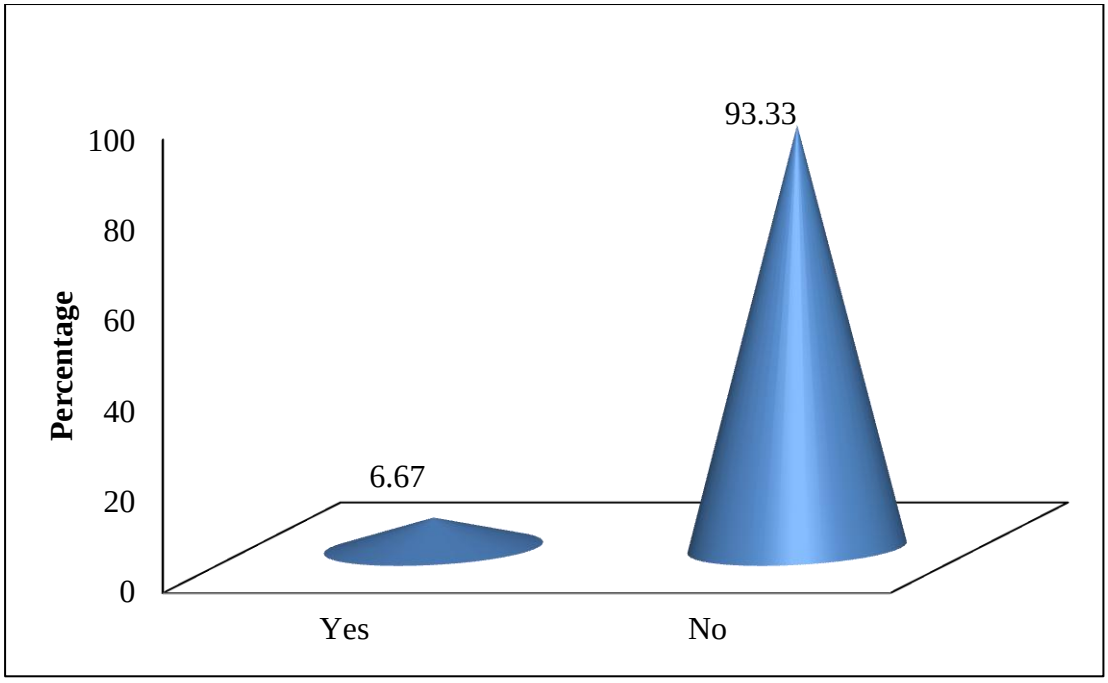


Fig. 8: Distribution of respondents (%) on the basis of administration of painkiller after castratioin

Deworming of piglets should be done to prevent the piglets and adults from different parasites which can affect optimum growth and health of pigs. All the farmers were deworming their pigs regularly after every 3 months. Similar results were revealed regarding deworming of pigs (Kannan *et al* 2008). Majority 120 (80%) were using same salt during consecutive deworming. Use of same salt during consecutive deworming may lead to development of resistance against the drug.

There should be provision of thermometer to record the temperature of the shed and to reduce heat stress either by providing ample amount of drinking water, providing mud for wallowing of pigs, by increasing the floor space to dissipate more heat and by providing the shade to the animal. Majority farmers 144(96%) were not having provision of thermometer at their farm and only 6 (4%) were having it. Heat loss from non-sweating animals can be improved by fogging water in order to cool the ambient air and enhance sensible heat dissipation. To prevent the pigs from heat stress

only 8 (5.33%) of farmers had foggers installed and rest 142 (94.67%) did not have this facility. The limited use of foggers at pig farms might be due to cost factor. Majority 145 (96.67%) farmers reported that they identify pigs in heat stress by panting signs and 5 (3.33%) identify it from sign of pig searching and sitting in wet place (Fig. 9). Wilson *et al* (2014) revealed that farmers reported panting as the most important indicator to identify pigs in heat stress followed by finding a wet/ cool spot in the pen. Pigs suffering from chronic diseases or incurable sickness were sold for slaughtering by majority 139 (92.67%) farmers, while rest 11 (7.33%) reported to keep them.

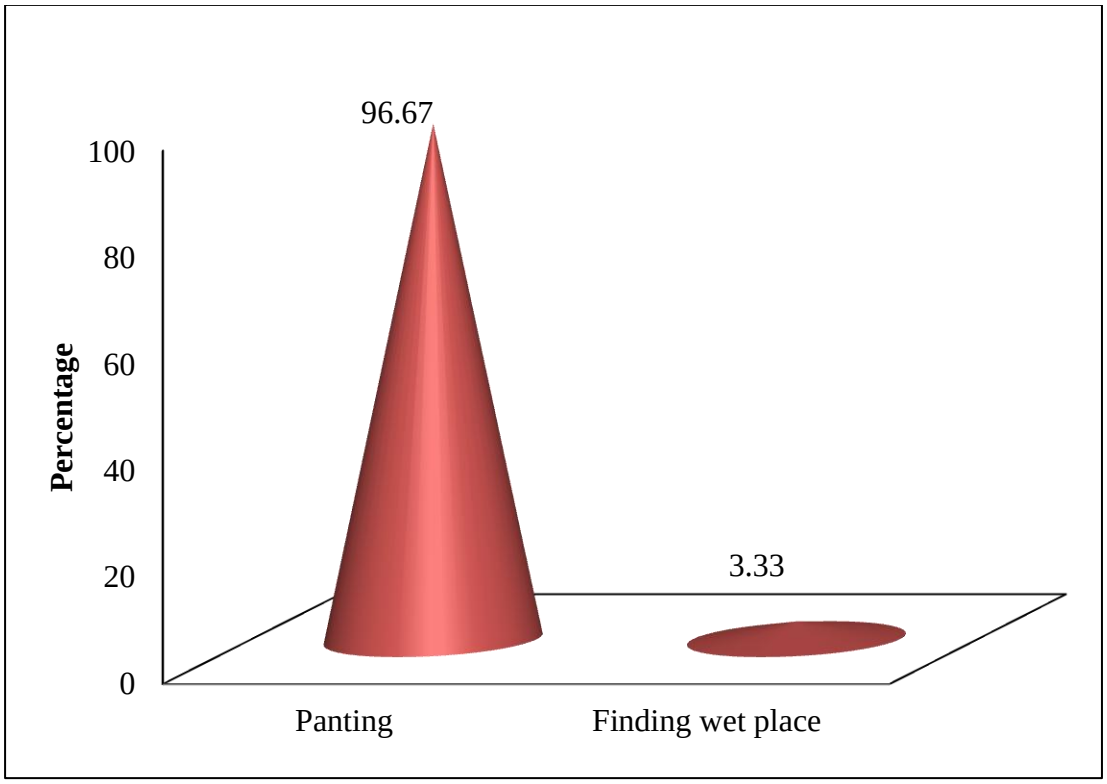


Fig. 9: Distribution of respondents (%) on the basis of indicators to identify pigs in heat stress

Animals suffering from chronic illness and fails to respond to treatment are "rule of thumb" for the euthanasia of the animal (Linden 2015). Majority 138 (92%) farmers do not have any other species, and use labor only for pigs while same labor was used to take care of other species kept by 12 farmers. Labor sharing with other species may spread disease to other species like FMD, HS etc. Majority 77 (51.33%) were not keeping record while 73 (48.67%) farmers were keeping it.

