ON-FARM EVALUATION OF PRODUCTION PERFORMANCE OF SASSO AND KUROILER CHICKENS IN MVOMERO DISTRICT, MOROGORO

LYAHAMA ONESMO JACKSON

A DISSERTATION SUBMITTED IN PARTIAL FULFULMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN TROPICAL ANIMAL PRODUCTION OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2022

EXTENDED ABSTRACT

Improved breeds of chickens such as Kuroiler and Sasso are currently the most favourable chickens in developing countries. In African countries, these breeds have been tested for suitability under smallholder environment in Nigeria, Ghana, Ethiopia, Uganda and Tanzania. The breeds are dual purpose with higher body weight and lay more eggs than the local chickens. They are more resistant to diseases and are able to scavenge on locally available feeds than the commercial birds. These breeds have good potential to improve the economies and health of smallholder farmers in Tanzania. However, knowledge related with management practices of these breeds such as housing, feeds and feeding and health care (disease awareness, control and prevention) is crucial to optimise their genetic potentials.

This study was aimed at evaluating on-farm production performance of Sasso and Kuroiler chickens reared under farmer's management conditions in Mvomero District. Two villages namely, Luhindo and Sokoine were involved in this study. Thirty one (31) farmers, 16 from Luhindo and 15 from Sokoine were included in this study. Chickens were purchased and reared for the first 7 weeks at Sokoine University of Agriculture and then distributed to the farmers. Each farmer received 18 chickens of mixed sex. The assessment of farmers' management practices such as housing, feeds and feeding and health care was carried out using a structured questionnaire. The assessment of poultry housing was carried out through observation of features required for a poultry house including the quality of materials used for construction. Feeds and feeding practices were assessed based on the feeding program, the type of feeds and the number of feed ingredients used during feed formulation. In addition, health care, bio security issues such as overall cleanness and disease awareness were also assessed.

Data collection started the day the chickens were distributed to the farmers and the recording was carried out four times at four weeks interval except for mortality, which was recorded when it occurred during the period of study. Data on poultry performance (weight measurement) and mortality were collected through well designed forms where by trained expert from ACGG Project and farmers participated in record keeping.

Data related to management practices were analysed using SPSS whereby, descriptive statistics such as frequencies and percentages were computed. Data on the overall management practices of the two villages and within individual villages were collected and analysed to determine whether there were any differences that existed. In addition, a combination of village management factors that led to optimum growth performance of chickens were determined by analysing the data from farmers having chickens with large body weight performance. Data of body weight performance and mortality rate were analysed using SAS version 20 and Chi-square respectively to evaluate the birds' performance and mortality in relation to breed, village, sex and management practices.

Housing as one of the management practices was assessed and shown to be in an adequate condition except for the type of floor, whereby 79 percent of poultry house floor were made on earth. Fifty-five (54.8) percent fed their chicken using homemade feed (mixture of three and above feed ingredients) and 45.2 percent used supplementary feeds like maize corn, maize bran, food left overs and other scavengable feeds. About 50% of the farmers used maize bran, sunflower seed cake and fish meal to compound the diets. Most of farmers were providing feed (48.4%) and water (58.1%) twice per day. Also, the findings showed that 51.6 percent of farmers had modern drinkers and feeders and 48.4 percent had local made feeders and drinkers. In case of health care, Newcastle was the most common disease (100%) followed by Infectious coryza (93.6%), Fowl typhoid (87.1%) and Fowl

pox (54.8%). Few farmers could identify diseases such as Coccidiosis (29%) and Gumboro (19.4%). Newcastle, fowl typhoid, Fowl pox and Infectious coryza were reported to occur more frequently than other diseases.

Disease control and prevention were the biggest challenge to farmers as only 32.3 percent of farmers were able to treat and isolate their chickens after disease eruption while the majority of them (67.7) did treatment only. In addition, 87.1, 12.9 and 12.9 percent of farmers knew how to prevent chickens against Newcastle, Gumboro and Fowl pox diseases respectively. Few farmers (41.9%) dewormed their chickens. Also, for those farmers preventing and controlling their chickens against diseases they do upon their understanding of the specific disease. Drugs used for poultry treatment by most of the farmers depended on their preference and their availability in the area.

Regarding the adequacy of housing management practice 48.4 percent scored good, 45.2 percent medium and 6.5 percent scored low. However, on feeds and feeding practice in both villages, many farmers fell into medium level (58%) followed by good level (35.5%) and then low level (6.5%). With regards to health care, 54.8 percent of farmers were in the medium level, 29 percent were in the low level and 16.1 percent had good health care practices.

Comparison between management practices levels in the two villages showed that Luhindo village scored higher on feed and feeding practices (Good level – 48.3%, Medium level – 50% and Low level 6.2) compared to Sokoine village (Good level - 26.7%, Medium level – 66.7% and low level – 6.6%). Moreover, Sokoine scored better in terms of housing (Good level – 53.3% and Medium - 46.7%) and health care (Good level - 13.3%, Medium level – 66.7% and Low level 20%) compared to Luhindo village which

scored 43.8% - good, Medium - 43.8% and 12.4 – low level for housing and for health care were 13.3% - Good, 66.7% - Medium and 20% - Low level.

In the prediction of management practices, levels required for optimum performance of these breeds under village conditions the results showed that, good or medium level housing, better feeding (good) and health care (good or medium) were associated with better bird's performance. The average growth rate of these breeds of chickens for 12 weeks of study was 13.8±0.4g/d and 10.2±0.4g/d for Kuroiler and Sasso respectively. The body weight at 20 weeks of age of birds in Luhindo village was significantly higher ($p \leq 0.05$) (1895.4±54.3g) compared to Sokoine village (1717.2±60.5g). Breed-wise Kuroiler, had significantly higher ($p \leq 0.05$) body weight (1937.2±60.4g) than Sasso (1687.4±54.5g) up to week twenty. The mean body weight for the three management levels were 2086.3±57.2g, 1805.2 ±25.8g and 1527.4±144.9g for good, medium and low level respectively.

The overall mortality was 18.8% which was contributed mostly by diseases (90.5%). Mortality rate was generally associated with management levels and there were no significant differences between breeds and villages. Correlation analysis showed a strong positive relationship between growth performance and feeds and feeding ($r = .893$) compared to growth performance and health care ($r = .415$) as well as growth performance and housing ($r = .093$).

DECLARATION

I, ONESMO J. LYAHAMA, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been produced nor being concurrently submitted for a degree award in any other institution.

_____ _____

Onesmo J. Lyahama Date

(MSc. Tropical Animal Production candidate)

The above declaration is confirmed by;

_____ _____

Prof. Mbaga, S.H. Date

(Supervisor)

COPYRIGHT

ACKNOWLEDGEMENTS

First, I would like to thank God for gift of life. I wish also to express my special thanks to the African Chicken Genetic Gain (ACGG) project for the financial support in carrying out this study. I wish express my grateful thanks to my supervisors Prof. Mbaga S.H for his guidance, assistance, advice and constructive criticisms.

I express my sincere thanks to the Director General of Tanzania Livestock Research Institute (TALIRI) Professor Erick Komba and the Officer In-Charge of TALIRI Kongwa Mr. Salum Omari Kuwi for granting me a study leave for postgraduate training at Sokoine University of Agriculture.

Special thanks to the poultry keepers and their group leaders at Sokoine and Luhindo villages for the good cooperation and assistance given to me during the period of data collection. Thanks to my fellow M.Sc. students for their corporation, good relationship, love, and support during the entire period of study.

Finally, yet importantly, thanks go to my family members, (my father Jackson Lyahama, my brother and sisters) for their prayers, advice, support and encouragement during the entire journey of my studies.

DEDICATIONS

I dedicate this work to sisters Recho Lyahama and Ajely Lyahama and to my brother Komesho Lyahama and my lovely father Jackson Lyahama who worked so hard to build the foundation and pillars of my education.

TABLE OF CONTENTS

LIST OF TABLES

TABLES IN MANUSCRIPT ONE

TABLES IN MANUSCRIPT TWO

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ACGG	African Chicken Genetic Gain
D	Day
G	Gram
GLM	General Linear Model
IBD	Infectious Bronchitis Disease
KR	Kuroiler
LU	Luhindo
Mgnt	Management
MLF	Ministry of Livestock and Fisheries
MSc	Masters of Science
SA	Sasso
SAS	Statistical Analysis System
Se	Standard error
SO	Sokoine
SPSS	Statistical Packages for Social Sciences
TALIRI	Tanzania Livestock Research Institute
W1	Initial weight
W2	Final weight
Wk	Week

CHAPTER ONE

1.0 GENERAL INTRODUCTION

1.1 Background Information

According to MLF (2018), the number of chickens in Tanzania has increased from 71.93 million in 2017/18 to about 74.8 million, in 2018/19. The sector is dominated by local chicken (MLF, 2018) with 86 percent of livestock keepers rearing poultry (Da silva *et al*., 2017). However, these chickens have low genetic potential for both egg and meat production compared to improved commercial breeds, specialized egg type and meat type chickens (Tsadik *et al*., 2016; Da silva *et al.,* 2017).

In many African countries, poultry production is practiced under three systems which are intensive, semi intensive and extensive/free range systems (Justus *et al.,* 2013; Kayitesi, 2015). Among them, extensive system is most preferred by many rural households than other systems (Guèye, 2000; Muchadeyi *et al*., 2007; Justus *et al.,* 2013; Kayitesi, 2015) because it is cheaper in terms of labour and management (Justus *et al.,* 2013). However, this system is associated with low productivity of the birds due environmental challenges such as poor quality of feeds, small quantity of feeds consumed by chickens per day, diseases and worm infestation (Muchadeyi *et al*., 2007; Goromela *et al.,* 2008; Justus *et al.,* 2013; Kayitesi, 2015). The system also has been reported to have poor housing which affects the performance of the chickens (Mapiye *et al*., 2008; Mwale and Masika, 2009; Justus *et al*., 2013). In terms of housing, feeding and health care, intensive system is the best among the three systems due to intensive care given to the birds (Kayitesi, 2015).

Keeping poultry is advantageous compared to keeping other animals, as they require small area and low input due to their small body size. The demand for poultry products has

increased in recent years due to changes in habits of meat consumption and an increase in the human population (Goromela *et al*., 2008; Kumaresan *et al*., 2008; Muchadeyi *et al*., 2007). In rural areas, poultry play significant roles as a source of income, animal protein, and manure and for social-cultural use (Justus *et al.*, 2013; Da silva *et al*., 2017; Muchadeyi *et al*., 2007; Osei-Amponsah *et al*., 2012; Yakubu and Ari, 2018). Keeping poultry has also been used as a form of empowerment among women and youth in addition to promoting food security and alleviating poverty (Guèye, 2000). In realization of the low productivity of local chickens, efforts are currently being made to introduce good producing and adaptable breeds in tropics, particularly in rural areas. Such breeds include Kuroiler breed originating from India and Sasso breed from France (Sharma *et al*., 2015; Yakubu and Ari, 2018; Pius and Mbaga, 2018). These breeds also have the ability of scavenging, as do the unimproved chickens (Yakubu and Ari, 2018).

1.2 Problem Statement and Justification

Although improved breeds such as Sasso and Kuroiler are claimed to perform better than unimproved strains there is limited documentation on this aspect under different production environments, particularly in African countries (Tsadik *et al.,* 2016; Yakubu and Ari, 2018). Some studies done on-farm and on-station reported on management practices prevailing in East, central and southern highlands of Tanzania, where these birds were tested (Guni *et al.,* 2021; Sanka *et al.,* 2020; Pius and Mbaga, 2017).

Generally, the management practices were considered as medium, with distinct differences across agricultural zones. Moreover, there is scanty documented information on the performance of these birds under village management conditions with respect to growth and survivability. Therefore, this study was aimed at evaluating the performance of the two breeds (Kuroiler and Sasso) under village management conditions with view to

suggest the best way of improving production performance to increase income and profit to the farmers through management practices.

1.3 Objectives

1.3.1 General objective

To evaluate the performance of Sasso and Kuroiler chicken under village management conditions.

1.3.2 Specific objectives

i. To characterize the management systems in villages in terms of housing, feeding, and health care.
ii. To compare the performance of Sasso and Kuroiler chickens in terms of growth and survival rate.
iii. To establish combinations of management factors (housing, feeding and health care) required for optimum performance under the village conditions.

