*Journal of Environmental Issues and Agriculture in Developing Countries*
*Volume 10, Number 1, April 2018*
*ISSN: 2141-2731*

# The Effect of Housing Systems on the Welfare of Pigs in Santa Sub-Division in the North West Region of Cameroon

*Kiambom Tracey*
*Muafueshiangha Ibrahim Menkeh*

## ABSTRACT

*This study adopts the survey design to examine the effect of different housing systems on the welfare of pigs in Santa Sub-Division of north west region of Cameroon. A total of 50 copies of questionnaire was administered in Santa Sub-Division. The determination of number of questionnaire per locality was based on the piggery farmers population which is about 5000 in the locality. Through random sampling, 50 piggery farmers were chosen for the research. The data obtained are analyzed using both descriptive and inferential statistics. The results show that the most common housing systems used by piggery farmers in Santa area are raised floor and deep floor litter systems. Pigs in raised floors suffer from lameness and injuries while those of deep floor suffer only from diarrhea. From a policy perspective, the study recommends that given that pigs in slated floor systems experienced fewer health hazards as compared to those in deep litter housing, piggery farmers in this locality should adopt the slatted floor system of housing in other to minimize parasitic infections as pigs will have no contacts with their faeces.*

***Keywords:*** *Housing systems, piggery farmers, Santa Sub-Division*

## INTRODUCTION

Pig is one of the oldest domesticated animals. A majority of the breeds we now know are descended from the Eurasian wild boar *sus scrofa* (Greger, Umberto, Keith, Peter, Jorg *et al.* 2007). Archeological evidence from the Middle East indicates that domestication of the pig occurred as early as 9000 years ago while most livestock were utilized initially by nomadic people, swine are more indicative of a settled farming (Zeder, 2008). Animal farming is as important as crop production. To booster the food production campaign in developing countries, production programmes should be concentrated not only on crop production but

***Kiambom Tracey*** *is a Lecturer in the University of Dschang, BP 96, Dschang, West Region, Cameroon. E-mail: kiambomtracey@yaoo.com, while* ***Muafueshiangha Ibrahim Menkeh*** *is a Finance Director at ECOM Trading, Nigeria.* E-mail: menkibra@gmail.com.

 

***Corrections have been made on the names of the authors of this Article. All inconveniences are highly regretted.***
**Production Editor**

also in livestock production. There is a national demand to meet the large protein deficiency of most developing countries including Cameroon (National research council, 1986). Pork is a very important source of animal protein in human diets. The (FAO) 1998 reports that there is a greater output of meat from pigs, over 63.9million tonnes per year. Pig rearing is particular in many places of Cameroon and it ranges from household extensive scale to very large intensive commercial farm. There exist different types of housing systems and these systems differ based on factors like; scale of production (intensive, semi intensive or extensive). It also differs based on types of materials used and this choice of material will depend on factors like; availability, affordability, durability, malleability and aesthetics. In cases of extensive systems, where pigs are mostly reared on free range, they are mostly valued as a kind of savings to the farmer from where he can tap in times of cash shortages and emergency needs (FAO, 1990). However, commercial production under the semi intensive system is becoming more popular in Santa because of its favourable rates of return on investment. The fundamental question is whether these different housing systems will have effects on the health and welfare of pigs. Given that little or no academic research on pig housing and health management have been carried out in Akum locality that is in Njangma, Ntaanche, Abuhmuchwi and Akum where many households consider the keeping of pigs as a back yard activity, it is in this light that this study describes the different housing systems used by piggery farmers in this area and analyzes the different health hazards associated to each housing system.

## Types of housing system for animal rearing

The construction of animal houses depends on the management system of the animals. For extensive systems of production, that is, when animals are allowed to roam freely; input on housing may be minimal. Also for a small scale production of a few animals, housing needs may also be minimal. However for intensive systems where animals are completely confined, the housing needs must be exact (NAP, 1996).

## Main Categories of Indoor Housing Systems of Production

Ariane, Regula and Danuser (2005) set out to analyze the different categories of indoor housing systems that are used by most piggery farmers in Switzerland. According to them, indoor systems can be divided into 3 categories based on the manure handling system adopted. They are deep litter systems, scraped systems, and slatted systems.

Deep Litter System entails that the total area occupied by the animals must be maintained in a clean and dry state with the regular provision and removal of absorbent bedding material. In such system, the animals will often subdivide the pen area into separate lying and excretory areas using its natural instinct, choosing to lie in the most thermally comfortable and undisturbed areas and excreting in areas of the pen which are cold, wet or draughty (Ariane, Regula and Danuser, 2005). In scraped system, the lying and excretory areas are made structurally distinct and the manure is removed at frequent intervals daily from the excretory area. This system has the advantage of little or no bedding and operating successfully at lower space requirement for the animal (Ariane, Regula and Danuser, 2005). Slatted housing system is the most widely used throughout the tropics. In this system, hygiene is maintained, usually in the absence of any bedding, by installation of slatted floors through which the faeces can fall and be stored in a physically separate place from that occupied by the animals. More recently, slatted system has been designed specifically to reduce ammonia emissions. There are three main types of flooring which can be used for the slates which include: the concrete, bamboo, and the plank floors (Ariane, Regula and Danuser, 2005).