Table 7: Distribution of 150 pig farmers according to the management practices followed

S. No.	Parameters	Response	Frequency	Percentage
1	Naval cord detachment	Yes	150	100
		No	0	0
2	Disinfection of naval cord detacher	Yes	13	08.67
		No	137	91.33
3	Proper disposal of placenta	Yes	138	92.00
		No	12	8.00
4	Extra care done in case of weak piglet	Yes	128	85.33
		No	22	14.67
5	Immediately feeding of colostrum after birth	Yes	150	100
		No	0	0
6	Ingredients of artificial colostrum	Yes	1	0.67
		No	149	99.33
7	Iron injection on 3rd followed by 13th day	Yes	150	100
		No	0	0
8	Needle teeth cutting on day 1	Yes	150	100
		No	0	0
9	Disinfection of needle teeth cutter	Yes	11	07.33
		No	139	92.67
10	Docking	Yes	116	77.33
		No	34	22.67
11	Painkiller given after castration	Yes	10	06.67
		No	140	93.33
12	Deworming done after every 3 months	Yes	150	100
		No	0	0
13	Drug used during consecutive deworming	Same salt	120	80
		Different salt	30	20
14	Vaccination	Yes	150	100
		No	0	0

S. No.	Parameters	Response	Frequency	Percentage
15	**Disinfection of needle before using on every piglet**	Yes	15	10
		No	135	90
16	**Provision of thermometer**	Yes	6	4
		No	144	96
17	**Provision of foggers**	Yes	8	05.33
		No	142	94.67
18	**Slaughtering of incurable sickness**	Yes	139	92.67
		No	11	07.33
19	**Labor sharing with other animals kept**	Yes	12	8

Vaccination is another necessary practice followed in pig farming as outbreak of these diseases can ruin whole farm or can cause severe financial losses to farmers. Pigs are usually vaccinated against classical swine fever, foot and mouth disease and hemorrhagic septicemia. The data described that all the farmers were vaccinating their pigs at 3 months of age followed by booster dose after every 6 months against Classical swine fever. Majority 85 (56.67%) farmers were using Foot and mouth disease vaccine and rest 65 (43.33%) were not using FMD vaccine. Only 6 (4%) of farmers were using Hemorrhagic septicemia vaccine and 144 (96%) were not using HS vaccine. Vaccination of animals was done by the farmers at their own. Only 15 (10%) farmers were using either new needle or disinfecting the needle before using on new pig, while 135 (90%) were not disinfecting the needle (Table 8).

Table 8: Distribution of 150 pig farmers according to usage of particular vaccine

S. No.	Vaccination	Response	Frequency	Percentage
1	**Classical swine fever**	Yes	150	100
		No	0	0
2	**Foot and mouth disease**	Yes	85	56.67
		No	65	43.33
3	**Haemorrhagic septicemia**	Yes	6	4
		No	144	96

4.2.4 Breeding: The results of this section have been presented in (Table 9).

The study described that majority 137 (91.33%) farmers were having knowledge about ideal weight required for breeding of boar. Majority 124 (82.67%) farmers were having knowledge about ideal weight required for breeding of sow and 26 (17.33%) were not having knowledge. Optimum use of boar for natural service i.e. not more than twice a week should be done to prevent the overexploitation of the boar. Majority 144 (96%) farmers were using boar either once or twice a week for service and only 6 (4%) were using boar three or four times a week for service. There was not a single farmer who had gone for semen evaluation of boar before use for breeding.

Table 9: Distribution of 150 pig farmers according to the breeding practices followed

S. No.	Parameters	Response	Frequency	Percentage
1	**Ideal age/weight of Boar for breeding**	Yes	137	91.33
		No	13	08.67
2	**Ideal age/weight of Sow for breeding**	Yes	124	82.67
		No	26	17.33
3	**Ideal use of Boar for natural service**	Yes	144	96
		No	6	4
4	**Semen evaluation**	Yes	0	0
		No	150	100
5	**Isolation of sow before farrowing**	Yes	150	100
		No	0	0
6	**Provision of bedding in farrowing pen**	Yes	130	86.67
		No	20	13.33
7	**Provision of bulb in farrowing pen**	Yes	126	84
		No	24	16
8	**Provision of fan in farrowing pen**	Yes	50	33.33
		No	100	66.67

Pregnant sows must be isolated from the rest of herd before the expected date of farrowing to provide extra care, comfort level and to make the sow adapted to farrowing pen. The study evaluated that all the farmers isolate the pregnant sow in farrowing pen before 1 or 2 weeks of farrowing. Provision of bedding and bulb should be there in farrowing pen to maintain the body temperature of the new born piglets. Majority 130 (86.67%) farmers had provided bedding material in farrowing pen while, rest 20 (13.33%) farmers did not provided bedding in farrowing pen. Majority of farmers 126 (84%) provided bulb in farrowing pen and 24 (16%) did not provided bulb in farrowing pen. Majority 100 (66.67%) farmers had not provided fan in farrowing pen while 50 (33.33%) farmers provided fan in farrowing pen.

4.2.5 Biosecurity

The results of this section have been presented in (Table 10).

Poor sanitation at the farm may increase the exposure of pigs to pathogens, various infectious or parasitic diseases; many of them may be zoonotic in nature. The study found that majority 115 (76.67%) farmers practiced disinfection of shed with potassium permanganate and 35 (23.33%) farmers do not disinfect their sheds.

Table 10: Distribution of 150 pig farmers according to biosecurity practices followed

S. No.	Parameters	Response	Frequency	Percentage
1	Disinfection of shed	Yes	115	76.67
		No	35	23.33
2	New animal kept in quarantine	Yes	77	51.33
		No	73	48.67
3	Provision of shoe cover/ Slippers	Yes	2	1.33
		No	148	98.67
4	Provision of foot bath	Yes	4	02.67
		No	146	97.33
5	Lime sprinkled at entry of farm	Yes	58	38.67
		No	92	61.33
6	Isolation of infected/ sick animal	Yes	130	86.67
		No	20	13.33

Newly purchased animals should be kept at least 3 weeks in quarantine to detect the more dramatic diseases in time to prevent their spread. During the quarantine period, the new pigs should be observed frequently for any signs of disease and should be treated for internal and external parasites and their blood should be tested for any ailment. Nearly half of respondents (51.33%) were keeping the new animal purchased in quarantine and rest were not following quarantine protocol. The average time period of quarantine followed by farmers was 10.21 days.