1.4 Hypothesis

This study hypothesized that, there is no difference in performance (growth and mortality) between Sasso and Kuroiler chickens under farmers' management conditions.

1.5 Organization of the Dissertation

This dissertation has adopted a publishable manuscript format that comprises five chapters. Chapter One comprises the general introduction of the study. Chapter Two consists of a manuscript entitled, "Characterization of management practices in two villages (Luhindo and Sokoine) of Mvomero district while, chapter Three consists of a manuscript entitled, Comparative performance of Sasso and Kuroiler chickens under

farmers' management", Chapter Four comprises the general discussion and Chapter Five comprises the general conclusions and recommendation.

1.6 General Methodology

1.6.1 Description of the study areas

This study was conducted in Mvomero District, Morogoro Region, Tanzania. The district is between 293 and 379m above sea level and lies at 6° 14' 8.2212" S and 38° 41' 37.4928" E (Mboera *et al*., 2010). The average annual rainfall is 975 mm while the average annual temperature is 25.0°C. The main economic activity undertaken by many people in this area is agriculture whereby more than 97 percent of the people are involved in crop and livestock keeping (Dickinson *et al*., 2012).

1.6.2 Sampling procedure and sample size

The study was conducted in two villages namely Sokoine and Luhindo in Mvomero District. Having local chickens and knowledge on poultry keeping were the inclusion criteria for the recruited households. Also, consideration was given to those farmers that was previously trained by ACGG Project on poultry production. Among trained farmers random selection was done in the entire villages to avoid biasness. Thirty-one (31) farmers were purposively selected for the study. A total of 558 chickens were distributed to the selected farmers in the study area. Each farmer was given 18 chickens whereas eight (8) farmers from Luhindo were given Kuroiler and the other 8 farmers were given Sasso while eight (8) farmers from Sokoine were given Kuroiler and 7 farmers were given Sasso chickens.

1.6.3 Management practices

Data on management practices were taken five times for an interval of 4 weeks starting the day of chicken distribution in both villages. Management aspects, which were observed in this study were housing, feeds and feeding and health care. Basically, the subjective assessment was used given the researcher experience. Details of aspects for each management factor are as described below:

1.6.3.1 Housing

House location, orientation, height of the wall and roof, materials used in construction (Blocks, bricks or muddy wall and also iron sheet or thatch grass), ventilation, floor status (Concrete or earth), roof status (leaking or not leaking) and general hygiene were assessed.

1.6.3.2 Feeds and feeding

Assessment on the type of feeds and the type of feed ingredients used in feed mixing was done. In addition, three types of feeds such as commercial feeds, homemade feed mix and supplementary feeds (Food left overs, maize or maize bran) were assessed to identify kind of feed mostly used by farmers. Feeding and watering frequencies, availability and the type of feeders and drinkers used by each household were also assessed.

1.6.3.3 Health care

The assessment was done on disease awareness in other words, by asking as to whether the farmer knew any disease and their signs, frequencies, handling of sick chicken and its treatment. This also included disease control routines that farmers used including deworming and vaccination. In addition, farmers were assessed on some issues related to bio- security such as cleanness around the poultry house, feeders and drinkers.

1.6.4 Characterization of management practices levels

Data on management practices and awareness were collected using questionnaires and on-site observations. In case of awareness farmers were assessed on disease understanding like if they know diseases, frequency of occurrence, vaccination and even treatment. Management practices level was characterized using scores in which each management practice had a total of 10 points. The three levels of management practices were characterized through scoring points 0 – 3.4 – for "low level", 3.5- 6.7 – for "medium level" and 6.8 - 10 – for "good level".

1.6.5 Growth performance and mortality rate

Data on poultry growth performance and mortality rate were collected on-farm during growing period from 8th to 20th week. Sasso and Kuroiler chicks were first brooded and reared at Sokoine University of Agriculture for 7 weeks prior distribution to the farmers. This was done to ensure that chicks were strong and could cope with village situation before distribution. During brooding, chicks were vaccinated against important diseases such as Newcastle, Gumboro and Fowl pox. Chicks were wing-tagged before distribution and in total there were 200 males and 358 females. Data on growth performance was collected after every 4 weeks beginning week 8 and ended on the 20th week by using digital weighing scale while, data on mortality were recorded once it occurred through a well-designed form. Trained expert on poultry production from ACGG Project together with farmers were able to identify the cause of mortality to the chickens. Growth and mortality rates were calculated using the following formula.

- **Growth rate** (g/d) = Final weight (W2) – Initial weight (W1)/Time
- **Mortality rate** (%) = $\frac{\text{Total no. of chicken died}}{\text{Initial no.of chikens}} \times 100$

Optimum growth performance of chickens

Body weight of chickens at 20 weeks was categorized into three groups-; Large (>2100g), medium (1600g – 2100g) and small (< 1600g). Management practices of farmers having chickens with large weight group was then corroborated with the level of management in household. Levels of management practices used in corroboration with farmers having chickens with large weight in determination of optimum growth performance were low, medium and good level. Correlation analysis was done to determine the degree of association between body weights and management practices.

1.6.6 Data analysis

The data on management characterization (Housing, feeding and health care) were processed and analysed using Statistical Package for Social Science (SPSS) Software version 20. Descriptive statistics such as frequencies and percentages were computed. The data were analysed into two categories, the first was data for disease awareness and management practices and the second was the levels of management practices overall and village wise. Data for growth performance (body weights) and mortality rate were analysed by using GLM procedure of SAS program version 20 and Chi-Square through FREQ procedure respectively. SPSS software was used to determine the correlation between management practice levels and growth performance. Also 6^{th} week weights were used as covariate (control/predictor) due to the reason that, chickens were reared on-station under good management instead of 8^{th} week which was already subjected to the farmers' management. The data for growth performance were subjected to the following model.

Model - $Y_{ijklm} = \mu + M_i + B_j + V_k + S_l + b(x_{ijkl} - \bar{x}) + eijklm$

Y_{ijklm} = Birds growth performance

μ = General mean

M_i = Effect associated to i^{th} management practices

B_j = Effect due to j^{th} breed

V_k= Effect associated with k^{th} location/village

S_l= Effect due to l^{th} sex

b (x_{ijkl} - $\bar{x}$) = Covariate (6^{th} week body wt)

eijklm = Random error

b = Regression coefficient of body weight /body weight gain on initial body weight

x_{ijkl} = Individual weight

$\bar{x}$ = Mean weight

REFERENCES

Ahuja, V. and Sen, A. (2007). Scope and space for small-scale poultry production in developing countries. Productivity and Market Success (IPMS) of Ethiopian Farmers Project. Working paper 5. ILRI (International Livestock Research Institute), Nairobi, Kenya. 73pp.

Ahuja, V., Dhawan, M., Punjabi, M. and Maarse, L. (2008). Poultry based livelihoods of rural poor: Case of Kuroiler in West Bengal. South Asia Pro Poor Livestock Policy Programme, initiative of NDDB and FAO: Document 12pp.

Arbor Acres (2009). Breeder Management Guide. [www.aviagen.com]. Site visited on 19/03/2020.

Cheng, H. and Muir, W. M. (2005). The effects of genetic selection for survivability and productivity on chicken physiological homeostasis. *World's Poultry Science Journal* 61(3): 383 - 397.

Da Silva, M., Desta, S. and Stapleton, J. (2017). Development of the chicken sector in the Tanzanian livestock master plan. *Tanzania Livestock Master Plan.*core.ac.uk. *Brief* 7(October): 1- 4.

Dessie, T. (2018). Progress narrative report: African Chicken Genetic Gains program. International Livestock Research Institute (ILRI), ACGG BNGF report February 2017 – December 2017.

Dickinson, K. L., Randell, H. F., Kramer, R. A. and Shayo, E. H. (2012). Socio-economic status and malaria-related outcomes in Mvomero District, Tanzania. *Global Public Health* 7(4): 384 - 399.

Getiso, A., Bekele, B., Zeleke, B., Gebriel, D., Tadesse, A., Abreham, E. and Jemal, H. (2017). Production performance of Sasso (distributed by ethio-chicken private poultry farms) and Bovans brown chickens breed under village production system in three agro-ecologies of Southern Nations, Nationalities and Peoples Regional State (SNNPR), Ethiopia. *International Journal of Livestock Production* 8(9): 145 - 157.

Goromela, E. H., Kwakkel, R. P., Verstegen, M. W. A. and Katule, A. M. (2008). Effect of season and farming system on the quantity and nutritional quality of scavengeable feed resources and performance of village poultry in central Tanzania. *Journal of Cell and Animal Biology* 2(3): 063 - 071.

Guèye, E. F. (2000). The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. *Outlook on Agriculture* 29(2): 129 - 136.

Guni, F. S., Mbaga, S. H., Katule, A. M. and Goromela, E. H. (2021). Performance evaluation of Kuroiler and Sasso chicken breeds reared under farmer management conditions in highland and lowland areas of Mvomero district, Eastern Tanzania. *Tropical Animal Health and Production* 53(2): 1- 8.

ISA (2007). General Parent stock Management Guide. [www.hendrix-genetics.com]. Site visited on 15/04/2020.

ISA (2008). General management guide for layer parent stock. [www.hendrix-genetics.com]. site visited on 15/04/2020.

Isenberg, D. (2008). Kegg farms (India)-Which came first, the Kuroiler or the Kegg. *Product Code* 3: 9 - 807.

Justus, O., Owuor, G. and Bebe, B. O. (2013). Management practices and challenges in smallholder indigenous chicken production in Western Kenya. *Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS)* 114(1): 51 – 58.

Katule, A. M. (1998). Study on the productivity of indigenous chicken under village management conditions. Proceedings of the 25th Scientific Conference, AICC – Arusha. TSAP Conferences Series 25: 48-54pp.

Kayitesi, A. (2015). Management systems and location effects on growth and carcass traits of Kuroiler and local chickens. Doctoral dissertation, Makerere University. 98pp.

Khobondo, J. O., Muasya, T. K., Miyumo, S., Okeno, T. O., Wasike, C. B., Mwakubambanya, R. and Kingori, A. K. (2015). Genetic and nutrition development of indigenous chicken in Africa. [Repository.maseno.ac.ke] site visited on 4/9/2020.

Kilezu, P. (2014). Establishment of poultry production for developing a strong and sustainable local market economy of widows in Itonjanda village, Tabora municipality (Doctoral dissertation, The Open University of Tanzania). 79pp. [Repository.out.ac.tz.] Site visited on 19/03/2020.

Kumaresan, A., Bujarbaruah, K. M., Pathak, K. A., Chhetri, B., Ahmed, S. K. and Haunshi, S. (2008). Analysis of a village chicken production system and performance of improved dual purpose chickens under a subtropical hill agro-ecosystem in India. *Tropical Animal Health and Production* 40(6): 395 - 402.

Larivière, J. M., Vandenheede, M. and Leroy, P. (2009). Effects of food restriction on rearing performance and welfare of a slow-growing chicken breed: a behavioural approach. *International Journal of Poultry Science* 8(7): 684 - 688.

Lyimo, H. E. (2013). *Impact of adoption of improved local chicken production methods in Tanzania: Case study of UMADEP and ILRP SUA projects* Doctoral dissertation, Sokoine University of Agriculture. 198pp.

Mapiye, C., Mwale, M., Mupangwa, J. F., Chimonyo, M., Foti, R. and Mutenje, M. J. (2008). A research review of village chicken production constraints and opportunities in Zimbabwe. *Asian-Australasian Journal of Animal Sciences* 21(11): 1680 - 1688.

Mboera, L. E., Senkoro, K. P., Mayala, B. K., Rumisha, S. F., Rwegoshora, R. T., Mlozi, M. R. and Shayo, E. S. (2010). Spatio-temporal variation in malaria transmission intensity in five agro-ecosystems in Mvomero district, Tanzania, National Institute for Medical Research. 89pp.

Mbuza, F., Habimana, R., Simbankabo, T. and Majyambere, D. (2016). Characterization of layer poultry production in Rwanda. *International Journal of Agriculture Sciences* 6: 1148 - 1156.

Miao, Z. H., Glatz, P. C. and Ru, Y. J. (2005). Free-range poultry production-A review. *Asian-Australasian Journal of Animal Sciences* 18(1): 113 - 132.

