DOI: 10.1017/S0043933907001493

Regional Report

Village chicken production in Myanmar – purpose, magnitude and major constraints

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The main objective of this work was to describe the characteristics of and major constraints to village chicken production in Myanmar. Data on village chicken production, health, husbandry and marketing were collected in 296 households in 10 villages in the Yangon division of Myanmar in November 2003. The average flock size in the study area was about 30 birds, comprising 12 chicks, 12 growers, 4 hens and 2 cocks. Disease as a cause of mortality was more prominent in growers and adults, while predation and exposure to unfavourable environmental conditions were major causes of mortality in chicks. The main predators identified were: birds, rats, snakes, dogs and cats in 32, 31, 17, 15 and 3% of households respectively. Two main strategies were identified to improve village chicken production: vaccination as a means of protecting birds against Newcastle disease and confinement rearing and supplementary feeding of chicks, as a means of reducing the attrition rate of young chicks. This is the first survey conducted describing village chicken population structure and productivity in Myanmar.

Keywords: village chickens; scavenging; Myanmar; Newcastle disease

Introduction

The rural population of Myanmar comprises 75% of the country's total population (United Nations Development Programm, 2006) and chickens are kept by the large majority of rural families. According to a census in 2003, a total of 84% of Myanmar's total chicken population were kept under scavenging conditions in villages (59.6 million), while only

World's Poultry Science Journal, Vol. 63, June 2007
Received for publication July 27, 2006
Accepted for publication August 29, 2006

12% were commercial layers (8.7 million) and 4% (2.9 million) commercial broilers (Figures from Myanmar Livestock, Breeding and Veterinary Department).

Prior to this study, there was limited information on constraints to village chicken production in Myanmar. However, it had been proposed that village chicken production was not achieving full potential because of poor husbandry and a high incidence of Newcastle disease. Newcastle disease has been considered to be a major cause of mortality in village chickens, but there was limited scientific evidence supporting this in Myanmar. The master seed of the I-2 Newcastle disease vaccine strain was introduced into Myanmar in 1998 as part of a FAO-sponsored Newcastle disease control programme and a nationwide Newcastle disease programme commenced in 2000 (Grimes, 2006). From April 2002 until March 2003 30 million doses of I-2 vaccine were produced per year, but less than a quarter of the village chicken population was vaccinated at that time (Figures from Myanmar Livestock, Breeding and Veterinary Department). Recently the I-2 vaccine production increased to 60 million doses per year commencing in the 2003/2004 financial year (Figures from Myanmar Livestock, Breeding and Veterinary Department).

The objective of this study was to describe the magnitude and characteristics of village chicken production in Myanmar and to identify major constraints.

Materials and methods

SURVEY ON VILLAGE CHICKEN HEALTH AND PRODUCTION IN LOWER MYANMAR

The survey was conducted in November 2003 in 10 villages located in two townships in the North and the South of the Yangon Division. A list of all chicken-owning households, including the number of chickens per household was prepared by field veterinarians working in these villages. This list was used as a sampling frame. As the prevalence of Newcastle disease within the households was unknown, to calculate the required sample size it was assumed that there was a 50% prevalence of the disease (Noordhuizen *et al.*, 1997). The software programme WINPEPI, procedure DESCRIBE Version 1.36 (Copyright: J.H. Abramson, 2004, *www.brixtonhealth.com*) was used for sample size calculation. The sample size was estimated for a precision of 5% and a confidence interval of 95%, based on a definite population of 500 households in the 10 villages and allowing for an expected loss of 25% of households due to refusal to participate in the survey. The required sample size was estimated to be at least 290 households and 296 households were randomly selected from the sampling frame using a random number generator in Microsoft Excel 2002 (Microsoft Cooperation).

A questionnaire on household demographics, the purpose of chicken keeping, feeding and housing practices, and chicken productivity and health was prepared using the expertise of agricultural economists, poultry specialists, pathologists, epidemiologists and virologists. Quantitative and qualitative questions referred mostly to farmers' experiences and observations in the preceding year. The number of birds present in different age groups was recorded at the time of the interviews (November 2003) and estimated for 6 months preceding the interviews (May 2003). Prices of chickens and chicken products were recorded in the Myanmar currency, Kyat (US $1 equals approximately 900 Kyat). We also used an approach which let farmers describe the health problems observed in their birds and classified these descriptions into several categories. The questionnaire was pre-tested in 5 households in a village south of Yangon and modified accordingly. Data were collected by field veterinarians, who were trained in conducting interviews in a one-day workshop on survey design. Field veterinarians interviewed the main person working with chickens in the selected households and recorded the information in the questionnaire.

DATA MANAGEMENT AND ANALYSIS

All data were entered by staff of the Livestock, Breeding and Veterinary Department in a Microsoft Access 2002 database (Microsoft Cooperation).

Descriptive statistics were prepared using Microsoft Excel (Microsoft Cooperation) and SPSS Vers. 14.0 for Windows (SPPS Inc.). If data were not normally distributed the median instead of the mean and its 95% confidence interval was presented (Altman *et al.*, 2000).

The amount of supplementary feed supplied per day was calculated as follows: the total amount of the supplementary feed supplied to the birds during the previous month in a household was divided by the number of birds present at the time of the visit; this figure was further divided by thirty (30 days within a month).