Entry should be made restricted at the farm for the visitors especially during outbreak of disease. Provision of disposable shoe cover, footbath and lime layer at the entry of the farm can prevent transmission of the disease. Majority 148 (98.67%) farmers did not provide shoe cover/ slippers to visitors on their farm while, only 2 (1.33%) farmers provide slippers to visitor during visit on their farms. Majority farmers 146 (97.33%) did not have provision of footbath at the entry of their farms and only 4 (2.67%) farmers had made footbath at entry of their farms (Fig. 10). Majority farmers 92 (61.33%) did not sprinkled lime at the entry of their farms while rest 58 (38.67%) farmers sprinkled lime at farm gate (Fig. 11). Majority 130 (86.67%) go for isolation of infected/ sick animal to prevent the spread of disease to other animals, while 20 (13.33%) farmers did not isolate the infected animal.

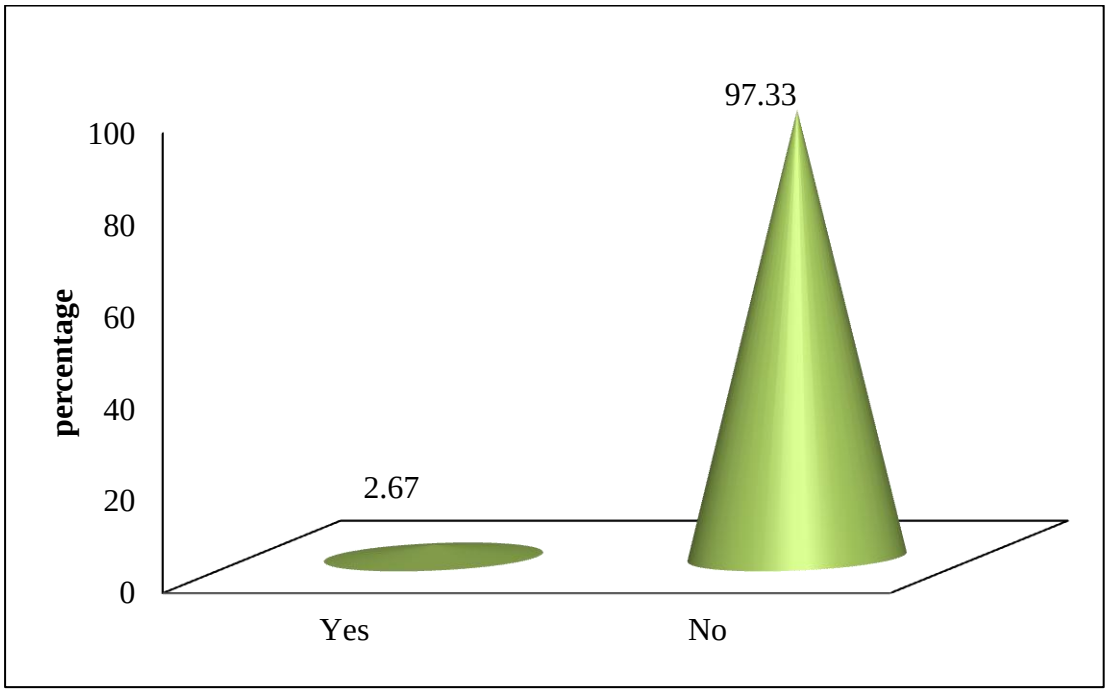


Fig. 10: Distribution of respondents on the basis of provision of foot bath at their farm

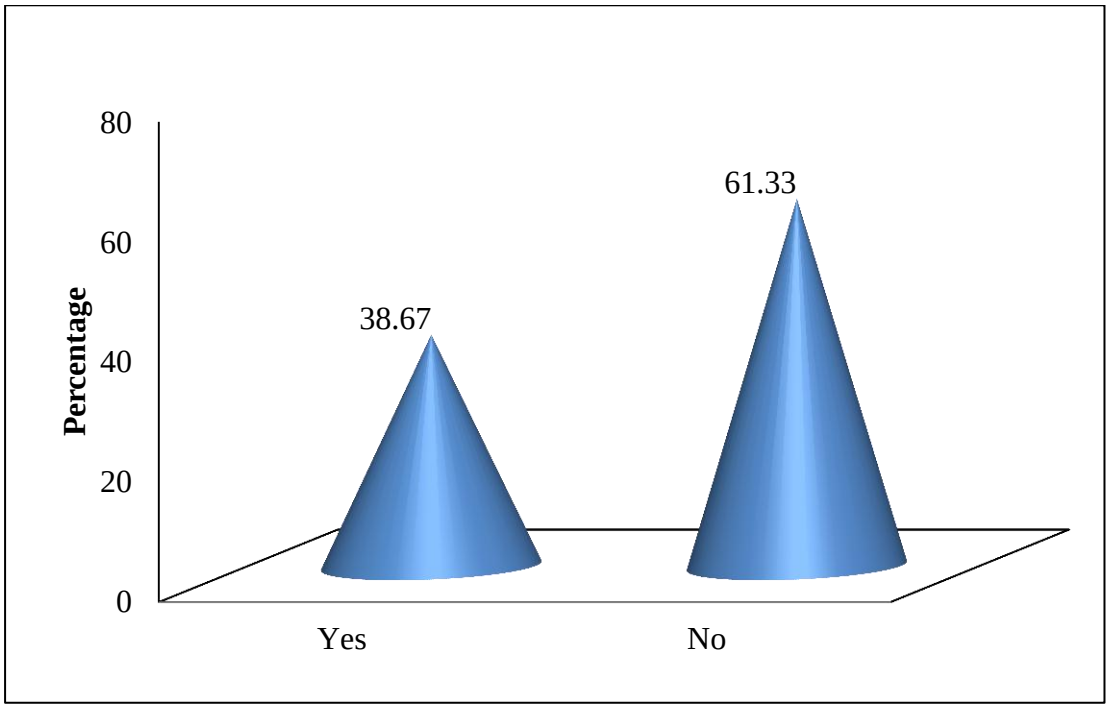


Fig. 11: Distribution of respondents on the basis of lime sprinkled at entery of farm

4.3 Relationship of knowledge score with independent variables

The results of this section have been presented in (Table 11).

Logistic regression model was applied to determine difference in farmer's knowledge about animal welfare rearing practices along the different levels of independent variables.

4.3.1 Knowledge score in relation with five Agro-climatic zones

There was non significant ($p \geq 0.05$) relation of knowledge score with agro-climatic zones in the state of Punjab with ($\beta = -0.014$ and $p = 0.840$).

4.3.2 Knowledge score in relation with age of farmer

There was non significant ($p \geq 0.05$) relation of knowledge score with the age of farmer with ($\beta = -0.054$ and $p = 0.422$).

4.3.3 Knowledge score in relation with family type

There was non significant ($p \geq 0.05$) relation of knowledge score with the family type with ($\beta = 0.023$ and $p = 0.739$).