## Housing systems for different categories of pigs

***Boars:*** Mature boars are normally housed separately and individually to facilitate staff safety and service management. Boars maintained at artificial insemination studs are typically housed in individual pens (COM/2001/0020 final).

***Dry Sows and Replacement Gilts:*** Replacement gilts are usually reared in groups, in the same way as slaughter pigs, until transfer to the breeding herd. It is most common for these gilts to be housed separately from older sows until completion of their first lactation. Breeding sows may be housed individually, in stable groups (formed at weaning or service and remaining unchanged until farrowing) or in large dynamic groups (where existing sows are removed to farrow and replaced by newly served sows on a regular basis). Individual housing may be in fully enclosed stalls or in partial stalls where the sow is tethered by a collar or girth belt. Here, feeding may be manual or automatic (1-3 times per day) and feed may be given dry or wet (COM/2001/0020 final).

***Group housing:*** The design of group housing systems is highly influenced by the constraints imposed by current sow feeding practice. Dry sows are typically fed a relatively small amount of a concentrated diet in one or two daily meals.

The main feed delivery systems available for group housed animals are individual feeding stalls, automated flat rate, individual feeding stalls, automated individual identification and rationing (feeding stations), *ad libitum* feeding systems (COM/2001/0020 final).

***Farrowing and lactation:*** Sows are typically moved from dry sow to far rowing accommodation 3-7 days before the expected farrowing date (115 days after service). In outdoor systems, farrowing and lactating sows are housed in either individual or group paddocks, with access to individual far rowing huts. In indoor systems, the use of farrowing crates for this period predominates. These crates, typically 2.0-2.4 x 0.6m in size, are designed to restrict the movement of the sow and placed centrally or offset in a pen which has specialized provision for the piglets. The tethering of the sow in partial crates is an alternative option, but will be precluded under the terms of Directive 91/630/EEC (COM/2001/0020 final). In some member States of the European Union, the use of farrowing crates is already restricted to a limited period around the time of farrowing. Most sows remain in the farrowing crate or individual pen throughout lactation. However, in some cases sows and litters may be grouped in a 'multi suckling' system once the piglets are established. The age at which this occurs can vary from 2-3 days to 2 weeks (COM/2001/0020 final).

***Weaning and Weaners:*** Weaning typically takes place abruptly at between 3 and 5 weeks of age, although some farms still wean as late as 8 weeks. At this time, the sow is returned to service accommodation, and the piglets either left in the farrowing pen for a period or moved immediately to the weaned accommodation. A variety of housing systems for weaned piglets exists. Tiered cages house small groups of pigs on fully-slatted floors, typically in highly controlled environments with supplementary heating. Flat decks are again fully-slatted but open-topped for easier access. If intensive housing is used, pigs will be moved from the first stage weaners' accommodation to larger and second stage accommodation after 2-4 weeks. If more extensive housing is used, weaners may remain in the same pen until 30-40 kg or, in a few instances, until slaughter (COM/2001/0020 final).

***Fattening Pigs:*** Accommodation for fattening pigs may again be fully slatted, partly slatted, minimally bedded with scraped dunging area or deep bedded with straw or sawdust. Although there are national differences, housing with fully or partly slatted flooring predominates within the EU. In controlled environment housing, it is normal to use two or three housing stages, each with larger pens, in the growing/finishing period to make most efficient use of space (COM/2001/0020 final).

***Selection of housing locations:*** According to (FAO 2009), the selection of a farm house location must be done following the criteria below.

i The site should be at an elevated place that cannot be flooded by rain water.

ii The site should be protected from the sun (shade from trees) and have ample fresh air.

iii Away from residences (around 8-10 meter away downwind).

iv In case of a large scale pig farm, the site selected needs also to be well connected to roads throughout the year,

v Suitable for manure disposal, connected to reliable water and electricity source.

vi Must be accessible for easy conveyance of inputs and outputs of the farm.

**Construction plan for a good pig house and shed**

According to FAO (2009), the construction of a good farm house must be done following the dimensions below. The floor of the house must be 3 X 3m. The floor of the house must be raised about 60cm above the ground. The floor boards should have spaces of 2cm between them. The roof must be rain, proof. The high side of the roof should face in a direction where sun light can shine into the house on this side: but there must always be shade in some part of the house. The house must be strongly built. A pigsty can be constructed cheaply by using locally available materials. It needs to be constructed according to climatic conditions and according to the pig production system. The production system is also characterized according to materials used, wall design, roof height from floor, floor height from drainage, floor space, number of pens per building, building orientation and other characteristics. The pigsty should be comfortable for the pigs: good ventilation and ample shade, no overheating, no smells, no draft and no dampness. The building should be constructed with its length axis in an East-West direction (protected from sun and rain). The pig building needs to be divided into different pens for each phase of the production cycle. The number and the size of the pens depend on the expected numbers of pigs to be housed in each production phase. The costs of constructing the pigsty should fit the pig production systems. An efficient pig production is required to cover high construction costs (FAO 2009).