Minh, D. V. (2005). Effect of supplementation, breed, season and location on feed intake and performance of scavenging chickens in Vietnam, *Doctoral Thesis, Swedish University of Agricultural Sciences* 101pp.

Ministry of Livestock and Fisheries development 'MLF' (2018). Minister speech 2018-2019.

Muchadeyi, F., Wollny, C., Eding, H., Weigend, S., Makuza, M. and Simianer, H. (2007). Variation in village chicken production systems among agro-ecological zones of Zimbabwe. *Tropical Animal Health and Production* 39: 453 - 461.

Mwale, M. and Masika, P. J. (2009). Ethno-veterinary control of parasites, management and role of village chickens in rural households of Centane district in the Eastern Cape, South Africa. *Tropical Animal Health and Production* 41(8): 1685 - 1693.

Mwalusanya, N. A., Katule, A. M., Mutayoba, S. K., Mtambo, M. M. A., Olsen, J. E. and Minga, U. M. (2002). Productivity of local chickens under village management conditions. *Tropical Animal Health and Production* 34(5): 405 - 416.

Osei-Amponsah, R., Kayang, B. B. and Naazie, A. (2012). Age, genotype and sex effects on growth performance of local chickens kept under improved management in Ghana. *Tropical Animal Health and Production* 44(1): 29 - 34.

Pius, L. O. and Mbaga, S. H. (2018). Variations in village chicken management packages in two agro-ecological zones of Tanzania. *International Journal of Livestock Production* 9(3): 42 - 49.

ROSS, A. (2009). Ross Broiler Management Manual. Scotland, UK. 114 pp.

Sanka, Y. D., Mbaga, S. H., Mutayoba, S. K., Katule, A. M. and Goromela, S. H. (2020). Evaluation of growth performance of Sasso and Kuroiler chickens fed three diets at varying levels of supplementation under semi-intensive system of production in Tanzania. *Tropical Animal Health and Production* 52(6): 3315 - 3322.

Semakula, J., Lusembo, P., Kugonza, D. R., Mutetikka, D., Ssennyonjo, J. and Mwesigwa, M. (2011). Estimation of live body weight using zoometrical measurements for improved marketing of indigenous chicken in the Lake Victoria basin of Uganda. *Livestock Research for Rural Development* 23: 170. [http://www.lrrd.org/lrrd23/8/sema23170.htm]. Site visited on 2/7/2020.

Sharma, J., Xie, J., Boggess, M., Galukande, E., Semambo, D. and Sharma, S. (2015). Higher weight gain by Kuroiler chickens than indigenous chickens raised under scavenging conditions by rural households in Uganda. *Livestock Research for Rural Development* 27(9): 1- 4.

Sonaiya, E. B. and Swan, S. (2004). Small-scale poultry production: technical guide. FAO animal production and health. 23-65pp.

Tadesse, D., Singh, H., Mengistu, A., Esatu, W. and Dessie, T. (2013). Study on management practices and marketing systems of village chicken in East Shewa, Ethiopia. *African Journal of Agricultural Research* 8(22): 2696-2702.

Tsadik, E. T., Tamir, B. and Sahile, Z. (2015). Characterization of the adoption of village poultry technology package elements, chicken and forms in the Central Oromia Region, *Ethiopia. Journal Economic Sustainable Development* 6(13): 87 - 89.

Tsadik, E. T., Tamir, B. and Sahle, Z. (2016). Characterization of the adoption of village poultry technology packages in the central Oromia region, Ethiopia. *Journal of Animal Production Advances* 6(3): 907 - 918.

Wang, K. H., Shi, S. R., Dou, T. C. and Sun, H. J. (2009). Effect of a free-range raising system on growth performance, carcass yield and meat quality of slow-growing chicken. *Poultry Science* 88(10): 2219 - 2223.

Yakubu, A. and Ari, M. M. (2018). Principal component and discriminant analyses of body weight and conformation traits of Sasso, Kuroiler and indigenous Fulani chickens in Nigeria. *Journal of Animal and Plant Sciences* 28(1): 46-55.

Yakubu, A. and Madaki, J. (2017). Modelling growth of dual-purpose Sasso hens in the tropics using different algorithms. *Journal of Genetics and Molecular Biology* 1(1): 1 - 9.

Yegani, M. and Korver, D. R. (2008). Factors affecting intestinal health in poultry. *Poultry Science* 87(10): 2052 - 2063.

CHAPTER TWO

2.0 MANUSCRIPT I

Characterization of chicken management practices in two villages (Luhindo and Sokoine) of Mvomero District

Lyahama, O.[1,2], Mbaga, S H.[2]

[1,2]TALIRI Kongwa, P O Box 05 Kongwa, Dodoma Region, Tanzania: Email: lyahamao@gmail.com

[2]Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture (SUA), P.O Box 3004, Morogoro

ABSTRACT

This study was carried out to assess and characterize chickens management practices that prevail among farmers in two villages (Luhindo and Sokoine) of Mvomero District. Thirty one (31) farmers in both villages were involved, 16 from Luhindo and 15 from Sokoine village. A structured questionnaire was used during data collection and complemented with on-site observations. Management practices characterized in this study were housing, feeds and feeding and health care. The determination of levels of management for each category in each village was done through assigning score to the parameters studied in each management practice. Each management practice was allocated ten (10) points score whereby score of 6.8 – 10 was considered “Good”, 3.5 – 6.7 “Medium” and 0 – 3.4 “Low”. Results showed that the majority of the farmers were aware on diseases such as New castle (100%), Infectious coryza (93.6%), Fowl typhoid (87.1%) and Fowl pox (54.8%) mainly through symptoms. Moreover, awareness of diseases such as Coccidiosis (29%) and Gumboro (19.4%) was poor. New castle disease was the most prevalent disease followed by Fowl typhoid, Infectious coryza and Fowl pox. Few farmers (32.3%) isolated

and treated chickens after the eruption of disease while 67.7 percent did only treatment. In addition; 71, 64.5 and only 9.7 percent of farmers knew how to treat chickens against Fowl typhoid, Infectious coryza and Coccidiosis respectively. Only 12.9, 12.9 and 87.1 percent of farmers were aware of vaccination against Fowl pox, Gumboro (IBD) and Newcastle diseases respectively. Deworming was done by about 2/3 of the farmers in Luhindo and Sokoine. Housing structures scored moderate in terms of floor type, house height, protection against predators and ventilation. Most of the feeds used were locally available feeds (kitchen left overs, maize corn or maize bran) in the area or homemade feed using ingredients such as maize bran, sunflower seed cake, rice bran and fish meal to large extent. On overall, both villages fell into medium management level. Luhindo village was better in feeding practice while, Sokoine village was better in housing and health care.

Key words: Characterization, Management practice, Feeds and feeding, Housing, Health care, Management practice levels, Chickens.

2.1 INTRODUCTION

In poultry rearing, there is a relationship between quality of poultry house and rearing system whereby intensive system has better houses followed by semi intensive and extensive/scavenging systems (Khobondo *et al*., 2015). Most poultry houses in rural areas are built using locally available materials such as wood, mud bricks, bamboo and cereal stovers (Ahuja and Sen, 2007; Tadesse *et al.,* 2013). Variations in house structures depend on the level of understanding or knowledge of poultry keeping and the local economy (Kilezu, 2014; Pius and Mbaga, 2018). Regardless of the rearing system, some factors, which are considered in poultry house for better performance include location, stocking density, ventilation and hygienic conditions (Arbor Acres, 2009; ISA, 2007; Tsadik *et al*.,

2016). Furthermore, it has been reported that apart from diseases, mortality can be caused by low standard of housing system and poor building materials in many households especially in developing countries (Mwale and Masika, 2009).

Mapiye *et al*. (2008) and Justus *et al*. (2013) reported that reduction of poultry loses through diseases, environmental hazards and exposure to rainfall can be attributed to good housing system. In addition, this observation is in agreement with Kayitesi (2015) who reported that good poultry house in one way protects the chickens against predators and theft.

Although the genetic makeup of a chicken to some extent determines the performance of the birds in terms of growth rate and production, such performance needs to be backed up by proper feeds and feeding system (Osei-Amponsah *et al*., 2012; Minh, 2005). Yakubu and Madaki (2017) reported that improvement of feed and feeding practice plus good selection strategies led to better growth performance of chickens. The scavenging poultry-keeping system is the one which dominate in many small holder households in African countries. The system is associated with poor performance of the chicken due to unsatisfactory feeds in terms of quality and quantity (Guèye, 2000; Goromela *et al.*, 2008; Justus *et al.*, 2013). Farmers occasionally provide supplementary feeds to improve chicken performance (Guèye, 2000) and the system can utilize different feeds such as food leftovers or kitchen wastes, garden vegetables, crop grains, harvest residues, and other environmental materials such as insects, worms, snails, forage leaves/flowers and forage seeds (Guèye, 2000; Mwalusanya *et al*., 2002; Minh, 2005; Goromela *et al.*, 2008). Nevertheless, variability with season, farming system and availability of the feeds may render the scavenging birds at certain periods of the year to fail to meet the nutrient requirements and thus influencing negatively birds' productivity (Minh, 2005; Goromela

et al., 2008). Wang *et al*. (2009) and Khobondo *et al*. (2015) reported that indoor/intensive and semi intensive systems resulted into better chicken performance in terms of body weight and body weight gain compared to free-range chicken. This implies that sustainable and economical production from scavenging chicken can be attained with adequate and proper supplementation (Minh, 2005).

Health care is among the management practices to be considered in poultry production. According to Minh (2005), 35 to 79 percent of poultry farmers in Africa rely on local herbs to treat or prevent poultry diseases. Guèye (2000) and Mbuza *et al*. (2016) reported, ethno veterinary medicine to have originated from natural products, especially from locally available plants and it is the most useful method of disease control in rural areas. Kumaresan *et al*. (2008) reported that 65.9 percent of farmers in rural households did not vaccinate their birds against any disease leading to high mortality. This may be due to low knowledge or poor adoption rate in health care as previously reported by Tsadik *et al*. (2015). The high cost of vaccines, lack of information and skills on health care are other reasons for poor health care practices in many areas (Justus *et al*., 2013). In addition, shortage of extension officers and lack of awareness on disease control by farmers are other reasons for poor health care management practices in many areas (Mapiye *et al*., 2008). Among the diseases affecting chicken, Newcastle disease is the most important disease in many developing countries. Other diseases that affect chicken include fowl cholera, fowl typhoid, fowl pox, infectious coryza, Marek's and Gumboro disease (Mwalusanya *et al.,* 2002; Miao *et al*., 2005; Justus *et al*., 2013; Tsadik *et al*., 2015; Yakubu and Madaki, 2017). For improvement of poultry performance in rural areas this study aimed at characterization of chicken management practices that prevails in two villages (Luhindo and Sokoine) in Mvomero district, Morogoro region.

2.2 Materials and Methods

2.2.1 Description of the study areas

This study was conducted in Mvomero District, Morogoro Region, Tanzania. The district is between 293 and 379m above sea level and lies at 6° 14' 8.2212" S and 38° 41' 37.4928" E (Mboera *et al*., 2010). The average annual rainfall is 975 mm while the average annual temperature is 25.0°C. The main economic activity undertaken by many people in this area is agriculture whereby more than 97 percent of the people are involved in crop and livestock keeping (Dickinson *et al*., 2012).

2.2.2 Sampling procedure and sample size

The study was conducted in two villages namely Sokoine and Luhindo in Mvomero District. Having local chickens and knowledge on poultry keeping were the inclusion criteria for the recruited households. Consideration was given to those farmers that were previously trained by ACGG Project on poultry production.

Among trained farmers random selection was done in the entire villages to avoid biasness. Thirty-one (31) farmers were purposively selected for the study. A total of 558 chickens were distributed to the selected farmers in the study area. Each farmer was given 18 chickens whereas eight (8) farmers from Luhindo were given Kuroiler and the other 8 farmers were given Sasso while eight (8) farmers from Sokoine were given Kuroiler and 7 farmers were given Sasso chickens.