4.3.4 Knowledge score in relation with education

There was non significant ($p \geq 0.05$) relation of knowledge score with education of farmer with ($\beta = 0.029$ and $p = 0.690$).

4.3.5 Knowledge score in relation with occupation

There was non significant ($p \geq 0.05$) relation of knowledge score with occupation of farmer with ($\beta=0.134$ and $p=0.074$).

4.3.6 Knowledge score in relation with land holding

There was non significant ($p \geq 0.05$) relation of knowledge score with land holding of farmer with ($\beta=0.009$ and $p=0.897$).

4.3.7 Knowledge score in relation with experience of pig farming

There was significant ($p \leq 0.05$) relation of knowledge score with the experience of pig farming ($\beta=0.335$ and $p=0.001$).

4.3.8 Knowledge score in relation with pig farming training

There was significant ($p \leq 0.05$) relation of knowledge score with training of pig farmer ($\beta=0.422$ and $p=0.000$).

4.3.9 Knowledge score in relation with pig herd size

There was significant ($p \leq 0.05$) relation of knowledge score with herd size of farm ($\beta=0.201$ and $p= 0.007$)

Table 11: Knowledge score of 150 pig farmers with independent variables according to univariate analysis

S. No.	Model	Standardiized coefficients	t	Sig.
		β		
1	Constant		6.328	.000
2	Agro-climatic zone	-.014	-.203	.840
3	Age of farmer	-.054	-.805	.422
4	Family type	.023	.334	.739
5	Education	.029	.400	.690
6	Main occupation	.134	1.798	.074
7	Land holding	.009	.129	.897
8	Experience of farming	.335	3.338	.001
9	Pig farming training	.422	5.709	.000
10	Pig herd size	.201	2.741	.007

4.3.10 Multivariate regression model

Explanatory variables showing statistical significance in univariate analysis were further tested in multivariate regression model using a step wise approach. The final model show significant association of pig farming training, experience of farming and pig herd size with knowledge score with adjusted R square value = 0.348 (Table 12).

Table 12: Multivariate regression model

S. No.	Model	Standardized coefficients	T	Sig.
		β		
1	Constant		28.205	.000
2	Training	.382	5.483	.000
3	Experience of farming	.226	3.219	.002
4	Herd size	.225	3.190	.002

4.3.11 Pain in relation to animal welfare

4.3.11.1 Farmers observation regarding behavioral and psychological indicators of pain in pigs on the basis of Garret's ranking

The respondents were asked to rank the behavioral indicators of pain in pigs according to their perception and Garret's ranking was applied for ranking. Off fed was perceived as the most impactful indicator of pain, followed by lethargic nature ,isolated and bilateral eye discharge, which were ranked 2nd, 3rd and 4th (Table 13). Wilson *et al* (2014) found vocalization as most commonly recognized indicator of pain followed by change in gait of animal.

Table 13: Garrett's ranking

S. No.	Indicator	Garret's Average score	Rank
1	Off fed	71.44	1
2	Eye discharge	41.26	4
3	Lethargic	45.3	2
4	Isolated	41.98	3

4.3.11.2 Farmers perception on pain to piglet during needle teeth cutting

Majority (89.33%) farmers perceived needle teeth cutting as slightly painful and (10.67%) perceived as no pain and no farmer perceived needle teeth cutting as painful procedure (Fig. 12).

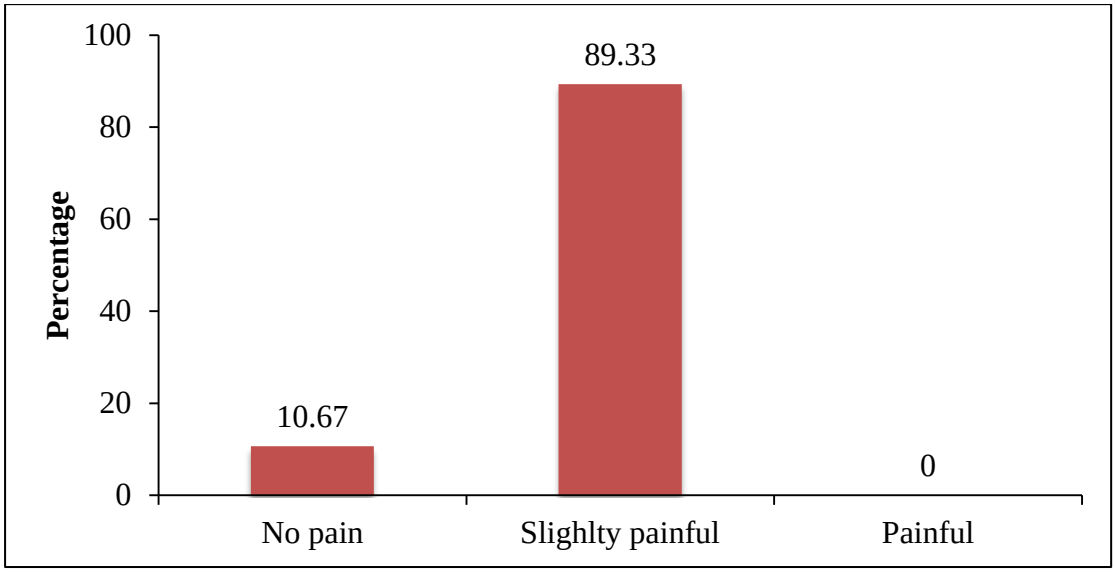


Fig. 12: Distribution of respondents (%) on the basis of pain perceived to piglet during needle teeth cutting

4.3.11.3 Farmers perception on pain to piglet during docking

Majority (99.33%) farmers perceived no pain during docking followed by (0.67%) perceived as slightly painful and no farmer perceived docking as painful procedure (Fig. 13).

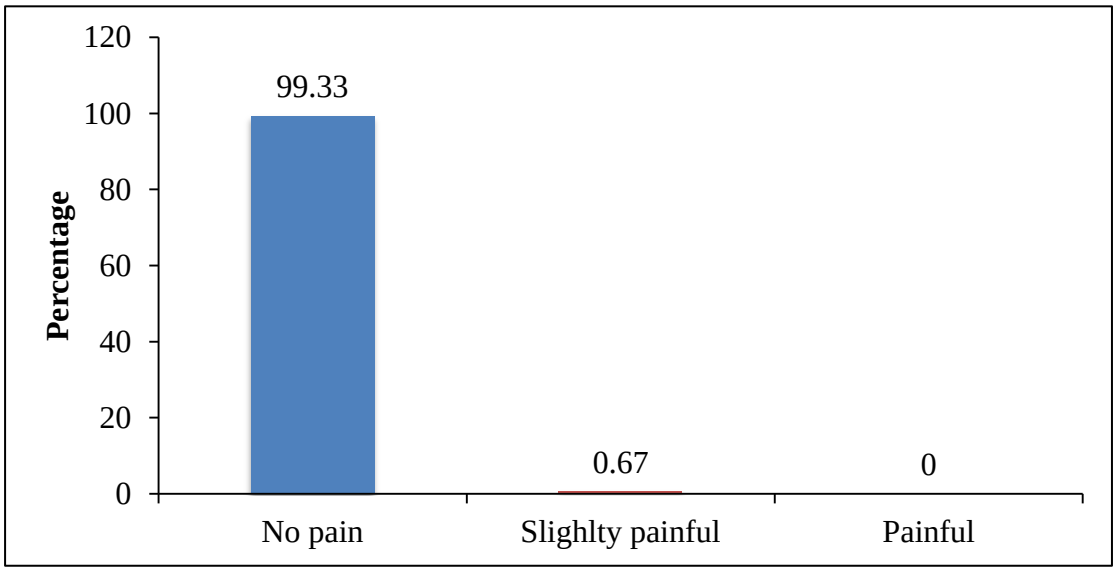


Fig. 13: Distribution of respondents (%) on the basis of pain perceived to piglet during docking