**Housing System: The health and welfare of animals**

Ariane, Regula and Danuser (2005) set out to evaluate the impact of housing systems on the health and welfare of grower and finisher pigs. Group-health evaluations and individual clinical examinations were performed during four visits to each farm. Evaluation of pig behaviours associated with health and welfare were assessed through indicators including presence of lesions on the snout, ears, shoulders, legs and tail. General group-health evaluations included lameness, respiratory disease, diarrhea, ear biting, skin abnormalities, injuries, abscesses, sunburn, recumbences, ill-thrift and behavioural abnormalities such as dog sitting and tail biting.

Weibke (2008) examines Croatian pig farms and finds out that of all Croatian pig farms, 75% are small, technologically outdated production units with less than ten sows and less than three hectares. Croatian pig production systems do not comply with European production standards and compliance with European production standards will require the modernization of pig housing systems (Croatian Government, 2006). It is expected that modernization will involve the termination of small farms and enlargement and intensification of larger farms. The aim of the study was to investigate what consequence this modernization process will have on the welfare of pigs (and humans) on Croatian farms. Seventeen Croatian piggery farmers and six institutional stakeholders were interviewed to describe the different pig production systems and to investigate the implementation and enforcement process of the EU pig welfare directives. Documents on the implementation processes in Croatia and the EU were compared and the welfare of pigs was assessed on fifteen farms using resource-based and animal-based welfare indicators. Three production systems were distinguished: part-time farming, family farming and fulltime farming. All farms show different welfare problems. The research findings did not show that modernization of production systems will improve pig welfare.

Weibke (2008) sets out to analyze the different living environments for pigs in confined spaces with regard to pig health and welfare. The EU pig welfare directives follow Brambell's (1967) report which stipulates five freedoms to ensure the welfare of farmed animals. These freedoms were summarized by the Farm Animal Welfare Council (2007) as follows:

i Animals in confinement should be free from hunger and thirst which can be ensured through the provision of fresh water and species-specific diets.

ii Care should also be taken that confined animals are free from discomfort by providing shelter, adequate environments and resting areas.

iii Furthermore, animals should be free from pain, injury or disease and preventive measures, rapid diagnoses and treatments should be ensured.
iv Animals should also be given opportunities to express normal behaviour.
v Finally, all confined animals should be free from fear and distress which can be suffering.

Therefore, following this line of thought, the EU Scientific Committee on Animal Health and Animal Welfare (SCAHAW) gathers scientific recommendations to suggest resources required to provide minimum welfare standards for farmed animal species such as pigs (Blandford, Bureau, Fulponi and Henson, 2002). According to FAO (2009), bad housing and environmental conditions can cause the following health hazards:

i. Abortions
ii. slow and retarded growth
iii. Dysentery and diarrhea.
iv. Dead piglets after birth
v. Parasitic infections
vi. Effect on human health
vii. Spread of contagious diseases
viii Deformed legs
ix Cannibalism (tail and ear biting)

Although the above researchers wrote about pig housing systems and health requirements, their research was conducted in other parts of Cameroon and other African countries. None of them study on the housing of pigs and pig health in Santa sub division, thus the need for this study.

## MATERIALS AND METHOD

### Area of study

The study site Akum locality in Santa sub-division in Mezam division was purposefully selected for this research. The Mezam division is one of the seven Divisions of the North West Region of Cameroon with administrative headquarters in Bamenda. Bamenda is located in the central town.

The agro-ecology is suitable for pig rearing. Average annual climate favour the growth of crops used in the feeding of the pigs and plants which are used in the construction of the pig house. The hydrology shows the abundance of natural water sources such as stream, rivers and bore-holes which are being given to the pigs. Trade is booming in this division for animal protein in general and pork in particular in all the markets of this division. Monthly statistics from the divisional

Delegation of Livestock, Fisheries and Animal Industries in Bamenda shows that 500-1000 pigs leave Mezam division every week to other divisions and towns in Cameroon for consumption. Some are even exported to neighboring countries especially Gabon and Equatorial Guinea.

The survey research design was used for this study. In this design information or opinions of all individuals or groups who constitute the sample of the study was gotten through the use of questionnaire. A total of 50 copies of questionnaire was administered in Santa Sub-Division. The determination of number of questionnaire per locality was based on the piggery farmers population which is about 5000 in the locality (MINEPIA Mezam, 2014/2015). A total of 8 villages were chosen for the study. Through random sampling, 50 piggery farmers were selected for the research. In order to get easy access to the piggery farmers of Akum locality in Santa sub division, the sub delegation of livestock in the area was visited to get the list of piggery farmers. After which a random sampling was done to know the exact farms for the research. The data on pig housing systems and pig health was obtained through a structured questionnaire. The data collection was entered into a log book and keyed into Microsoft excel. Data were analyzed using both descriptive and inferential statistics with the help of the SPSS Software program and micro soft excel.