2.2.3 Management practices

Data on management practices were taken five times for an interval of 4 weeks starting the day of chicken distribution in both villages. Management aspects, which were observed in this study were housing, feeds and feeding and health care. Basically, the subjective

assessment was used given the researcher experience. Details of aspects for each management factor are as described below:

2.2.3.1 Housing

House location, orientation, height of the wall and roof, materials used in construction (Blocks, bricks or muddy wall and also iron sheet or thatch grass), ventilation, floor status (Concrete or earth), roof status (leaking or not leaking) and general hygiene were assessed.

2.2.3.2 Feeds and feeding

Assessment on the type of feeds and the type of feed ingredients used in feed mixing was done. In addition, three types of feeds such as commercial feeds, homemade feed mix and supplementary feeds (Food left overs, maize or maize bran) were assessed to identify kind of feed mostly used by farmers. Feeding and watering frequencies, availability and the type of feeders and drinkers used by each household were also assessed.

2.2.3.3 Health care

The assessment was done on disease awareness in other words, by asking as to whether the farmer knew any disease and their signs, frequencies, handling of sick chicken and its treatment. This also included disease control routines that farmers used including deworming and vaccination. In addition, farmers were assessed on some issues related to bio- security such as cleanness around the poultry house, feeders and drinkers.

2.3 Characterization of Management Practices Levels

Data on management practices and awareness were collected using questionnaires and on-site observations. In case of awareness farmers were assessed on disease understanding like if they know diseases, frequency of occurrence, vaccination and even treatment.

Management practices level was characterized using scores in which each management practice had a total of 10 points. The three levels of management practices were characterized through scoring points 0 – 3.4 – for “low level”, 3.5- 6.7 – for “medium level” and 6.8 - 10 – for “good level”.

2.4 Data Analysis

The data on management characterization (Housing, feeding and health care) were processed and analysed using Statistical Package for Social Science (SPSS) Software version 20. Descriptive statistics such as frequencies and percentages were computed. The data were analysed into two categories, the first was data for disease awareness and management practices and the second was the levels of management practices overall and village wise

2.5 RESULTS

2.5.1 Management practices

2.5.1.1 Housing

In housing management practice, the parameters assessed included the type of floor, height of the wall and protection against other animals as presented in Table 1. Most of poultry houses were dominated by earth floor (71%) with good (54.8%) height of walls. The quality of building materials and ventilation condition were moderate while, chickens protection against other animals like predators was good (54.8).

Table 1: Poultry housing (n=31)

Variables	Frequency	Percent
Type of floor		
Concrete floor	9	29.0
Earth floor	22	71.0
Height of wall		
Good (2.5m)	17	54.8
Fair (1.5 -2m)	13	42
Poor (below 1.5m)	1	3.2
Wall status (Protection against other animals)		
Good	17	54.8
Fair	14	45.2
Building materials quality		
Good	12	38.7
Fair	16	51.6
Bad	3	9.7
Ventilation		
Good	7	22.6
Moderate	17	54.8
Poor	7	22.6

2.5.1.2 Feeds and feeding

The results from both villages (Luhindo and Sokoine), showed that 64.5 percent of the famers used homemade feeds and 35.5 percent used supplementary feeds including maize bran, maize corn and feed leftovers as presented in Table 2. The majority of the respondents provided their chicken with feed and water twice per day. According to observations, about half (51.6%) of the farmers used improved/modern feeders and

drinkers and the remaining half used improvised local equipment. Table 3 presents different feed ingredients used for homemade feed preparation. Around 50 percent of farmers used maize bran, sunflower seed cake and fishmeal to compound feed. This was followed by maize bran, sunflower seed cake, fishmeal and bone meal. Generally, there is a big variation in types of feed ingredients used depending on availability.

Table 2: Response on feeds and feeding (n=31)

Variables	Frequency	Percent
Type of feed	0.0	0.0
Commercial feed		
Homemade feed mix	20	64.5
Supplementary feed	11	35.5
Feeding frequency		
Once per day	13	41.9
Twice per day	15	48.4
Three times per day	3	9.7
Water supply frequency		
Once per day	13	41.9
Twice per day	18	58.1
Feeders and drinkers		
Improved/Modern	16	51.6
Local	15	48.4

Table 3: Response on ingredients/materials used in feed mixing (n=20)

Variable	Frequency	Percent
Maize bran and Sunflower seed cake	2	10
Maize bran and Fish meal	1	5
Maize bran, Sunflower seed cake and Fish meal	10	50
Maize bran, Sunflower seed cake, Fish meal and Bone meal	4	20
Maize bran, Fish meal, Bone meal, Salt and Rice bran	1	5

Maize, Maize bran, Sunflower seed cake, Blood meal, Bone meal, Salt, Soya, Fish meal and Lime stone	1	5
Maize bran, Sunflower seed cake, Bone meal, Fish meal, Blood meal and Lime stone	1	5

2.5.1.3 Health care

i. Disease awareness

In terms of awareness, the results show that all (100%) farmers were aware of the symptoms of Newcastle disease followed by Infectious Coryza (93.5%), Fowl typhoid (87.1%) and Fowl pox 54.8%. Awareness on Coccidiosis (29.0%) and Gumboro-IBD (19.4%) were low as indicated in Table 4.

Table 4: Response on awareness of farmers to poultry disease treatment (n=31)

Disease treatment	Frequency	Percent
Coccidiosis		
YES	9	29.0
NO	22	71.0
Fowl pox		
YES	17	54.8
NO	14	45,2
Fowl typhoid		
YES	27	87.1
NO	4	12.9
Gumboro (IBD)		
YES	6	19.4
NO	25	80.6
Infectious Coryza		
YES	29	93.5
NO	2	6.5
Newcastle		
YES	31	100

NO	0	0

ii. Common diseases occurring in the villages

Of the six diseases mentioned by farmers only four, Fowl pox, Fowl typhoid, Infectious Coryza and Newcastle occurred frequently. All (100%) respondents admitted that Newcastle was the most frequently occurring disease in the villages followed by Fowl typhoid (25.8%), Fowl pox (16.1%) and Infectious Coryza (32.3 %) (Table 5).

Table 5: Response on occurrence of common diseases (n=31)

Disease occurrence	Frequency	Percent
Fowl pox		
YES	5	16.1
NO	26	83.9
Fowl typhoid		
YES	8	25.8
NO	23	74.2
Infectious Coryza		
YES	10	32.3
NO	21	67.7
Newcastle		
YES	31	100
NO	0	0

iii. Disease occurrence frequency

Farmers seem to have different understanding on the frequencies of occurrence of the four common diseases in the villages. Fowl pox was reported to occur once per year while Fowl typhoid and infectious Coryza occurred between two and three times per year. Newcastle was reported to occur more than once by the majority (80.6%) of farmers.

Table 6: Frequency of common disease

Disease	Frequency	Percent
Fowl pox (n=5)		
Once per year	5	100
Twice per year	0	0
Three times and above	0	0
Fowl typhoid (n=8)		
Once per year	1	12.5
Twice per year	4	50
Three times and above	3	37.5
Infectious coryza (n=10)		
Once per year	2	25
Twice per year	2	25
Three times and above	4	50
Newcastle (n=31)		
Once per year	6	19.4
Twice per year	15	48.4
Three times and above	10	32.2

iv. Handling of sick birds

The results show that 67.7 percent of the farmers treat the chicken when they fall sick while, few (32.3%) of them were isolating sick chickens followed by treatment as it is shown in Table 7.

Table 7: Response on disease handling methods (n=31)

Disease handling methods	Frequency	Percent
Treatment	21	67.7
Isolation and treatment	10	32.3

v. Knowledge on disease treatment

Table 8 shows that 71 and 64.5 percent of the farmers had knowledge on treatment of sick birds against fowl typhoid and infectious Coryza respectively whereas, only 9.7 percent of farmers knew how to treat Coccidiosis.

Table 8: Response on knowledge of disease treatment (n=31)

Disease treatment	Frequency	Percent
Coccidiosis		
YES	3	9.7
NO	28	90.3
Fowl typhoid		
YES	22	71
NO	9	29
Infectious Coryza		
YES	20	64.5
NO	11	35.5

vi. Drugs used for disease treatment

Table 9 shows the results on the types of drugs that were used in chickens' treatment for each disease. For Coccidiosis, two out of three farmers preferred Amprolium followed by ESB3 (33.3%). Doxicol, ESB3 and Amoxicol were used for Fowl typhoid with Amoxicol being preferred by most farmers. Most (90%) farmers used Fluquin to treat Infectious Coryza with the remaining 10 percent using Fluban.

Table 9: Response of drugs used in disease treatment

Types of drugs used	Frequency	Percent
Drugs for Coccidiosis (n=3)		
ESB3	1	33.3
Amprolium	2	66.7
Drugs used for Fowl typhoid (n=22)		
Doxicol	8	36.4
ESB3	4	18.2
Amoxicol	10	45.4
Drugs used for Infectious Coryza (n=20)		
Fluban	2	10
Fluquin	18	90

Vii Vaccinations

The results on prevention of chicken against important diseases such as Fowl pox, Gumboro and Newcastle are presented in Table 10. All farmers vaccinated against Newcastle disease while only a few vaccinated against diseases such as Fowl pox (13%) and Gumboro (13%). Farmers also had knowledge on vaccination frequency as presented in Table10 where 87.1 percent of the respondents reported that Newcastle is vaccinated three times and above, four respondents reported to vaccinate for Fowl pox once per year and also four respondents said that for Gumboro (IBD) vaccination is done twice per year.

Table 10: Responses on vaccination frequencies

Disease	Frequency	Percent
Fowl pox		
Once per year	4	100
Twice per year	0	0
Three times and above	0	0
Gumboro (IBD)		
Once per year	0	0
Twice per year	4	100

Three times and above	0	0
Newcastle		
Once per year	1	3.2
Twice per year	3	9.7
Three times and above	27	87.1

Viii Deworming practices

Results related to deworming practices are presented in Table 11. A small percent (41.9%) of farmers were aware on the need for deworming. In addition, most (53.8%) of the farmers dewormed their chickens three times and above per year and the drugs commonly used were Levamisole (46.2%) followed by albendazole (30.8%).

Table 11: Response on deworming practices

Variables	Frequency	Percent
Deworming (n=31)		
YES	13	41.9
NO	18	58.1
Deworming frequency (n=13)		
Once per year	3	23.1
Twice per year	3	23.1
Three times and above	7	53.8
Medicine used in deworming (n=13)		
Piperazine	3	23.0
Albendazole	4	30.8
Levamisole	6	46.2

ix Biosecurity

The results show further that the majority (77.3%) of the farmers did not have isolation pen for sick birds. The level of hygiene such as drinkers and feeders were at acceptable level except for the feed store.

Table 12: Response on biosecurity parameters (n=31)

Variables	Frequency	Percent
Sick bird's isolation pen		
Present	7	22.7
Absent	24	77.3
Cleanness around poultry house		
Good	22	71
Fair	9	29
Cleanness of drinkers and feeders		
Good	7	22.6
Fair	24	77.4
Cleanness of feed store		
Good	1	3.2
Fair	25	80.7
Poor	5	16.1

2.5.2 Management practices levels

The summaries for levels of management practices prevailing in both villages are presented in Tables 13 and 14. Generally, management practices levels in housing were 48.4% good, 45.2% medium and 6.5% low level. However, in feeds and feeding practice the scores were medium level (58%), good level (35.5%) and low level (6.5%). For health care 58.1% scored medium level, 25.8% low level and 16.1% good level. At Sokoine village the scores for housing management practice were 53.3 and 46.7% good and medium level respectively, while over two thirds (66.7%) scored medium for feeds and feeding practices. Similarly, the majority (66.7%) of households, scored medium for health care.

Table 13: Scores of management practices level (n=31)

Variable	Frequency	Percent
Housing		
Good (6.8 - 10)	15	48.4
Medium (3.5 - 6.7)	14	45.2
Low (0 -3.4)	2	6.5
Feed and feeding		
Good (6.8 - 10)	11	35.5
Medium (3.5 - 6.7)	18	58.0
Low (0 – 3.4)	2	6.5
Health care		
Good (6.8 – 10)	5	16.1
Medium (3.5 - 6.7)	18	58.1
Low (0 -3. 4)	8	25.8

Village-wise, Luhindo village the score for level of management were 43.8, 43.8 and 12.6 percent for good, medium and low levels respectively in case of housing practice while, for feed and feeding practice 50% scored medium 43.8% good and 6.2% low. About one half scored medium level for health care.