4.3.11.4 Farmers perception on pain to piglet during castration

Majority (92.67%) farmers perceived castration as painful procedure, as slightly painful by (6.67%) farmers and only (0.67%) farmers perceived no pain during castration (Fig. 14).

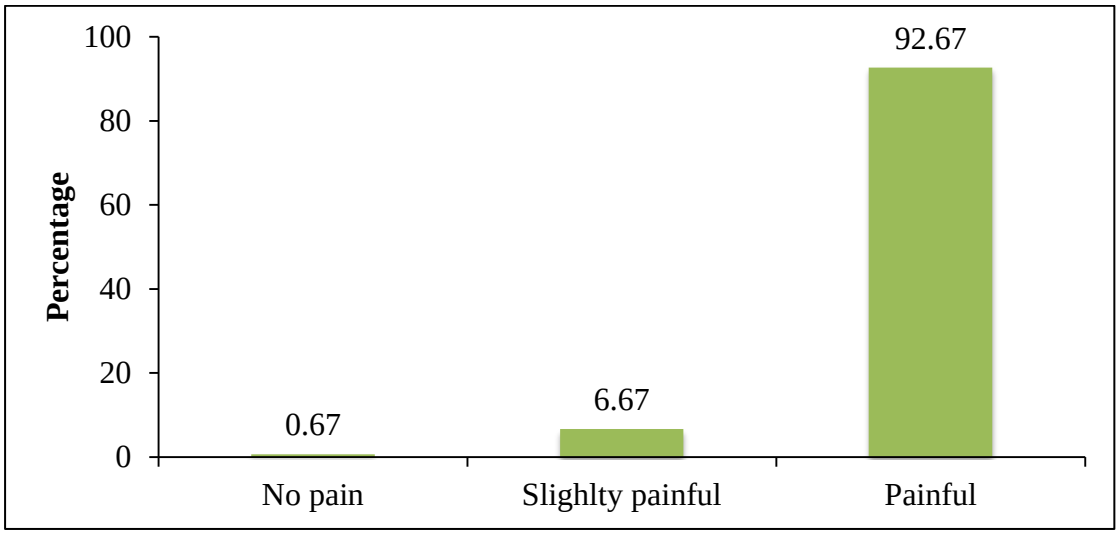


Fig. 14: Distribution of respondents (%) on the basis of pain perceived to piglet during castration

Wilson *et al* (2014) revealed that castration at 2 days of age was considered as very painful procedure whereas teeth clipping and tail docking were identified as slightly painful procedures.

4.4 Exploration of marketing channels followed by pig farmers

4.4.1 Marketing channels followed by pig farmers in Punjab

Marketing is most important aspect in pig farming from reaching the product to consumer. In our study majority (98%) farmers were found selling their live animal through various channels to middleman. Out of these, majority (96%) farmers were selling directly to middleman (channel I), 44% farmers were selling directly to other farmers mainly new entrants (Channel II), 38% farmers were selling through online marketing to middleman (Channel III) and 1.33% farmers were acting as assembler for the sale of animal to middleman (Channel IV) and only (2%) of farmers were doing value addition of pork and were selling through brand name or directly to consumer or through retailer chain (Channel V) (Fig. 15). Middleman/Brokers after buying live pigs from different channels and transport them either in specially designed trucks or by hiring bogies of train to Dimapur, Nagaland or other North-East destination as shown in Fig. 15.