## RESULTS AND DISCUSSION

***Socio-economic Characterization of Piggery Farmers:*** Male piggery farmers constituted 55.3% of the studied sample while female farmers made up only 44.7%. This shows that pig farming is an activity that is practised by both males and females in Santa Sub-Division. From the table 1, it is also seen that the modal household size for the study population is 6 and 8 which is relatively high. This is closely followed by households who were only 3 in number. At the bottom of the list are households that had 5, 7 and 9 individuals as they all recorded a percentage of 10.6 respectively.

As concerns the level of education of piggery farmers in Santa Sub-Division, only 10.6% of the total studied sample had not received education in any form, while. 42.6% completed primary education. Those who had attended high school and some form of Higher education made up to 36.2%. The table also shows that up to 10.6% of the pig farming population are public servants who do this activity on part time basis. Those motivated into this activity (piggery farming) by self–employment constitutes 63.8% while those who are self-employed in other activities but also practice piggery farming constitute 25.5%.

This implies that majority of the respondents are into the business on full time basis. Pig farming is an activity that is carried out with the help of some housing facilities in a bit to provide shelter for the animals and equally provide necessary protection against possible infections from interaction with the environment. From the table, 68.1% of the farms studied were owned by the piggery farmers' family. Only 21.3% of housing was rented. All pig farms made adequate provision for safe drinking water, lighting, toilet facilities and cooking energy. From the table 1, 12.8% of the respondents owned cars, 42.6% owned motorbike, 10.6% owned bicycle, 12.8% used public transportation while 21.3% embarked on trekking. It can be explained here that majority of the piggery farmers owned motor bikes for transportation because of the undulating terrain of the Santa locality.

***Characteristics of different pig housing systems in Santa Sub-Division:*** From the table 2, 10.6% of the population used thatch and 89.4% used aluminum. Of the total number of pig houses studied, 10.6% were of height of 1.7m, 66% were of height of 2m, another 10.6% were of height of 2.50m and 12.8% of them were of height of 3m. In this locality, majority of pig houses are 2m in height, which constitute 66% of the sample. It can also be seen from the table that there are only two forms of possible wall materials used by piggery farmers in Santa Sub-Division which are plank or wood and cement blocks. On basis of the data obtained, 74.5% of the study area used plank or wood as wall material as opposed to only 25.5% who used cement blocks to raise pig houses. It could also be seen that 63.8% of the piggery farmers in Santa Sub-Division designed the walls of their pig houses with either half having wire mesh or bamboo while 36.2% designed a full wall with a window. Given that most of the houses in this locality were slatted, 66% of the population measured .5m of floor height from drainage, 12.8% had a height of .75m 10.6% measured 1m and 10.6% measured 1.25m. In Santa Sub-Division, 63.8% of the pig houses had a floor space of 2m square, 23.4% had a floor housing of 3m square and 12.8% of the population had a floor space of 2m square. In this locality of Akum 36.2% of the population had 3pens per building, 21.3% had 2 pens per building and the rest of the piggery farmers had 8,6,5, and 4 pens per building with 10.6% each.

Pig houses in Santa Sub-Division were either East-west oriented or North-south oriented. On the basis of the data obtained, it was discovered that 53.2% of the houses in Akum area were orientated in the East-west direction and 46.8% in the North-south direction as shown by the information on the table above. Though subsistent in nature, it was found out that pig houses in Santa Sub-Division often housed more than 1 pig per building. It was reported that a majority i.e. 46.8% of piggery farmers in Akum locality owned two pigs. 10.6% kept 5, 6 and 10 pigs each and 21.3% did a multipen of 10pigs. Three main forms of drinking vessels are used in this locality which are: the iron pot, cemented hole and a motor tyre as seen on the figure 2. From the table 3, 53.2% of the population used a pot or a vessel as a drinker, 34% used a motor tyre and 12.8% used a cemented hole. This indicates the local nature of pig farming practiced in Santa Sub-Division. From the above table, it can be seen that 66% of drinkers in the pig farms of this locality had a capacity of 10L, 12.8% of drinkers had a capacity of 20L and 10.6% had a drinker capacity of 15L and 5L each.44.7% of pig farms in Akum locality had 3 drinkers, 34% had 4 drinkers and10.6% had 5 and 8 drinkers each. The majority of piggery farmers who accounted for 44.7% of piggery farmers in this locality used a motor wheel drum as a feeder.31.9% used a pot or a vessel, 12.8% used a cemented hole and 10.6 used a carved wood. It can be seen from the table that a majority of the feeders which accounted for up to 44.7% of feeders had a capacity of 20L, 12.8% had a feeder capacity of 50L and 10.6% had a capacity of 10L, 15L, 25L, and 30L each. The table also shows that, 36 (76.6%) out of 47 of the total piggery farmers contacted in Akum locality had no provisions for farrowing crates and 23.4% of pig farms had farrowing crates.