Table 14: Management levels village wise

	Luhindo (n=16)		Sokoine (n=15)	
Variable	**Frequency**	**Percent**	**Frequency**	**Percent**
Housing				
Good (6.8 - 10)	7	43.8	8	53.3
Medium (3.5 - 6.7)	7	43.8	7	46.7
Low (0 - 3.4)	2	12.4	0	0
Feeds and feeding				
Good (6.8 - 10)	7	43.8	4	26.7
Medium (3.5 - 6.7)	8	50.0	10	66.7
Low (0 - 3.4	1	6.2	1	6.6
Health care				

Good (6.8 - 10)	3	18.7	2	13.3
Medium (3.5 - 6.7)	8	50.0	10	66.7
Low (0 - 3.4)	5	31.3	3	20.0

2.6 DISCUSSION

2.6.1 Management practices

2.6.1.1 Housing

The floors of most poultry houses constructed in rural areas were mainly soil compacted types. Low level of knowledge on poultry production and poverty to most of farmers are reported to be the reason for low standard of poultry house (Kilezu, 2014; Pius and Mbaga, 2018). The heights of the constructed poultry houses to some extent were acceptable with good protection against predators. Many farmers in rural areas use local materials for poultry house construction (Ahuja and Sen, 2007; Tadesse *et al.*, 2013). The results from this study are also in line with previous literature as reported above although the quality of building materials in most of the houses were in fair condition. Ventilation of most of the poultry houses was poor due to houses having small windows or by having windows on one side only thus, limiting cross ventilation. Moreover, ISA (2007) and ROSS (2009) suggested that poultry houses should have open-sided windows to allow the flow of air in and out so as to reduce noxious gas and regulation of environmental temperature.

2.6.1.2 Feeds and feeding

Feeds and feeding management practice were moderate to poor in many households in the study area. Most farmers used homemade feeds, the rest used locally available feeds including maize bran, and house leftovers with unknown quality and quantity (See also Tsadik *et al.*, 2015). The reason for using homemade and local feeds is because of the high cost of commercial feeds as reported by Pius and Mbaga (2018), Goromela *et al.* (2008) and Lyimo (2013). Feed ingredients used by many farmers in feed mixing were maize

bran, sunflower seed cake and fishmeal. In feed supplementary, the study is in agreement with Goromela *et al.* (2008), Guèye (2000), Minh (2005) and Mwalusanya *et al.* (2002) who reported that, chicken kept in rural areas relied on freely available feeds such as food leftovers or kitchen wastes, vegetables, harvest residues and environmental materials such as insects, worms and snails.

Most farmers in rural areas supply feeds and water to the chickens twice per day, that is, early in the morning and in the afternoon or late in the evening. The current results are in agreement with ISA (2008) poultry management guide, that birds should be fed once or twice per day as long as the time of feeding is kept as short as possible to avoid bad behaviours and feed wastage. Farmers also utilized feeders and drinkers whether modern or locally made for feeding and water supply to the chickens, which reduce feed waste and maintain hygiene in the poultry house. The use of such equipment is rare in rural areas and for this study, the motivation came following the training of farmers on necessity of using feeders and drinkers on poultry production provided by ACGG project.

2.6.1.3 Health care

Farmers in both villages have adequate knowledge/awareness on some diseases such as Newcastle, infectious coryza and fowl typhoid but, had low levels of awareness for diseases such as coccidiosis, fowl pox and gumboro (IBD). As also reported by Tadesse *et al.* (2013) and Pius and Mbaga (2018), Newcastle disease is well known by farmers given the high birds' mortality after eruption. It is evident that most of the farmers in the study areas have little knowledge on disease handling procedures and biosecurity issues. Cleanness status, was good around the poultry houses but, fair on feeders, drinkers and feed stores to most farmers. Poultry diseases were treated using different types of medicines according on the type of disease and availability of drugs in the area. Treatment

of some diseases, which are not well known to them, was not carried out. Vaccination and deworming programs were done properly by farmers who were more aware of the impact of the disease on their flocks and they were willing to pay for the costs. As reported by Lyimo (2013) and Pius and Mbaga (2018), poultry deworming program is not commonly practiced by farmers.

2.6.2 Management practices levels

In general, most of the farmers in all management practices i.e. housing, feeds and feeding and health care fall into medium level similar to report by Pius and Mbaga (2018) who conducted a study in the central and southern highlands of Tanzania. However, few of them were in good and low levels in terms of feed and feeding and housing practices respectively while for the health care management practices were medium, low and good level. The difference of levels in health care practices as compared to feeds and feeding and housing practices can be attributed to low understanding of bio-security and other issues related to poultry safety (Pius and Mbaga, 2018). Of the three management practices farmers were relatively better in housing practice followed by feeds and feeding and then health care. On the other hand, village wise, Sokoine village was better in housing and health care management practices while Luhindo village, was better in feeds and feeding management practice. The difference may be contributed by the level of understanding (literacy), income/economy and availability of feeds in the area.

2.7 CONCLUSION

Farmers had low awareness on two management practices, viz Feeds and feeding and health care practices. Due to cost of ingredients most of them use only few locally available feed ingredients to compound feeds. It is further concluded that awareness in disease and disease management was moderate.

2.8 RECOMMENDATION

More training should be provided to farmers mainly on feeds and feeding (Types of feeds and feeding programs) and health care.

2.9 ACKNOWLEDGEMENT

Acknowledgement is made to ACGG Project for financial support, which enabled this research work to be conducted.

REFERENCES

Ahuja, V. and Sen, A. (2007). Scope and space for small-scale poultry production in developing countries. Productivity and Market Success (IPMS) of Ethiopian Farmers Project. Working paper 5. ILRI (International Livestock Research Institute), Nairobi, Kenya. 73pp.

Arbor Acres (2009). Breeder Management Guide. [www.aviagen.com]. Site visited on 19/03/2020.

Dickinson, K. L., Randell, H. F., Kramer, R. A. and Shayo, E. H. (2012). Socio-economic status and malaria-related outcomes in Mvomero District, Tanzania. *Global Public Health* 7(4): 384 - 399.

Goromela, E. H., Kwakke, R. P., Verstegen, M. W. A. and Katule, A. M. (2008). Effect of season and farming system on the quantity and nutritional quality of scavengeable feed resources and performance of village poultry in central Tanzania. *Journal Cell of Animal and Biology* 2(3): 063 - 071.

Guèye, E. F. (2000). The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. *Outlook on Agriculture* 29(2): 129 - 136.

ISA (2007). General Parent stock Management Guide. [www.hendrix-genetics.com]. Site visited on 15/04/2020.

ISA (2008). General management guide for layer parent stock. [www.hendrix-genetics.com]. site visited on 15/04/2020.

Justus, O., Owuor, G. and Bebe, B. O. (2013). Management practices and challenges in smallholder indigenous chicken production in Western Kenya. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 114(1): 51 - 58.

Kayitesi, A. (2015). Management systems and location effects on growth and carcass traits of Kuroiler and local chickens. Doctoral dissertation, Makerere University 127pp.

Khobondo, J. O., Muasya, T. K., Miyumo, S., Okeno, T. O., Wasike, C. B., Mwakubambanya, R. and Kingori, A. K. (2015). Genetic and nutrition development of indigenous chicken in Africa. [Repository.maseno.ac.ke] site visited on 4/9/2020.

Kilezu, P. (2014). Establishment of poultry production for developing a strong and sustainable local market economy of widows in Itonjanda village, Tabora municipality (Doctoral dissertation, The Open University of Tanzania). 79pp. [Repository.out.ac.tz.] Site visited on 19/03/2020.

Kumaresan, A., Bujarbaruah, K. M., Pathak, K. A., Chhetri, B., Ahmed, S. K. and Haunshi, S. (2008). Analysis of a village chicken production system and performance of improved dual purpose chickens under a subtropical hill agro-ecosystem in India. *Tropical Animal Health and Production* 40(6): 395 - 402.

Lyimo, H. E. (2013). *Impact of adoption of improved local chicken production methods in Tanzania: Case study of UMADEP and ILRP SUA projects* Doctoral dissertation, Sokoine University of Agriculture. 198pp.

Mapiye, C., Mwale, M., Mupangwa, J. F., Chimonyo, M., Foti, R. and Mutenje, M. J. (2008). A research review of village chicken production constraints and opportunities in Zimbabwe. *Asian-Australian Journal of Animal Science* 21(11): 1680 - 1688.

Mboera, L. E., Senkoro, K. P., Mayala, B. K., Rumisha, S. F., Rwegoshora, R. T., Mlozi, M. R. and Shayo, E. S. (2010). Spatio-temporal variation in malaria transmission intensity in five agro-ecosystems in Mvomero district, Tanzania, National Institute for Medical Research. 89pp. Suaire.suanet.ac.tz. Site visited on 14/05/2019.

Mbuza, F., Habimana, R., Simbankabo, T. and Majyambere, D. (2016). Characterization of layer poultry production in Rwanda. *International Journal of Agriculture Sciences* 6: 1148 - 1156.

Miao, Z. H., Glatz, P. C. and Ru, Y. J. (2005). Free-range poultry production-A review. *Asian-Australasian Journal of Animal Sciences* 18(1): 113 - 132.

Minh, D. V. (2005). Effect of supplementation, breed, season and location on feed intake and performance of scavenging chickens in Vietnam, Doctoral Thesis, Swedish University of Agricultural Sciences, 101pp.

Mwale, M. and Masika, P. J. (2009). Ethno-veterinary control of parasites, management and role of village chickens in rural households of Centane district in the Eastern Cape, South Africa. *Tropical Animal Health and Production* 41(8): 1685-1693.

Mwalusanya, N. A., Katule, A. M., Mutayoba, S. K., Mtambo, M. M. A., Olsen, J. E. and Minga, U. M. (2002). Productivity of local chickens under village management conditions. *Tropical Animal Health and Production* 34(5): 405 - 416.

Osei-Amponsah, R., Kayang, B. B. and Naazie, A. (2012). Age, genotype and sex effects on growth performance of local chickens kept under improved management in Ghana. *Tropical Animal Health and Production* 44(1): 29 - 34.

Pius, L. O. and Mbaga, S. H. (2018). Variations in village chicken management packages in two agro-ecological zones of Tanzania. *International Journal of Livestock Production* 9(3): 42 - 49.

ROSS, A. (2009). Ross Broiler Management Manual. Scotland, UK. 114 pp.

Tadesse, D., Singh, H., Mengistu, A., Esatu, W. and Dessie, T. (2013). Study on management practices and marketing systems of village chicken in East Shewa, Ethiopia. *African Journal of Agricultural Research* 8(22): 2696-2702.

Tsadik, E.T., Tamir, B. and Sahile, Z. (2015). Characterization of the adoption of village poultry technology package elements, chicken and forms in the Central Oromia Region, *Ethiopia. Journal Economic Sustainable Development* 6(13): 87 - 89.

Tsadik, E. T., Tamir, B. and Sahle, Z. (2016). Characterization of the adoption of village poultry technology packages in the central Oromia Region, Ethiopia. *Journal of Animal Production Advances* 6(3): 907 - 918.

Wang, K. H., Shi, S. R., Dou, T. C. and Sun, H. J. (2009). Effect of a free-range raising system on growth performance, carcass yield and meat quality of slow-growing chicken. *Poultry Science* 88(10): 2219 - 2223.

Yakubu, A. and Madaki, J. (2017). Modelling growth of dual-purpose Sasso hens in the tropics using different algorithms. *Journal of Genetics and Molecular Biology* 1(1): 1 - 9.