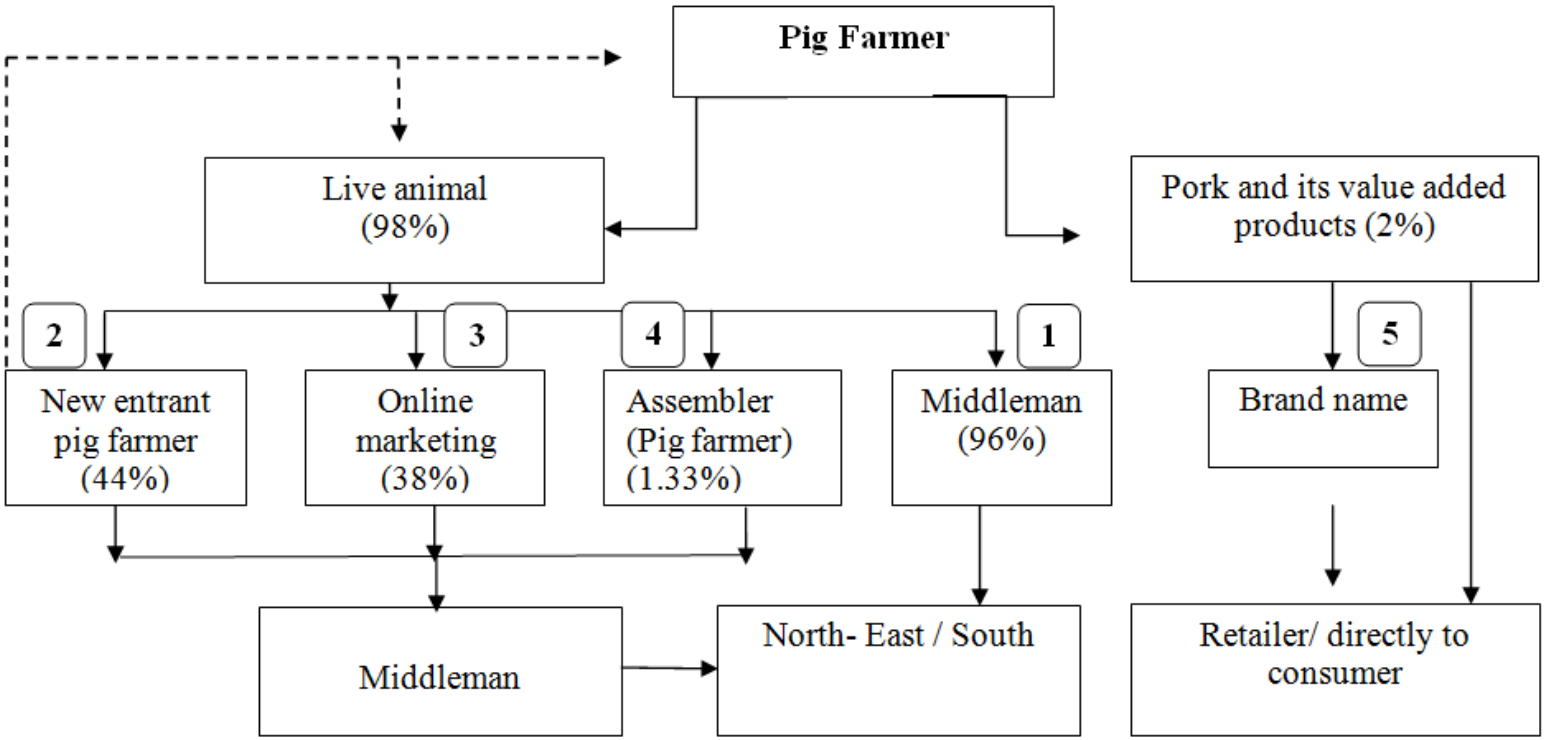


Fig. 15: Different marketing channels followed by pig farmers in Punjab

Different marketing channels followed by farmers:

Channel I: Pig farmer → Middleman → North-East /South

Channel II: Pig farmer → New entrant pig farmer → Middleman → North-East /South

Channel III: Pig farmer → Online marketing → Middleman → North-East /South

Channel IV: Pig farmer → Assembler (Pig farmer) → Middleman → North-East /South

Channel V: Pig farmer → Value added products → Consumer

Value added products → Retailer → Consumer

Suchiang *et al* (2017) also revealed that majority (72.5%) farmers disposed their pigs through local traders followed by (25%) through retailers and only (2.5%) disposed their pigs directly to consumers. Generally live animals were sold as piglets after weaning at 8 weeks of age, pregnant animal and finisher after the weight of 80-100 kg.

Study found that overall pig marketing in Punjab is in the hands of finger counted brokers as evident from the (channel 1). Whatsapp group is the major online channel used by pig farmers to sell their animals. It is important to mention that pig farmers across Punjab have created different whatsapp groups as per area, so message regarding sale or purchase of pigs can easily be exchanged between those groups. All farmers were using multiple channels for sale of animals, no farmer was found dependent solely upon single marketing channel.

4.4.2 Categorization of pigs for sale

Majority farmers preferred to sale finisher pig (91.33%), followed by piglets (72.67%), pregnant animal (40.67%), gilt (12.67%) and boar (10.67%) to farmer respectively (Table 14). Dietz (2011) quoted the purpose of sale of different type of animal viz boar and gilt for breeding, finisher for meat purpose, piglets for starting new pig venture etc.

Table 14: Categorization of pigs for sale by 150 farmers

S. No.	Saleable category	Purpose/purchaser	Number of farmers	Percentage of farmers
1	Pregnant animal	New entrant	61	40.67
2	Piglets	New entrant	109	72.67
3	Gilt	Breeding	19	12.67
4	Boar	Breeding	16	10.67
5	Finisher	Slaughter	137	91.33

4.4.3 Market related Information

The study revealed no difference in price of live pig reared on either feed or on kitchen/industrial waste and the price of animal is generally fixed on the basis of

live weight of the animal. Fellow pig farmers were the major source of market price information, revealed by majority of respondents (62%). Majority (62.67%) farmers disclosed the seasonal variation in the demand and price of the live animal. However Deka *et al* (2007) reported that the price of pork in Assam did not vary by season because market committee control it but if price increased during festival season it remained unchanged for at least another year. Whatever the channel finally the middleman supplies the pigs to either North-East states or to south. Only 3 farmers were doing value addition of pork and were marketing under brand name and selling either directly to consumer or through retailer chain (Table 15).

Table 15: Market related information as revealed by 150 pig farmers

S. No.	Parameters	Response	Frequency	Percentage
1	**Do Price of pig varies for rearing exclusively on waste or feed**	Yes	0	0
		No	150	100.00
2	**Source of market price information**	Middleman	57	38.00
		Farmer	93	62.00
3	**Price is totally decided on basis of weight**	Yes	150	100.00
		No	0	0.00
4	**Effect of breed on the price of animal**	Yes	0	0.00
		No	150	100.00
5	**Effect of season on demand/price of pigs**	Yes	94	62.67
		No	56	37.33
6	**Farmers acting as middleman**	Yes	2	1.33
		No	148	98.67
7	**Value addition of pork**	Yes	3	2.00
		No	147	98.00

4.4.4 Rearing cost and price of animal

The cost of raising one adult pig to the weight of one quintal in 7.5 months on readymade feed was Rs 6225.17±242.77 as revealed by farmer with maximum of Rs 7000 and minimum price Rs 6000. Respondents revealed the Mean cost of raising adult animal on waste was Rs 4357.14±198.81 with maximum of Rs 4500 and minimum price of Rs 4000. Recently Bhadauria *et al* (2019) also reported that a fully mature pig can be sold at Rs 8000-10000. Average existing price of live animal per kg was Rs 106.38±2.4 with maximum and minimum price of Rs 115 and Rs 100 respectively. Average maximum price fetched by farmer in past was Rs 120 and minimum price was Rs 80 (Table 16).

Table 16: Rearing cost and price of animal as revealed by 150 pig farmers

S. No.	Category	Mean price (Rs)	Std. deviation	Maximum price (Rs)	Minimum price (Rs)
1	Cost of raising one adult pig (Readymade feed) (n=136)	6225.17	242.77	7000	6000
2	Cost of raising one adult pig (waste) (n=14)	4357.14	198.81	4500	4000
3	Existing price of live animal per Kg	106.38	2.4	115	100
4	Maximum price fetched by farmer per Kg	113.25	2.9	120	100
5	Minimum price fetched by farmer per Kg	88.84	3.43	100	80

4.4.5 Cost of ration provided for different category of pigs

The study revealed that the price of starter ration ranged from Rs 30 to Rs 35. The average mean of the price of starter ration was 32.65 ± 1.30 SD. The price of grower ration ranged from Rs 25 to Rs 29 with average mean of 27.75 ± 0.92 SD. The price of finisher ration ranged from Rs 23 to Rs 28 with average mean of 24.78 ± 0.97 SD. The price of boar ration ranged from Rs 21 to Rs 24 with average mean of 22.06 ± 0.97 SD. The price of sow ration ranged from Rs 23 to Rs 26 with average mean of 24.20 ± 0.82 SD (Table 17).