***Relationship between Pig Housing and Pig Health and Welfare:*** From the contingency table (table 4), out of the 70% of the respondents whose roof design is just a single slope, none of them agrees that there are no symptoms of diarrhea with smell nor piglet pale and lost weight while of the 24% of piggery farmers whose roof design is two slope, 12% of them maintain that they have suspected symptoms of diarrhea with smell and another six say they instead see their piglet pale and lost weight. From the test statistic, table 4 indicates that there is a relationship between roof design of pig house and health of pigs. Hence, it is concluded that roof design and suspected sickness by pigs are highly correlated. The phi coefficient shows that this relationship is a perfect relationship.

Table 5 indicates that out of 35 respondents who had just a single slope, 5 argue that their pigs scratch their skin against any object, 10 argue that their pigs experienced hair loss. And 20 did not experience any of these symptoms. Of the 12 piggery farmers whose roof design is two slopes, 6 claimed their pigs scratch skin against any object, none experienced hair loss and 6 had no symptoms. From the test statistic table, it shows that at 5% significance, roof design and suspected sickness by pigs in the form of Scratching of Skin against any objects and hair loss are highly correlated.

From table 6, out of the 5 respondents whose roof material was thatch, none of them experienced diarrhea and pale piglets meanwhile out of the 42 respondents whose roof material was aluminum, 30 experienced none of these symptoms while 6 had diarrhea and 6 had pale pigs with loss in weight. The relationship is insignificant even at 10% therefore, we accept the hypothesis that there is no relationship between roof material of pig house and health of pigs in terms of diarrhea with Smell and Piglet is Pale and lost weight. From table 7, out of the 5 respondents whose roof material was thatch, none of them experienced scratching of skin against object and hair loss. Meanwhile out of the 42 respondents whose roof material was aluminum, 21 experienced none of these symptoms while 11 had scratching of skin and 10 had pale pigs with loss of hair. From the test statistic table, it shows that at 2 degree of freedom even at 10% level of significance, there is no relationship between roof material of pig house and health of pigs in terms of hair loss and scratching of skin against object.

Table 8 shows that out of the 35 respondents who built their walls with plank, 5 respondents argued that their pigs scratch their skin against any object, 10 argue that their pigs experienced hair loss. And 20 did not experience any of these symptoms. While of the 12 piggery farmers who built using cement blocks, six (6) responded that their pigs scratch skin against any object, none experienced hair loss and 6 had no symptoms. Meanwhile the test shows that wall material and suspected sickness by pigs in the form of Scratching of Skin against any objects and hair loss are highly correlated.

Table 9 indicates that out of 35 respondents who used plank, 5 reported symptoms of diarrhea with Smell, 10 had pale piglets and 20 showed no symptoms. Of the 12 piggery farmers who used cement blocks, 6 suspected symptoms of diarrhea with Smell and none had pale piglets and the other 6 experienced none of the above. While the test shows that wall material and suspected sickness by pigs in the form of diarhoea and pale piglets are highly correlated.

From table 10, out of the 5 respondents who had floor materials made of mud, none of them experienced diarhoea and pale piglets and out of the 27 respondents whose floors were made of cement, 6 had diarhoea symptoms and 6 had pale piglets while 15 experienced none of the above signs. Meanwhile out of the 15 who built their floors with plank, none of them experienced any of these symptoms, while the test shows that floor material and suspected sickness by pigs are highly correlated. The phi coefficient shows that this relationship is a perfect relationship. Out of the 5 respondents who had floor materials made of mud, all of them experienced scratching of skin against objects and out of the 27 respondents whose floors were made of cement, 6 had diarrhea symptoms and 5 had pale piglets while 16 experienced none of the above signs. Meanwhile out of the 15 who built their floors with plank none of them experienced any of these symptoms. The test reveals that there is a relationship between the floor material of a pig house and health of pigs in terms of scratching of skin and hair loss (table 11). The study has found out that pigs in Akum area suffered from lameness, diarrhea, injuries, and sun burns. This is in line with the work of (Ariane, Regula and Danuser, 2005) who found out that pigs in Croatia suffered the same diseases. It is also in agreement with the guide of FAO (2009), which confirms that bad housing could directly cause hazards such as diarrhea, abortions, lameness, hair loss, cannibalism etc. The study also shows that factors such as roof design, wall material and floor material were significantly related to the health and welfare of pigs as they caused different health malfunctions. This is in agreement with the guide of FAO (2009), which confirms that several housing factors like wall material and floor material significantly affect the health of pigs. However, it is in disagreement with the works of (Roe, Kjærnes, Bock, Higgin, van Huik and Cowan, 2003) who says that except the five freedoms of animal welfare are not put into plaace, housing material does not significantly affect the health of pigs. The most common housing systems used by piggery farmers in Akum area were raised floor and deep floor litter systems. Pigs in raised floors suffered from lameness and injuries while those of deep floor suffered only from diarrhea.