CHAPTER THREE

3.0 MANUSCRIPT II

Comparative performance of Sasso and Kuroiler chickens under farmers' management

Lyahama, O.[1,2], Mbaga, S H.[2]

[1,2]TALIRI Kongwa, P O Box 05 Kongwa, Dodoma Region, Tanzania: Email: lyahamao@gmail.com

[2]Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture (SUA), P.O Box 3004, Morogoro

ABSTRACT

This study evaluated on-farm growth performance and mortality rates of Sasso and Kuroiler breeds in two villages namely Luhindo and Sokoine in Mvomero District. Random selection of farmers who were previously trained by ACGG Project on poultry production was done. Thirty-one (31) farmers (16 from Luhindo and 15 Sokoine) were given 18 chickens of one breed each. In Luhindo village, 8 famers received Sasso chickens and the other 8 were given Kuroiler chickens while at Sokoine 8 farmers were given Kuroiler and 7 were given Sasso. Data were collected from 8th up to 20th week after the completion of brooding stage and vaccination programs of for important diseases such as Newcastle, Gumboro (IBD) and Fowl pox. Data on growth performance were collected after every four weeks while data related to mortality were collected when it occurred. Data were analysed using GLM procedure of SAS program for growth data and Chi-square for mortality using FREQ procedure. The average growth rate was (13.8±0.4g/d) and (10.2±0.4g/d) for Kuroiler and Sasso respectively. The average 20-week old body weight of chickens at Luhindo village were better ($P<0.05$) (1895.4±54.3g) compared to

those of the same age at Sokoine village (1717.2±60.5g). In terms of breed, Kuroilers were heavier (1937.2±60.4g) than Sasso (1687.4±54.5g). Management practices levels significantly ($P<0.05$) influenced the 12^{th}, 16^{th} and 20^{th} week weights. The overall mortality rates in both villages for the period of this study was 18.8 percent, and that was mainly 90.5 percent caused by diseases. Major diseases causing mortalities included infectious coryza, fowl typhoid and coccidiosis. Other causes were worm infestations, snakebite, and predators. Optimum growth performance of chickens under village condition can be achieved if farmers adopt good level of management in terms of feeds and feeding practice and medium or good level for housing and health care practices. Management practices significantly ($P<0.05$) affected mortality rates ($\chi^2= 7.3703$). There were no significant effects of management on the mortalities to breeds ($\chi^2= 0.7897$) and villages ($\chi^2= 0.0073$). There was strong correlation observed between feeding practices and growth performance (r= 0 .893).

Key words: Growth performance, Mortality rate, Kuroiler, Sasso

3.1 INTRODUCTION

The growth performance of chickens can be determined within the first 10 weeks of growth (ISA, 2007). Such performance is influenced mainly by quality, quantity of feed, and management (Sanka *et al*., 2020; Justus *et al*., 2013; Minh, 2005). Likewise, growth performance and survival of chicken may vary according to breed, environment and rearing system (Guni *et al.*, 2021; Sanka *et al.*, 2020; Cheng and Muir, 2005; Minh, 2005; Yakubu and Ari, 2018). Furthermore, according to the literature performance of birds apart from feed, management and rearing system in a certain environment can be determined by the genetic potential of the individual breed as well as sex of the birds (Kayitesi, (2015); Osei-Amponsah *et al.*, 2012; Yakubu and Ari, 2018).

Some reports have indicated that improved chicken such as Sasso and Kuroiler perform better compared to local chickens and yet they are able to adapt to environmental conditions as local chickens (Osei-Amponsah *et al.,* 2012; Yakubu and Ari, 2018). Normally, Kuroiler attain weight of 3500g and 2500g for males and females respectively and lay 150-250 eggs during their 12 to 16 months egg-laying period (Ahuja *et al*., 2008; Isenberg, 2008; Sharma *et al.,* 2015) and body weight of Sasso can reach up to 3192g for males and 2635g for females and lay 195-280 eggs per year (Getiso *et al.*, 2017; Osei-Amponsah *et al.*, 2012) while mature local chicken in Tanzania have mean live weights of 1948g and 1348g for cocks and hens respectively (Mwalusanya *et al*., 2002) and lay 50-150 eggs per year (Katule, 1998). However, other literatures show that Kuroiler is superior to Sasso in growth performance (Yakubu and Ari, 2018).

Scavenging birds have been reported to exhibit high mortality rates compared to semi-intensive systems due to diseases and predation (Justus *et al*., 2013; Miao *et al*., 2005). Furthermore, Miao *et al*. (2005) reported that mortality to most of scavenging chickens in some areas was caused by worm infestations. Poor health management has also been associated with disease eruption causing high mortality (Mbuza *et al*., 2016). Likewise, environmental factors such as poor ventilation, high stocking density, high temperatures, lack of water and feed were also reported to be the causes of mortality apart from diseases (Arbor Acres; 2009 and Tsadik *et al*., 2015). Sonaiya and Swan (2004) reported that mortality may only be reduced if farmers have good understanding on health care and disease control. This implies that for successful poultry production it requires addressing management factors such as diseases, feeds, worm and environmental conditions (Minh, 2005; Mbuza *et al*., 2016; Sonaiya and Swan, 2004). The objective of this study was to compare the growth performance and mortality rates of Sasso and Kuroiler chickens raised under farmers' management conditions.

3.2 MATERIALS AND METHODS

3.2.1 Description of the study areas

This study was conducted in Mvomero District, Morogoro region, Tanzania. The district is between 293 and 379m above the sea level and lies at 6° 14' 8.2212" S and 38° 41' 37.4928" E (Mboera *et al*., 2010). The average annual rainfall is 975 mm while the average annual temperature is 25.0 °C. The main economic activities undertaken by many people in this area is agriculture, whereby more than 97 percent of the people are involved in crop and livestock keeping (Dickinson *et al*., 2012).

3.2.2 Sampling and sample size

The study was conducted in two villages namely Luhindo and Sokoine in Mvomero District. Having chickens and knowledge on poultry keeping were the inclusion criteria for the recruited households. Thirty-one farmer were purposively selected for the study. A total of 558 chickens of 7 week of age were distributed to the selected farmers in the study area. Each farmer was given 18 chickens whereby eight (8) farmers in Luhindo village were given Kuroiler and the other 8 farmers were given Sasso while eight (8) farmers inSokoine were given Kuroiler and 7 farmers were given Sasso chickens at random.

3.2.3 Growth performance and mortality rate

Data on poultry growth performance and mortality rate were collected on-farm during growing period from 8^{th} to 20^{th} week. Sasso and Kuroiler chicks were first brooded and reared at Sokoine University of Agriculture for 7 weeks prior distribution to the farmers. This was done to ensure that chicks were strong and could cope with village situation before distribution. During brooding, chicks were vaccinated against important diseases such as Newcastle, Gumboro and Fowl pox. Chicks were wing-tagged before distribution and in total there were 200 males and 358 females. Data on growth performance was

collected after every 4 weeks beginning week 8 and ended on the 20th week by using digital weighing scale while, data on mortality were recorded once it occurred through a well-designed form. Trained expert on poultry production from ACGG Project together with farmers were able to identify the cause of mortality to the chickens.

Growth and mortality rates were calculated using the following formula

- **Growth rate** (g/d) = Final weight (W2) – Initial weight (W1)/Time
- **Mortality rate** (%) = $\frac{\text{Total no. of chicken died}}{\text{Initial no.of chikens}} \times 100$

3.2.4 Optimum growth performance of chickens

Body weight of chickens at 20 weeks was categorized into three groups-; Large (>2100g), medium (1600g – 2100g) and small (< 1600g). Management practices of farmers having chickens with large weight group was then corroborated with the level of management in household. Levels of management practices used in corroboration with farmers having chickens with large weight in determination of optimum growth performance were low, medium and good level. Correlation analysis was done to determine the degree of association between body weights and management practices.

3.3 Data Analysis

Data for growth performance (body weights) and mortality rate were analysed by using GLM procedure of SAS program version 20 and Chi-Square through FREQ procedure respectively. SPSS software was used to determine the correlation between management practice levels and growth performance. Also 6th week weights were used as covariate (control/predictor) due to the reason that, chickens were reared on-station under good

management instead of 8th week which was already subjected to the farmers' management. The data for growth performance were subjected to the following model.

Model - $Y_{ijklm} = \mu + M_i + B_j + V_k + S_l + b(x_{ijkl} - \bar{x}) + eijklm$

Y_{ijklm} = Birds growth performance

μ = General mean

M_i = Effect associated to i^{th} management practices

B_j = Effect due to j^{th} breed

V_k= Effect associated with k^{th} location/village

S_l= Effect due to l^{th} sex

b ($x_{ijkl} - \bar{x}$) = Covariate (6^{th} week body wt)

eijklm = Random error

b = Regression coefficient of body weight /body weight gain on initial body weight

x_{ijkl} = Individual weight

$\bar{x}$ = Mean weight

3.4 Results

3.4.1 Growth performance

Growth performance results of both breeds between week 8 to 20 according to village, sex, breed and management practices are presented in Table 1, 2, 3 and 4 respectively while the performance of growth rate indicated in Table 5.

3.4.1.1 Growth performance according to village

There were no significant differences ($p>0.05$) between villages in body weights of the two breeds at 8^{th}, 12^{th} and 16^{th} week. At the age of 20 weeks birds raised at Luhindo village had significantly ($p<0.01$) higher body weights (1895.4±54.3g) than those at Sokoine village (1717.2±60.5g) as shown in Table 1.

Table 1: LS Means ±se for body weights (g) at different ages at Luhindo and Sokoine village

Village	6th WK	8th WK	12th WK	16th WK	20thWK
LU	552.4±7.3[a]	740.3±27.7	1042.7±23.7	1340.6±39.5	1895.4±54.3[a]
SO	567.9±8.5[b]	749.6±31.9	1014.9±25.5	1324.8±44.5	1717.2±60.5[b]
P –value	0.0244	0.7146	0.1731	0.6408	0.0002

WK = Week, LU = Luhindo and SO = Sokoine

ab =means with different superscript letters within a column are significantly different ($p<0.05$)

3.4.1.2 Growth performance according to sex

As it is indicated in Table 2, the results show that male chickens were heavier at all ages than female chickens.

Table 2: LS Means ±se for body weights (g) of sex

Sex	6th WK	8th WK	12th WK	16th WK	20th WK
F	531.3±7.8[a]	690.8±29.4[a]	979.7±24.9[a]	1264.1±41.8[a]	1699.9±56.9[a]
M	589.0±8.0[b]	799.2±30.1[b]	1077.9±25.5[b]	1401.4±42.2[b]	1912.7±57.7[b]
P –value	0.0001	0.0001	0.0001	0.0001	0.0001

WK = Week, F = Females and M = Males

ab =means with different superscript letters within a column are significantly different ($p<0.05$)

3.4.1.3 Breed growth performance

Kuroiler chickens significantly outperformed Sasso ($p<0.05$) at 8th, 16th and 20th week in terms of body weight as shown in Table 3.

Table 3: LS Means ±se for body weights (g) of breeds (Kuroiler+Sasso)

Breed	6th WK	8th WK	12th WK	16th WK	20th WK
KR	592.3±8.5[a]	783.9±31.7[a]	1095.0±26.7	1411.2±44.3[a]	1937.2±60.4[a]
G/rate(g/d)		13.8	11.1	11.3	18.8
SA	588.1±7.8[b]	703.1±27.9[b]	997.5±23.9	1261.2±39.8[b]	1687.4±54.5[b]
G/rate(g/d)		8.2	10.5	9.4	15.2
P-value	0.0001	0.0026	0.5437	0.0325	0.0006

WK = Week, KR = Kuroiler and SA = Sasso

ab =means with different superscript letters within a column are significantly different (p<0.05)

3.4.1.4 Growth performance according to management levels

Management practice levels significantly (P<0.05) influenced growth performance. Table 5, results show that good level of management was associated with better growth performance compared to medium level and low level except at 8th week of age.

Table 4: LS Means ±se for body weights (g) at different management level

Mgnt	6th WK	8th WK	12th WK	16th WK	20th WK
Good	565.5±8.4	742.8±31.5	1113.4±24.3[a]	1462.7±40.1[a]	2086.3±57.2[a]
Medium	565.8 ±3.8	723.4±14.0	1039.4±11.3[b]	1333.2 ±18.7[b]	1805.2 ±25.8[b]
Low	549.2±19.3	768.7±72.9	933.5 ±63.9[c]	1202.2±106.7[c]	1527.4±144.9[c]
P –value	0.7014	0.7357	0.0038	0.0049	0.0001

WK = Week, Mgnt = Management
abc =means with different superscript letters within a column are significant different (p<0.05)

3.4.1.5 Growth rates of Kuroiler and Sasso

There was significance difference in growth rates (p<0.05) between Kuroiler (13.8±0.4g/d) and Sasso (10.2±0.4g/d) during the period of study (Table 5). This shows that Kuroiler chickens outperformed Sasso in growth rates for 3.6g/d.