Table 16: Cost of ration provided for different category of pigs by 150 pig farmers

Category	Mean price (Rs)	Standard deviation	Maximum price (Rs)	Minimum price (Rs)
Starter ration	32.65	1.3	35	30
Grower ration	27.75	0.92	29	25
Finisher ration	24.78	1.03	28	23
Boar ration	24.06	0.97	24	21
Sow ration	24.2	0.82	26	23

CHAPTER – V

SUMMARY AND CONCLUSIONS

The issue of farm animal welfare has become increasingly gaining ground these days owing to activation of many animal welfare organizations and formation of law and policy by governments in many countries including India. Animal welfare reflects the wellbeing of an animal and comprises an animal's physical and mental health.

Successful marketing is a necessary part of any profitable enterprise and alternative marketing is often necessary for pig farmer to survive. But majority of pig farmers especially new entrants often face difficulty in marketing the live or processed pig. Present study therefore was planned with following objectives:

1. To assess the pig rearing practices in relation to animal welfare.
2. To study marketing channels followed by Pig farmers in Punjab.

The study revealed that all the farmers were providing feed to pigs according to recommended feed or by providing adlib feed to different category of pigs except breedable boar and sow, as they were kept on restricted feeding. Majority 148 (98.67%) of farmers are feeding pigs twice a day. All the farmers offered creep feed to the piglets from 2^{nd} week of age and adlib fresh quantity of water to the pigs. Majority pig farmers were not feeding mineral mixture (69.33%), not gone for feed testing (97.33%) and don't have knowledge about composition of feed (80.67%). The data revealed majority (>90%) pig farmers were not using toxin binder in feed, have no knowledge about the age weight ratio, and did not know about feed conversion ratio.

The study revealed that majority 116 (77.33%) farmers were having East-West direction of shed. All the farmers were having concrete floor in their farm. Majority 148 (98.67%) of farmers were having height of roof more than 12 feet and rest 2 (1.33%) were having 8 feet height of roof. Study found inadequate space to boar (68.67%), sow (68%), grower-cum-finisher (64.67%) and to gilt/dry sow (66%).All most all farmers (96%) were not having knowledge about animal welfare rules and regulations.

The study showed that all the farmers go for naval cord detachment with blade after tying with thread, but only 13 (8.67%) farmers were disinfecting the naval cord

detacher before using on every piglet. Majority 138 (92%) farmers disposed the placenta by burial method and 12 (8%) were not disposing appropriately. All the farmers provide colostrum to new born piglets immediately after birth, but were not aware about ingredients of artificial colostrum. All the farmers were practicing administration of iron injection on day 3rd followed by 13th day and needle teeth cutting. Only 11 (7.33%) farmers were disinfecting the needle teeth cutter either with spirit or dettol before using on every piglet. Majority 116 (77.33%) farmers found performing docking by rubber band method to prevent the tail biting in future period.

Almost all farmers (96%) were not having provision of thermometer at their farm to record the daily environment temperature. Only 8 (5.33%) farmers had foggers installed to prevent the pigs from heat stress. Farmers identified pigs in heat stress from panting (96.67%) and by sign of pig searching and sitting in wet place (3.33%).

Practice of vaccinating pigs against Classical swine fever was used by all followed by Foot and mouth disease vaccine 85 (56.67%). Only 6 (4%) farmers were using Hemorrhagic septicemia vaccine. Only 15 (10%) of farmers were using either new needle or disinfecting the needle before using on every pig, while 135 (90%) were not disinfecting the needle.

Farmers were having knowledge about ideal weight required for breeding of boar137 (91.33%) and sow 124(82.67%). Majority 144 (96%) farmers were using boar either once or twice a week for service and only 6 (4%) were using boar three or four times a week for service. There was not a single farmer who had gone for semen evaluation of boar before used for breeding.

The study found that all the farmers isolate the pregnant sow in farrowing pen before 1 or 2 weeks of parturition. Bedding was provided by 130 (86.67%) farmers in farrowing pen. Majority of farmers 126 (84%) provided bulb in farrowing pen but only 50 (33.33%) farmers provided fan in farrowing pen.

The study found 115 farmers were practicing disinfection of shed and around half (51.33%) were keeping the newly animal purchased in quarantine. Only 2 (1.33%) farmers provide disposable shoe covers to visitors. Majority of farms 146 (97.33%) do not had provision of footbath at the entry of their farms. Majority farmer

92 (61.33%) did not sprinkle any disinfectant like lime at entry gate. Majority 130 (86.67%) farmer reported isolation of infected/ sick animal from healthy animals to prevent the spread of disease.

Majority (98%) farmers were selling live animal through various channels to middleman and only (2%) farmers were doing value addition of pork. Among farmers selling live animals, (96%) of farmers were selling directly to middleman, (44%) of farmers were selling directly to farmer, (38%) of farmers were selling through online marketing to middleman and (1.33%) of farmers were acting as assembler for the sale of animal to middleman. Majority farmers preferred to sale finisher pig, followed by piglet, pregnant animal, gilt, boar to farmer respectively.

The study revealed no difference in price of live pig reared on either feed or on kitchen/industrial waste and the price of animal is generally fixed on the basis of live weight of the animal. Fellow pig farmers were the major source of market price information said majority respondents (62%). Majority (62.67%) farmers disclosed the seasonal variation in the demand and price of the live animal. Whatever the channel finally the middleman supplies the pigs to either North-East states or to south. Only 3 farmers were doing value addition of pork.

The study disclosed the average existing price of live animal per kg was Rs 106.38±2.4 with maximum and minimum price of Rs 115 and Rs 100 respectively. Respondents revealed the mean cost of raising one adult pig to the weight of 1 quintal in 7.5 months on readymade feed was Rs 6225.17. Mean cost of raising adult animal on waste was Rs 4357.14.

CONCLUSIONS

- Majority of the farmers 57 % (n= 85) were having low knowledge score regarding animal welfare.
- Inadequate space was provided by majority of the farmers to different categories of pigs.
- Majority of farmers perceived no pain during docking, needle teeth cutting as slightly painful and castration as painful procedure.
- Training, experience of pig farming has significant impact on the scientific knowledge of the farmer. As the herd size of the farm is increasing, it exhibits positive effect on farmer’s knowledge.

- Off fed, lethargic, isolated, bilateral eye discharge are the rank wise behavioral and psychological indicators of pain perceived by farmer in pigs.
- North-eastern and Southern states are the major hub for live pigs and are absorbing majority of live pig coming from Punjab through middleman.
- Only 2% of farmers were practicing value addition of pork.
- The study found that there is no well-defined market structure for pig and pig products and market is fully under the control of brokers/ middleman. This channel has both advantage and disadvantage. Advantage is that all the live pigs are directly picked up by the brokers from the farm gate and disadvantage is that the middleman/ broker can exploit the situation to get maximum economic return.
- Secondly there is no pork processing unit established anywhere in North India, though the pig farmers associations are trying their best to establish the same in Punjab but it seems a distinct dream.
- Presently the study suggests that to prevent the exploitation of the pig farmers in future, local market or processing plant should be established in Punjab.
- Further quality/ designer pork should be promoted through scientific information and by giving incentive on basic price.