## CONCLUSION AND RECOMMENDATIONS

Given that those who had the slated floor systems experienced fewer health hazards such as diarrhea as compared to those who had deep litter housing, it is recommended that piggery farmers in this locality should adopt the slatted floor system of housing in other to minimize parasitic infections as pigs will have no contacts with their faeces. Given that majority of piggery farmers in this locality have a very low level of literacy; the government should educate piggery farmers through Agric Posts and Non-Governmental Organizations (NGOs) on the modern techniques and methods of pig production. It is also suggested that piggery farmers in these area should come together as a society in order to share their housing and health experiences so as to adopt the best practices from those facing no difficulties. Given that there is no significant relationship between roof design, roof material, wall material and health, piggery farmers in this locality can maintain these aspects of their housing systems but given that there is a significant relationship between floor material and health, they are advised to use rough cement floors which are more durable on a gentle slope to allow for easy drainage and cleaning thus minimizing parasitic infections and also to prevent injuries associated with plank floors. In perspective, it is important that further research be conducted on the effect of housing systems on the zoo technical performance of pigs.

**Table 1:** Socioeconomic Characterization of the study population

| Factors | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 26 | 55.3 |
| Female | 21 | 44.7 |
| Total | 47 | 100 |
| **Household size** | | |
| 4 | 10 | 21.3 |
| 5 | 5 | 10.6 |
| 6 | 11 | 23.4 |
| 7 | 5 | 10.6 |
| 8 | 11 | 23.4 |
| 9 | 5 | 10.6 |
| Total | 47 | 100 |
| **Level of education** | | |
| No School | 5 | 10.6 |
| Primary | 20 | 42.6 |
| Secondary | 5 | 10.6 |
| Above High School | 17 | 36.2 |
| Total | 47 | 100 |
| **Occupation** | | |
| Public Servant | 5 | 10.6 |
| Self-employed in agriculture | 30 | 63.8 |
| Self-employed in other sector | 12 | 25.5 |
| Total | 47 | 100 |
| **House arrangement** | | |
| Owner | 5 | 10.6 |
| Family Occupant | 32 | 68.1 |
| Rentage | 10 | 21.3 |
| Total | 47 | 100 |
| **Means of Transport** | | |
| Own Car | 6 | 12.8 |
| Own Motorbike | 20 | 42.6 |
| Own bicycle | 5 | 10.6 |
| Public Taxi | 6 | 12.8 |
| Trekking | 10 | 21.3 |
| Total | 47 | 100 |

***Source:*** Field Survey, 2015

**Table 2:** Housing characteristics of different pig housing systems in Santa Sub-Division

| Factors | Frequency | Percentage |
|---|---|---|
| **Roof material** | | |
| Thatch | 5 | 10.6 |
| Aluminum | 42 | 89.4 |
| Total | 47 | 100 |
| **Roof height from floor** | | |
| 1.7m | 5 | 10.6 |
| 2m | 31 | 66.0 |
| 2.5m | 5 | 10.6 |
| 3m | 6 | 12.8 |
| Total | 47 | 100 |
| **Wall material** | | |
| Plank/Wood | 35 | 74.5 |
| Cement Block | 12 | 25.5 |
| Total | 47 | 100 |
| **Wall design** | | |
| Full with Window | 17 | 25.5 |
| Half wall with pigs mesh, half completed with Bamboo | 30 | 42.6 |
| Total | 47 | 100 |
| **Floor height from drainage(m)** | | |
| .5 | 31 | 66.0 |
| .75 | 6 | 12.8 |
| 1 | 5 | 10.6 |
| 1.25 | 5 | 10.6 |
| Total | 47 | 100 |
| **Floor space($m^2$)** | | |
| 2.00 | 30 | 63.8 |
| 3.00 | 11 | 23.4 |
| 6.00 | 6 | 12.8 |
| Total | 47 | 100 |
| **Number of rooms per building** | | |
| 2 | 10 | 21.3 |
| 3 | 17 | 36.2 |
| 4 | 5 | 10.6 |
| 5 | 5 | 10.6 |
| 6 | 5 | 10.6 |
| 8 | 5 | 10.6 |
| Total | 47 | 100 |
| **Building orientation** | | |
| East-west | 25 | 53.2 |
| North-south | 22 | 46.8 |
| **Number of pigs per building** | | |
| 2 | 22 | 46.8 |
| 5 | 5 | 10.6 |
| 6 | 5 | 10.6 |
| 8 | 10 | 21.3 |
| 10 | 5 | 10.6 |
| Total | 47 | 100 |