Table 5: LS Means ±se for growth rates (g/d) of breeds (Kuroiler+Sasso)

Breed	Growth rate
KR	13.8±0.4[a]
SA	10.2±0.4[b]
P-value	0.0001

WK = Week, KR = Kuroiler and SA = Sasso
ab =means with different superscript letters within a column are significantly different (p<0.05)

3.4.2 Mortality rate

Results on mortality are summarized in Table 6, 7, and 8. The overall mortality rate of these in both villages starting from 8th week up to 20th week was 18.8%.

Mortality rate (%) = $\frac{105}{558} \times 100$ = 18.8%

3.4.2.1 Mortality in relation to managements, breed, village and sex

The data of mortality were analysed and interpreted by using χ^2 and the results are summarized in Table 6. There was no significant ($p>0.05$) difference in mortalities between breeds ($\chi^2= 0.7897$), villages ($\chi^2= 0.0073$) as well as sex ($\chi^2= 9.0095$; $p=0.5312$) while management practices level had significant ($p<0.05$) influence on mortalities ($\chi^2= 7.3703$).

Table 6: Mortality rates by breed, village, sex and management level

Class	No of chickens	No. died	Mortality rate (%)	χ^2	p. value
Overall	558	105	18.8	-	-
Breed					
KR	279	42	15.2	0.7897	0.3742
SA	279	63	22.7		
Village					
LU	288	65	22.8	0.0073	0.9317
SO	270	40	14.9		
Sex					
M	200	40	20.0	9.0095	0.5312
F	358	65	18.2		
Management level					
High	90	15	16.9	7.3703	0.0251
Medium	450	83	18.6		
Low	18	7	38.9		

3.4.2.2 Causes of mortality

Most of the deaths were associated with diseases as indicated in Table 7. Of the diseases mentioned by farmers, infectious coryza (51.6%) ranked highest followed by fowl typhoid (36.8%) and coccidiosis (11.6%). Other causes were worm infections (50%), snake bite (30%) and predators (20%).

Table 7: Causes of mortality (n=105)

Cause of death	Frequency	Percent
Diseases	95	90.5
Other causes	10	9.5

Table 8: Mortality due to diseases and other causes

Diseases	Frequency	Percent
Mortality caused by diseases		
Coccidiosis	11	11.6
Fowl typhoid	35	36.8
Infectious coryza	49	51.6
Other causes of death (n=10)		
Snake bite	3	30
Predators	2	20
Worm infestations	5	50

3.4.2.3 Levels of management practices for optimum growth performance

Results from management practices data of farmers having chickens with large weight used for determination of optimum growth performance of chickens in relation to management factors, presented in Table 9 and 10. Out of 31 farmers in the study area only 6 (19.3%) fell into heavy weight as shown in Table 9. According to this study for the case of feeds and feeding practice 83.3 percent of farmers were in good level and the rest were in medium level while for housing and health care practices were 50% - good level and also 50% - medium level in each practice.

Table 9: Category of weights of chickens in households (n=31)

Weight category	Frequency	Percent
Large (>2100g)	6	19.3
Medium (1600g – 2100g)	15	48.4
Small (< 1600g)	10	32.3

Table 10: Levels of management practices for optimum growth performance (n=6)

Weight category viz management level	Frequency	Percent
Housing		
Good (6.8 - 10)	3	50
Medium (3.5 - 6.7)	3	50
Feed and feeding		
Good (6.8 - 10)	5	83.3
Medium (3.5 - 6.7)	1	16.7
Health care		
Good (6.8 - 10)	3	50
Medium (3.5 - 6.7)	3	50

3.4.3 Correlation between growth performance and management practices

Results of correlation analysis between growth performance and management practices show that there is positive correlation between growth performance and management practices as presented in Table 11. In general high correlation was obtained between growth performance and feeds and feeding (r =0.893) followed by growth performance and health care (r =0.274) and lowest was between growth performance and housing (r = 0.093).

Table 11: Pearson Correlation between growth and management practices

	Growth performance	Housing	Feeds and Feeding	Health Care
Growth Performance	1.00	0.093	0.893	0.274

3.5 DISCUSSION

3.5.1 Growth performance

Growth performance of chickens at 8th week in Sokoine village were better compared to Luhindo village although the difference was not significant. The performance in this week cannot be taken into consideration in comparison between these villages because the chicks were just distributed. Higher bird's performance at 12th 16th and 20th week at Luhindo village in both breeds compared to Sokoine could only be explained by difference in management especially feeds and feeding since the two villages are in the same agro ecological zone.

Regarding sex difference, the results conform to other published data whereby male chickens had higher growth performance compared to female chickens, due to either sex dimorphism or hormonal difference which lead into higher muscle development in males compared to females (Semakula *et al.*, 2011; Kayitesi, 2015; Yakubu and Ari, 2018).

Body weights for Kuroiler in the current study were also lower than those reported by Dessie (2018) and Pius and Mbaga (2018). The difference was that Dessie (2018) results were from on-station where many variables were controlled. In this regard, feed quality and quantity has also been reported to be a cause for variation of growth performance of chickens (Sanka *et al.*, 2020; Justus *et al.*, 2013; Larivière *et al.*, 2009; Minh, 2005). Comparison between the two breeds showed that Kuroiler had significantly ($p<0.05$)

higher body weights at 8th, 16th and 20th week than Sasso. Findings from current study are also supported by Dessie (2018) who reported that in Ethiopia and Tanzania to large extent Kuroiler breed had better performance than Sasso. Also, this study is in agreement with Yakubu and Ari (2018) but, in contrast to Pius and Mbaga (2018) who reported that Sasso breed had better growth performance compared to Kuroiler. Differences in performance could be explained by genetic make-up and adaptability to environmental condition (Yakubu and Ari, 2018).

Management practices had an influence on chickens' growth performance in both breeds. The absence of difference at week 8 was that birds were just introduced to the farmers. Subsequently, however adjustment or improvement of these management practices not all had the same effects. This also agreed by Justus *et al*. (2013) who reported that improvement of feed and feeding management practice had higher effect on poultry performance than housing.

The average growth rate of the breeds under village condition for 20 weeks were 13.8±0.4g/d and 10.2±0.4g/d for Kuroiler and Sasso respectively. The growth rates indicate that, there was significant ($p<0.05$) difference between the breeds. For Kuroiler , the observed growth rates is in agreement with Kayitesi (2015) who reported thatthe growth rates of 15.2g/d from 16th to 20th week .

3.5.2 Mortality rate

There were no significant differences of mortality rates on breeds, although the minor difference showed that, Sasso had higher mortality rates compared to Kuroiler. This finding is in agreement with Dessie (2018), who conducted on-station study where Sasso and Kuroiler were compared and showed that Sasso had higher mortality (30 – 60%) than

Kuroiler (10 – 25%). Mortality rate also appeared to be not significant ($p<0.05$) different between villages ($\chi^2= 0.7897$) probably due to project interventions especially on disease management. Sex showed to have no direct relation on mortality rates of the chickens in the study area. But management levels relate significantly with mortality rate ($\chi^2= 7.3703$) as also reported by Sharma *et al*. (2015).

The study revealed that the overall mortality rate for both breeds was 18.8% where by 90.5% were contributed by diseases and 9.5% from other causes. Getiso *et al*. (2017), Justus *et al.* (2013), Miao *et al.* (2005) and Kayitesi (2015) reported that diseases are the main cause of poultry mortality especially Newcastle. In contrast to findings reported by other literature, for this study the leading disease to cause mortality was Infectious coryza followed by Fowl typhoid and then Coccidiosis. Newcastle did not appear in this study to be a major cause of mortality, since birds were vaccinated before and after delivery to farmers.

Apart from diseases other cause of mortality were worm infestations, snake bite and predators. The study is in agreement with Miao *et al*. (2005) who conducted research in England and Wales for endo parasites and found 43% of flocks at 20 weeks of age were affected by worms. A large number of farmers in rural areas are not aware of deworming program of chickens that is why 50% of the mortality originated from other cause were worm infestations. Also, Getiso *et al*. (2017) and Justus *et al.* (2013) reported that apart from disease, mortality can be caused by predators.

3.5.3 Levels for optimum growth performance of the chickens

It is well known that chicken performance depends on different factors like management system, type and quality of feed and even health programs (Pius and Mbaga, 2018; Yegani

and Korver, 2008). In overall management practices for both villages, farmers were in medium level. However, six (6) farmers among of them had chickens having large weight in which management practices were characterised to obtain their levels of management for determination of optimum growth performance. Large number (5) of farmers fell into good level and only one were in medium level in case of feeds and feeding. This finding is supported by Yegani and Korver (2008) who reported on advantage of good feed and feeding practice on poultry performance. Apart from feeds and feeding practices, in both housing and health care management practices were of acceptable levels for the majority of households.

3.5.4 Correlation between growth performance and management practices

There was positive correlation between growth performance and management practices which indicates that improvement of one of the management practices affects positively the performance of chickens. These findings agree to ISA (2007) and ROSS (2009) who explained on importance of good management like feeds and feeding, housing and health programs on poultry performance in all three stages namely, brooding, growing and production.

Correction between growth performances and feeds and feeding was high (r= 0 .893) compared to growth performance and health care (r= 0.274) as well as growth performance and housing (r= 0.093). This also is in agreement with Yakubu and Madaki (2017) who reported that best feeding practices led into better performance of the birds.

3.6 CONCLUSION

Management practices especially feeds and feeding have significant effect on poultry growth performance compared to health care and housing. These two practices had little influence on mortality, as long as basic care such as vaccination are adhered to. Kuroiler

outperformed Sasso in growth performance under normal village conditions indicating that the breed is better adapted to low input- semi scavenging environment.

3.7 RECOMMENDATION

More study needs to be conducted on evaluation of growth performance of these two breeds in relation to type of feeds, feed quality and feeding standards/quantity of feed given per bird age wise in different areas especially in rural households.

3.8 ACKNOWLEDGEMENTS

Acknowledgement is made to ACGG Project for financial support which enabled this research work to be conducted successfully.

REFERENCES

Ahuja, V., Dhawan, M., Punjabi, M. and Maarse, L. (2008). Poultry based livelihoods of rural poor: Case of Kuroiler in West Bengal. South Asia Pro Poor Livestock Policy Programme, initiative of NDDB and FAO: Document 12pp.

Arbor Acres (2009). Breeder Management Guide. [www.aviagen.com]. Site visited on 19/03/2020.

Cheng, H. and Muir, W. M. (2005). The effects of genetic selection for survivability and productivity on chicken physiological homeostasis. *World's Poultry Science Journal* 61(3): 383 - 397.

Dessie, T. (2018). Progress narrative report: African Chicken Genetic Gains program. International Livestock Research Institute (ILRI), ACGG BNGF report February 2017 – December 2017.

Dickinson, K. L., Randell, H. F., Kramer, R. A. and Shayo, E. H. (2012). Socio-economic status and malaria-related outcomes in Mvomero District, Tanzania. *Global Public Health* 7(4): 384 - 399.

Getiso, A., Bekele, B., Zeleke, B., Gebriel, D., Tadesse, A., Abreham, E. and Jemal, H. (2017). Production performance of Sasso (distributed by ethio-chicken private poultry farms) and Bovans brown chickens breed under village production system in three agro-ecologies of Southern Nations, Nationalities and Peoples Regional State (SNNPR), Ethiopia. *International Journal of Livestock Production* 8(9): 145 - 157.

Guni, F. S., Mbaga, S. H., Katule, A. M. and Goromela, E. H. (2021). Performance evaluation of Kuroiler and Sasso chicken breeds reared under farmer management conditions in highland and lowland areas of Mvomero district, Eastern Tanzania. *Tropical Animal Health and Production* 53(2): 1 - 8.

ISA (2007). General Parent stock Management Guide. [www.hendrix-genetics.com]. Site visited on 15/04/202.

Isenberg, D. (2008). Kegg farms (India)-Which came first, the Kuroiler or the Kegg. *Product Code* 3: 9 - 807.

Justus, O., Owuor, G. and Bebe, B. O. (2013). Management practices and challenges in smallholder indigenous chicken production in Western Kenya. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 114(1): 51-58.

Katule, A. M. (1998). Study on the productivity of indigenous chicken under village management conditions. Proceedings of the 25th Scientific Conference, AICC – Arusha. TSAP Conferences Series 25: 48-54pp.