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ANNEXURE

INTERVIEW SCHEDULE

1. Name of the Farmer: _____
2. Age of the farmer:
   i) Upto 35 years ii) 36-45 years iii) >45 Years
3. Village, Block:
4. District:
5. Contact No:
6. Family Size:
   i) Small (up to 4) ii) Medium (5-8) iii) large (>8)
   iv) Young (M / F) v) Adult (M / F)
7. Education:
   i) Illiterate ii) Primary School iii) Matriculation
   iv) Graduate v) Higher education
8. Main Occupation: _____ Any Other (Specify):_____
9. Land holding:
   i) Landless ii) Small(<5Acre)
   iii)Medium(5-10Acre) iv)Large(>10Acre)
10. Experience of pig farming < 1 year 1-5 years > 5 years
11. Training of Pig farming Yes/ No
12. Any other animal kept: i) Pet ii) Livestock (Cattle, Buffalo, Sheep, Goat, Poultry, Fishery)
13. Herd Size: i) (<12) Small ii) (<25) Medium iii) (>25) Large
    Number of Boar_____, Number of Sows_____, Number of Pregnant Animals_____, Number of Grower _____, Number of Finisher _____,Number of piglets: (M)____(F)____
14. Ratio of Boar: Sow- i)1:10 ii)1:>10 iii)1:<10
15. Location of farm: i) Within village ii) Away from village iii) At Periphery of village

Feeding practices

16. Feed Offered:

    i) Readymade ii) Home made

    iii)Kitchen waste(Swill)

17. Do you know the composition of feed? Yes/No_____
18. Cost of Feed/kg: Starter _____, Grower _____, Finisher_____, Boar_____, Sow ____
19. Adequate feed provided for different age groups per animal
20. Frequency of feeding per day? Once _____ Twice_____
21. Creep feed offered? _____
22. Source and quantity of water offered? _____
23. Do you add toxin binder in feed? Yes/No _____
24. Mineral Mix: Yes/No_____
25. Feed testing for Aflatoxins? Yes/No_____
26. Do you know about age weight ratio? Yes/No _____
27. Have you heard of FCR? Yes/No _____

Housing practices

28. Direction of Shed? i) East-West ii)North-South
29. Type of floor: Concrete / Kucha or both
30. Height of roof_____
31. Space provided for different age groups:

	Covered Area	Open Area	No of Animals / pen
Breedable Boar	_____	_____	_____
Sow with suckling	_____	_____	_____
Piglets	_____	_____	_____
Weaner of growers	_____	_____	_____

32. Creep Area: Yes/No
33. Provision of guard rails: Yes/No
34. Ventilation in farm: Windows/ Exhaust/ Shed- open or closed/ Fans
35. What do you understand from animal welfare rules and regulations?

Management practices

36. Naval cord detachment and disinfection: Yes/No
    - Instrument used:
    - Instruments are whether sterilized before using on every piglet:
37. How placenta is discarded after removal?
38. In case of weak piglets/last piglet, any particular care done? Yes/No
39. Whether colostrum feeding immediately after birth?
40. Artificial Colostrum ? Yes/No

    Ingredients used_____
41. Piglet Anaemia Iron injection after birth: 3rd Day/ 13th Day
42. Needle teeth Cutting: Yes/No_____

- At what age_____
- Instrument used_____
- Instrument is disinfected or sterilized before using on each piglet_____

43. Docking: Yes /No_____
44. Castration: Yes /No

    Age?_____

    Method?_____ _____Painkiller?_____
45. Deworming: Yes/No_____ If Yes ,Age at first deworming &Repetition _____
46. Vaccination: Yes/No_____ Classical Swine Fever/ FMD/ HS
    - Age of first vaccination & booster_____
    - Do you use new needle for every animal which is vaccinated?
    - By whom vaccination is done?
47. Pre weaning mortality?
48. Behavioural and physiological indicators to identify pigs in pain?
    - Change in condition of eyes
    - Isolated

- Lethargic
- off fed

49. Pain perceived during different animal husbandry practices-

	No pain	Slightly painful	Painful
Teeth clipping			
Tail docking			
Castration			

50. Provision of thermometer at farm ?
51. Behavioral and physiological indicators to identify pigs experiencing heat stress
    - Panting
    - Drooling
    - High internal temperature
52. Cooling system at farm level for summer management?
    Fans, foggers, coolers, shades, wallows, none, any other.
53. Whether you go for Slaugher, if animal is suffering from incurable sickness, injury or deformity?
54. Whether you slaughter animal at your farm and by which method ?_____
    Who slaughters the animal?
55. Whether you take medical fitness certificate before slaughtering of animal? Yes/No
56. Behaviour and attitude of the labour during handling of animals?
57. Whether labour is same for pig farm and any other animals kept?

Breeding

58. Breedable age_____& live weight _____of boar at time of breeding?
    Breedable age_____ & live weight _____of sow at time of breeding?
59. How many times boar is used for service in one week? Once/ Twice/ Thrice/ Four /Five
60. Whether you go for semen evaluation before breeding?
61. Isolation of sow before farrowing: i) Before 1 week ii) Before 2 weeks iii) Not done
62. Provision of bedding material in farrowing pen? Yes/No
63. Provision of bulbs/heaters in farrowing pen in winters? Yes/No
64. Provision of fans in farrowing pen in summers? Yes/No

Biosecurity measures

65. Whether you use disinfectant for cleaning of shed? Y/N

    Frequency of cleaning shed_____

66. If new animal is purchased, do you keep it in quarantine Y/N

    For how much time?

67. Do you provide shoe cover to the Vet / farmer on their visit to farm?

68. Provision of footbath? Yes/No

69. Whether lime is poured on the entry of farm?

70. Whether you isolate the infected/sick animal incase of disease outbreak or disease?

71. Record keeping: Yes/No

Marketing

72. Marketing Channel:
    a. Middle man
    b. Butcher
    c. Directly to farmers
    d. Processing plants/slaughtering plants
    e. Online Marketing

73. Which age group is preferred for sale of animals at your farm?

    Piglet, Grower, Finisher, Breedable Gilt/Boar, Pregnant Sow

74. Sale of live/dressed carcass? Price/kg_____

75. Whether price is different for animals fed on swill or feed?

76. What is the source of market rate information? Farmer_____ Middleman _____

77. Total cost of rearing adult pig? Readymade_____ Swill_____

78. On what basis price of different age group is decided?

79. Whether there is any effect of festival / season on the marketing?

80. What is maximum/minimum price of adult animals fetched by you?

81. Whether you act as middle man in the sale of animals?

82. Whether you go for value addition of meat and meat products? Yes/No
    - If yes, which products are prepared? and what is trade mark?
    - What is the source of marketing?
    -

VITA

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Master's degree	:	M.V.Sc.
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Awards/Distinction/ Scholarships	:	University Merit Scholarship during Master's Degree Programme