***Source:*** Field Survey, 2015

AN IRON POT A CEMENTED HOLE A MOTOR TYRE

**Fig. 1:** The various drinking vessels used in this locality. ***Source:*** Field Survey, 2015

**Table 3:** Factors of Feeding and Drinking Equipment

| **Factors** | **Frequency** | **Percentage** |
|---|---|---|
| **Type of Drinkers** | | |
| Pot/Vessel | 25 | 53.2 |
| Motor Tyre | 16 | 34.0 |
| Cemented Hole | 6 | 12.8 |
| **Drinking capacity(litres)** | | |
| 5 | 5 | 10.6 |
| 10 | 31 | 66.0 |
| 15 | 5 | 10.6 |
| 20 | 6 | 12.8 |
| 9 | 5 | 10.6 |
| Total | 47 | 100 |
| **Number of drinkers** | | |
| 3 | 21 | 44.7 |
| 4 | 16 | 34.0 |
| 5 | 5 | 10.6 |
| 8 | 5 | 10.6 |
| Total | 47 | 100 |
| **Feeders Material** | | |
| Carved Wood | 5 | 10.6 |
| Motor Wheel Drum | 21 | 44.7 |
| Pot/Vessel | 15 | 31.9 |
| Cemented Hole | 6 | 12.8 |
| Total | 47 | 100 |
| **Feeder capacity(litres)** | | |
| 10 | 5 | 10.6 |
| 15 | 5 | 10.6 |
| 20 | 21 | 44.7 |
| 25 | 5 | 10.6 |
| 30 | 5 | 10.6 |
| 50 | 6 | 12.8 |
| Total | 47 | 100 |
| **Availability of farrowing crate** | | |
| Yes | 11 | 23.4 |
| No | 36 | 76.6 |
| Total | 47 | 100 |

***Source:*** Field Survey, 2015

*Journal of Environmental Issues and Agriculture in Developing Countries*
*Volume 10, Number 1, April 2018*
*ISSN: 2141-2731*

**Table 4:** Contingency Table

| | | Symptoms of Sickness Suspected | | | Total |
|---|---|---|---|---|---|
| | | Diarrhea with Smell | Piglet is Pale and lost weight | None | |
| Roof Design | One Slope | 0 | 0 | 35 | 35 |
| | Two Slope | 6 | 6 | 0 | 12 |
| Total | | 6 | 6 | 35 | 47 |

| **Tests** | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson (Calculated) Chi-Square | 47.000 | 2 | .000 |
| Critical Value | 9.21034 | 2 | .000 |
| Phi Coefficient | 1.000 | | .000 |

***Source:*** Field Survey, 2015

**Table 5:** Contingency Table

| | | Suspicion of Ectoparasitism | | | Total |
|---|---|---|---|---|---|
| | | Scratching of Skin against any object | Hair Loss | None | |
| Roof Design | One Slope | 5 | 10 | 20 | 35 |
| | Two Slope | 6 | 0 | 6 | 12 |
| Total | | 11 | 10 | 26 | 47 |

| **Tests** | Value | Df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 8.381[a] | 2 | .015 |
| Critical Value | 5.99146 | 2 | 0.05 |
| Phi Coefficient | .422 | | .015 |

***Source:*** Field Survey, 2015

**Table 6:** Contingency Table and test

| | | Symptoms of Sickness Suspected | | | Total |
|---|---|---|---|---|---|
| | | Diarhoea with Smell | Piglet is Pale and lost wirth | None | |
| Roof Material | Thatch | 0 | 0 | 5 | 5 |
| | Aluminium | 6 | 6 | 30 | 42 |
| Total | | 6 | 6 | 35 | 47 |

| Test | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.918[a] | 2 | .383 |
| Critical Value (5%) | 5.99146 | 2 | 0.05 |

***Source:*** Field Survey, 2015

**Table 7:** Contingency Table and test

| | | Suspicion of Ectoparasitism | | | Total |
|---|---|---|---|---|---|
| | | Scratching of Skin against any object | Hair Loss | None | |
| Roof Material | Thatch | 0 | 0 | 5 | 5 |
| | Aluminium | 11 | 10 | 21 | 42 |
| Total | | 11 | 10 | 26 | 47 |

| **Tests** | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 4.519[a] | 2 | .104 |
| Critical Value (5%) | 5.99146 | 2 | 0.05 |
| Phi Coefficient | .310 | | .104 |

***Source:*** Field Survey, 2015

**Table 8:** Contingency Table and test

| | | Suspicion of Ectoparasitism | | | Total |
|---|---|---|---|---|---|
| | | Scratching of Skin against any object | Hair Loss | None | |
| Wall Material | Plank/Wood | 5 | 10 | 20 | 35 |
| | Cement Block | 6 | 0 | 6 | 12 |
| Total | | 11 | 10 | 26 | 47 |

| **Tests** | Value | Df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 8.381[a] | 2 | .015 |
| Critical Value (5%) | 5.99146 | 2 | 0.05 |
| Phi Coefficient | .422 | | .015 |