Kayitesi, A. (2015). Management systems and location effects on growth and carcass traits of Kuroiler and local chickens Doctoral dissertation, Maker ere University. 127pp.

Larivière, J. M., Vandenheede, M. and Leroy, P. (2009). Effects of food restriction on rearing performance and welfare of a slow-growing chicken breed: a behavioural approach. *International Journal of Poultry Science* 8(7): 684 - 688.

Mboera, L. E., Senkoro, K. P., Mayala, B. K., Rumisha, S. F., Rwegoshora, R. T., Mlozi, M. R. and Shayo, E. S. (2010). Spatio-temporal variation in malaria transmission intensity in five agro-ecosystems in Mvomero district, Tanzania, National Institute for Medical Research. 89pp. [Suaire.suanet.ac.tz]. Site visited on 14/05/2019.

Mbuza, F., Habimana, R., Simbankabo, T. and Majyambere, D. (2016). Characterization of layer poultry production in Rwanda. *International Journal of Agriculture Sciences* 6: 1148 - 1156.

Miao, Z. H., Glatz, P. C. and Ru, Y. J. (2005). Free-range poultry production-A review. *Asian-Australasian Journal of Animal Sciences* 18(1): 113 - 132.

Minh, D. V. (2005). Effect of supplementation, breed, season and location on feed intake and performance of scavenging chickens in Vietnam, *Doctoral Thesis, Swedish University of Agricultural Sciences* 101pp.

Mwalusanya, N. A., Katule, A. M., Mutayoba, S. K., Mtambo, M. M. A., Olsen, J. E. and Minga, U. M. (2002). Productivity of local chickens under village management conditions. *Tropical Animal Health and Production* 34(5): 405 - 416.

Osei-Amponsah, R., Kayang, B. B. and Naazie, A. (2012). Age, genotype and sex effects on growth performance of local chickens kept under improved management in Ghana. *Tropical Animal Health and Production* 44(1): 29 - 34.

Pius, L. O. and Mbaga, S. H. (2018). Variations in village chicken management packages in two agro-ecological zones of Tanzania. *International Journal of Livestock Production* 9(3): 42 - 49.

ROSS, A. Broiler Management Manual. *Scotland, UK: Aviagem*. 1 - 114 pp.

Sanka, Y. D., Mbaga, S. H., Mutayoba, S. K., Katule, A. M. and Goromela, S. H. (2020). Evaluation of growth performance of Sasso and Kuroiler chickens fed three diets at varying levels of supplementation under semi-intensive system of production in Tanzania. *Tropical Animal Health and Production* 52(6): 3315 - 3322.

Semakula, J., Lusembo, P., Kugonza, D. R., Mutetikka, D., Ssennyonjo, J. and Mwesigwa, M. (2011). Estimation of live body weight using zoometrical measurements for improved marketing of indigenous chicken in the Lake Victoria basin of Uganda. *Livestock Research for Rural Development* 23: 170. [http://www.lrrd.org/lrrd23/8/sema23170.htm]. Site visited on 2/7/2020.

Sharma, J., Xie, J., Boggess, M., Galukande, E., Semambo, D. and Sharma, S. (2015). Higher weight gain by Kuroiler chickens than indigenous chickens raised under scavenging conditions by rural households in Uganda. *Livestock Research for Rural Development* 27(9): 1- 4.

Sonaiya, E. B. and Swan, S. (2004). Small-scale poultry production: technical guide. FAO animal production and health. 23-65pp.

Tsadik, E.T., Tamir, B. and Sahile, Z. (2015). Characterization of the adoption of village poultry technology package elements, chicken and forms in the Central Oromia Region, *Ethiopia. Journal Economic Sustainable Development* 6(13): 87 - 89.

Yakubu, A. and Ari, M. M. (2018). Principal component and discriminant analyses of body weight and conformation traits of Sasso, Kuroiler and indigenous Fulani chickens in Nigeria. *Journal of Animal and Plant Sciences* 28(1): 46 - 55.

Yakubu, A. and Madaki, J. (2017). Modelling growth of dual-purpose Sasso hens in the tropics using different algorithms. *Journal of Genetics and Molecular Biology* 1(1): 1 - 9.

Yegani, M. and Korver, D. R. (2008). Factors affecting intestinal health in poultry. *Poultry Science* 87(10): 2052 - 2063.

CHAPTER FOUR

4.0 GENERAL DISCUSSION

Development of poultry subsector in Tanzania depends on production performance of birds especially chickens. However, good production performance of chickens contributed by different factors such as housing, feeds and feeding and health care as also reported by (Khobondo *et al*., 2015; Osei-Amponsah *et al*., 2012; Minh, 2005; Yakubu and Madaki (2017). Although genetic and environmental factor are also reported to affect poultry production in one way or another (Yakubu and Ari, 2018).

On-farm evaluation of production performance of Sasso and Kuroiler chickens in Mvomero district showed that, level of management practices differs depending on knowledge and economy of the farmers. Majority of farmers performed better on housing practice compared to feeds and feeding and health care. Many poultry houses were made by compacted soil floor and strong walls with fair condition in quality of building materials which prevents chickens from predators. Most of poultry house in the villages are constructed by using locally available materials and majority (64.5%) of farmers used homemade feeds. As reported by Pius and Mbaga (2018); Goromela *et al*. (2008) and Lyimo (2013) high feed cost were the major constraint in the use of commercial feed by most famers. Maize bran, sunflower seed cake and fishmeal were the most used feed ingredients in feed compounding.

Farmers have some knowledge of poultry diseases and were able to identify at least six diseases. These were New castle, Infectious coryza, Fowl typhoid coccidiosis, fowl pox and gumboro (IBD). Newcastle disease is well known by farmers given the high birds'

mortality after eruption (Tadesse *et al.*, 2013 and Pius and Mbaga, 2018). Moreover, hygienically, the poultry premises including feeding equipment (feeders and drinkers) and feed stores scored either good or fair. Poultry diseases were treated using different types of drugs according on the type of disease and availability of drugs in the area. However, deworming is not commonly practiced by farmers while vaccination done to those who knows the advantage.

Management practices in both villages fall into medium level similar to Pius and Mbaga (2018) reported from central and southern highlands of Tanzania, followed by good and low levels. By comparing the three practices, housing was better compared to feeds and feeding and health care. Although village-wise Sokoine had higher score compared to Luhindo village. In consideration to each management practice, Sokoine had higher score on housing and health care while Luhindo scored higher on feeds and feeding (Table 14).

The growth performance of chickens in these villages were significant difference ($p<0.05$) in the week 20, whereas Luhindo had better (1895.4±54.3g) performance compared to Sokoine (1717.2±60.5g). This difference could be attributed to difference in scavengable feed availability. Higher body weight of Kuroiler chickens than Sasso indicates genetic differences in adaptability since they were in the same agro ecological zone. Improved management in terms of feeding, housing and health care resulted in better growth performance. Likewise Kuroiler performed better than Sasso on growth performance indicating that under farmers' management conditions in rural areas Kuroiler chickens are better than Sasso.

Neither breed, sex nor villages which showed significant ($p<0.05$) difference in mortality rate of the chickens during the study period. This study showed that mortality was high under poor level of management followed by medium and then good level. Overall mortality rate for both breeds was 18.8% where by 90.5% were contributed by diseases and 9.5% from other causes while in village chicken Newcastle is a major cause of mortality, for this study most death were caused by infectious coryza.

Good performance in terms of body weight gain were obtained when the three elements vis. feeding, housing and health were optimised. Analysis showed that, all management practices correlated positively with growth performance of chicken although the level of correlation depends upon the component studied. Whereby higher value was obtained between growth performances and feeds and feeding ($r= 0\ .893$). This means that more attention should be put on proper feeding but not forgetting prevention of disease outbreaks.

CHAPTER FIVE

5.0 GENERAL CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

Farmers had low awareness on two management practices; Feeds and feeding and health care practices.

i. Generally, the management status of poultry in both villages fell under medium level.
ii. Management practices especially feeds and feeding had high effect on poultry growth performance compared to health care and housing.
iii. Under normal village condition with different feeds available in rural areas Kuroiler breed performed better compared to Sasso.

5.2 Recommendation

i. More training to be conducted to the farmers mainly on feeds and feeding practice as well as health care especially on disease management.

APPENDICES

Appendix 1: Questionnaire used in assessment of management practices

PART "A" DISEASE AWARENESS

1. Farmers name…….…….... Village …….……Breed of chicken ……....

2. Do you know poultry diseases? NO ( ) YES ( )

3. IF YES a) Mention diseases you know and its signs if possible

i) …… ii) ……. iii) …….. iv)……. v) ……

4. Which kind of diseases are common in your area?

i) …… ii) ……. iii) ……..... iv)…….. v) …….

5. How many times do this disease occur per year? Mention diseases and frequencies of occurrence

Disease		Occurred any time per year
i)	……..	a. once ( ) b. twice ( ) c. three times ( )
ii)	……..	a. once ( ) b. twice ( ) c. three times ( )
iii)	……..	a. once ( ) b. twice ( ) c. three times ( )
iv)	……..	a. once ( ) b. twice ( ) c. three times ( )
v)	……..	a. once ( ) b. twice ( )c. three times ( )

6. Do you know how to handle diseased chicken? YES ( ), NO ( )

If YES how do you handle them? ……

7. Do you know how to treat chickens if disease occurred/errupt? YES ( ), NO ( )

If YES, you have treated your chicken against which kind of disease …… and what medicine used …….

8. Do you know how to vaccinate chickens against diseases? YES ( ), NO ( )

If YES, which diseases, mention disease and frequency of vaccination program

Disease	Vaccination program per year
vi) ……..	a. once ( ) b. twice ( ) c. three times ( )
vii) ……..	a. once ( ) b. twice ( ) c. three times ( )
viii) ……..	a. once ( ) b. twice ( ) c. three times ( )
ix) ……..	a. once ( ) b. twice ( ) c. three times ( )
x) ……..	a. once ( ) b. twice ( )c. three times ( )

9. Is there any deworming program done to your chickens? YES ( ), NO ( )

If YES how many times per year …… and which drugs is used.....

PART "B" FORM USED FOR ASSESSMENT OF MANAGEMENT PRACTICE

Name of farmer ……. Village ……. Breed of chicken …… HOUSING		
Parameters	Points	Score
1. Floor status		
a. type of floor i. Concrete floor ii. Earth floor	1	
b. Presence of litter material i. Present and clean ( ) ii. Present but dirty ( ) iii. Absent ( )	2	
2. Wall status	2	

a. Height i. Good (2.5m) ( ) ii. Fair (1.5 – 2m) ( ) iii. Poor (below 1m) ( )		
b. Protection (Against other animals and Water proof) i. Good ( ) ii. Fair ( ) iii. Poor ( )	1	
c. Building materials quality i. Good ( ) ii. Fair ( ) iii. Bad ( )	1	
3. Ventilation i. Good ( ) ii. Moderate ( ) iii. Poor ( )	2	
FEEDS AND FEEDING		
1. Types of feed a. Commercial feeds b. Home made c. Local feeds	3	
2. Feeding frequencies a. Once per day ( ) b. Twice per day ( )	2	

c. Three times per day ( )		
3. Water supply frequencies a. Once per day ( ) b. Twice per day ( ) c. Three times per day ( )	2	
4. Feeders and drinkers a. Present b. Present but local c. Absent	3	
Health care		
1. Bio security a. Sick bird isolation room/area i. Present ( ) ii. Present but it is in bad condition ( ) iii. Absent ( )	4	
b. Cleanness and hygiene i. Around poultry house Good ( ), Fair ( ), Poor ( ) ii. Drinkers and Feeders Good ( ), Fair ( ), Poor ( ) iii. Feed store Good ( ), Poor ( ), Fair ( )	6	

Appendix 2: Form used for assessment of chicken performance (growth performance and mortality)

PART "A" GROWTH PERFORMANCE

Name of Farmer …….. Village ……. Breed …….			
S/N	Chicken reg. no	Age (week)	Weight
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

PART "B" FORM USED FOR MORTALITY DATA COLLECTION

Name of Farmer …….. Village …….

Breed ……. Initial no. of birds ……

Tag. No.	Date of death	Age (week) of death	Sex		Village		Total	Cause/Symptoms
			M	F	LU	SO		
Total								