***Source:*** Field Survey, 2015

**Table 9:** Contingency Table and test

| | | Suspicion of Ectoparasitism | | | Total |
|---|---|---|---|---|---|
| | | Diarhoea with Smell | Piglet is Pale and lost weight | None | |
| Wall Material | Plank/Wood | 5 | 10 | 20 | 35 |
| | Cement Block | 6 | 0 | 6 | 12 |
| Total | | 11 | 10 | 26 | 47 |

| **Tests** | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 8.381[a] | 2 | .015 |
| Critical Value (5%) | 5.99146 | 2 | 0.05 |
| Phi Coefficient | .422 | | .015 |

***Source:*** Field Survey, 2015

**Table 10:** Contingency Table and test

| | | Symptoms of Sickness Suspected | | | Total |
|---|---|---|---|---|---|
| | | Diarhoea with Smell | Piglet is Pale and lost worth | None | |
| Floor Material | Mud | 0 | 0 | 5 | 5 |
| | Cement | 6 | 6 | 15 | 27 |
| | Plank/Wood | 0 | 0 | 15 | 15 |
| Total | | 6 | 6 | 35 | 47 |

| **Tests** | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 11.937[a] | 4 | .018 |
| Critical Value (5%) | 9.48773 | 4 | 0.05 |
| Phi Coefficient | .504 | | .018 |

***Source:*** Field Survey, 2015

**Table 11:** Contingency Table and test

| | | Suspicion of Ectoparasitism | | | Total |
|---|---|---|---|---|---|
| | | Scratching of Skin against any object | Hair Loss | None | |
| Floor Material | Mud | 5 | 0 | 0 | 5 |
| | Cement | 6 | 5 | 16 | 27 |
| | Plank/Wood | 0 | 0 | 15 | 15 |
| Total | | 11 | 10 | 26 | 47 |

| **Tests** | Value | Df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 21.437[a] | 4 | .000 |
| Critical Value (5%) | 9.48773 | 4 | 0.05 |
| Phi Coefficient | .675 | | .000 |

***Source:*** Field Survey, 2015

## REFERENCES

**Ariane C., Regula G.** and **Danuser J. (**2005). The impact of different housing systems on health and welfare of grower and finisher pigs in Switzerland. Swiss Federal Veterinary Office, Schwarzenburgstrasse 161, CH-3003 Berne, Switzerland. *Preventive Veterinary Medicine*. 05/2005; 68(1), 49-61. DOI: 10.1016/ j.prevetmed.2005.01.004.

**Blandford D., Bureau J. C., Fulponi L.** and **Henson S.** (2002). *Potential implications of animal welfare and public policies in industrialised countries for international trade*. In: Kirssoff B., Bohman M. and Caswell J. A. (Eds.) *Global food trade and Consumer demand for quality.* Kluwer: New York.

**COM/2001/0020 final** (2001). Communication from the commission to the council and the European parliament on the welfare of intensively managed pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups.

**Croatian Government** (2006). *National Programme for the Integration of the Republic of Croatia into the European Union-2006*. Government of the Republic of Croatia.

**EU** (2007). EUROPA- Overview of the European union activities. Agriculture: Retrieved11.01.2008: *http://Europa.eu/pol/agr/overview_en.htm*

**Farm Animal Welfare Council (FAWC)** (2007). Five Freedoms. Farm Animal Welfare Council. Retrieved 29.09.2008: *http://www.fawc.org.uk/freedoms.htm*

**FAO** (1998). Quarterly bulletin of statistics V (3). Rome Italy: FAO.

**FAO** (1990). Strategies for sustainable animal agriculture in developing countries. Rome Italy: FAO.

**FAO** (2009). Farmers hand book on pig production for the small holders at village level. pp 47-54, jp. Rome Italy: FAO.

**Greger L., Umberto A., Keith D., Peter R., Jorg S., Anne T., Jean D. V.** and **Angela S.** (2007). Ancient DNA, pig domestication and the spread of Neolithic into Europe. Proceedings of the national academy of science (PNAS), vol 104, no 39, pp 15276-15281.

**MINEPIA** (2014/2015). *Mezam divisional delegation Annual report.* Mezam: MINEPIA.

**NAP** (1996). *Guide for the care and use of laboratory animals.* Washington DC: National Research Council.

**Roe E., Kjærnes U., Bock B., Higgin M., van Huik M.** and **Cowan, C.** (2003). Farm Animal Welfare in Hungary: A study of Hungarian producers, its food retail market and of Hungarian consumers. Welfare Quality Report No. 5 Cardiff University, Cardiff.

**Weibke, W.** (2008). Pig welfare in Croatia: A critical reflection on the Eu pig welfare directives, M.Sc Thesis Wagnigen University.

**Zeder M. A.** (2008). Domestication and early agriculture in the Mediterenian basin.origins, diffusion and impact: University of Carlifornia Press. Proceedings of the national academy of science (PNAS), 105(33), 11597-11604

 