Results

A total of 296 questionnaires were completed. The mean family size in the households interviewed was five people, comprising two adult men, two adult women and one child.

IMPORTANCE OF VILLAGE CHICKEN PRODUCTION

The importance of village chicken production among all wealth earning activities is shown in *Figure 1*.

Crop production was considered the most important wealth earning activity; chicken keeping was mainly classified as less important, and also pig keeping had some minor importance. The most important crop cultivated was rice (cultivated by 75.7% of participants) followed by peas and beans (cultivated by 35.5% of participants). From the participants cultivating crops, about 51.8% cultivated only one crop, 38.4% two crops and the remaining proportion (9.8%) more then 2 crops. Transfer from relatives or fish production was either not important or not practiced at all.

To further evaluate the importance of chickens, the farmers were asked to distinguish between different purposes of chicken keeping. The most important purpose of chicken keeping was cash income from the sale of chickens, with 64% of farmers (n=188) considering it as very important, followed by consumption of chickens (*Figure 2*). Consumption and sale of eggs and barter trade of chickens and chicken products were largely considered not important.

FLOCK STRUCTURE

The average flock size in villages in the Yangon district was 30 birds (SD 18 birds), with a minimum of 0 and maximum of 78 birds kept within a flock in November 2003. An average flock consisted of 12 chicks, 12 growers, 4 hens and 2 cocks (*Table 1*). Flock sizes varied over time, with more birds present 6 months earlier in May 2003 (*Table 1*).

About 98% of interviewed families (n=287) kept local chicken breeds. About 70% of farms (n=206) kept one single breed and 28% (n=82) of farms had two breeds. The most popular breeds kept were Sittagaung kept by about 91% of farmers (n=270), followed by Taik Kye (21% of farms, n=61). Other local breeds kept were Tanyin (7%, n=21), Hle pyaung (2%, n=5), Rhode Island Red cross breeds (1%, n=2) and some other breeds (mainly Malaysian cross-breeds, mainly kept as cocks).

Most important poultry species beside chickens were ducks (22% of farmers, n=66), with most farmers keeping 1-5 ducks (n=41) and only 25 farmers keeping more than 5 ducks. Turkeys were kept by 3% of farmers (n=10), while 3% of farms kept also geese (n=9). No pigeons, quail or other poultry were kept on any of the farms visited.

Regarding future plans for chicken keeping, 87% of farmers (n=258) indicated that they

would like to increase the number of chickens kept, 8% (n=24) indicated they planned to maintain the same flock size and 5% (n=14) had no specific future plans for chicken keeping (category 'don't know').

FLOCK MANAGEMENT

Chickens were nearly always provided with supplementary feed; only in 1% of cases (n=2) was no supplementary feed supplied. Where chickens were supplied with supplementary feed (n=286), feed was supplied in 96% of cases daily (n=275), the rest supplied feed only a few times per week. Similar results were maintained for watering of chickens, with only 1% of farmers not supplying water (n=2). Again, of the farmers supplying water (n=284), 96% supplied it daily (n=273) and the remaining proportion only a few times per week.

The main supplementary feed was rice, supplied by 91% of farmers (n=295). Within the group of households where broken rice was supplied as a supplementary feed, the mean amount of broken rice supplied per bird per day was 0.0152 viss (95% CI 0.0136-0.167) or 24.8 gramme per bird per day (1 viss≈1.6329kg).

A total of 33% of farmers (n=97) supplied food scraps to their birds, with a mean amount of 0.0058 (95% CI 0.0043-0.0073) viss per bird per day or 9.5 gram per bird per day. Rice bran or peas were not supplied as supplementary feed in any of the villages surveyed.

Age related feeding was conducted by less than 1% (n=1) of farmers. In only 1% of cases (n=2) was supplementary feed purchased.

Assessing 293 responses, a total of 68% (n=200) farmers keep their birds overnight under the house, 29% (n=86) inside the cowshed and 1% (n=4) in a separate shelters for birds. In 1% of cases (n=3) birds rested overnight in trees. Of the 4 households that provided separate shelters for birds, only one was used as a permanent shelter, while the other three were only used as an overnight shelter. The main material used for shelters was bamboo for the walls (or the floor) and Nipah palm leaves for roofing.

In 98% (n=290) of cases, nests for laying and brooding were provided. In most cases a bamboo basket was used as a nest (n=279), but also wooden boxes (n=6) or cane baskets (n=3) were supplied. Rice straw was usually provided as bedding for the nests.

On average, eleven minutes were spent daily by household members for feeding and watering chickens, including the cleaning of troughs. Considering 286 valid responses, the main person conducting feeding, watering and cleaning of troughs were women (78%, n=223). In 19% of cases (n=55) men and in 3% (n=8) children managed the chickens. The average age of a female adult person feeding chickens was 39 years (95% CI 38-41 years), of a male adult person 39 years (95% CI 37-42 years) and of a child 13 years (95% CI 12-14 years). About 40 minutes were spent per month for building nests for hens and this was also predominately conducted by woman (81%).

CHICKEN PRODUCTIVITY

A total of 276 farms completed all questions on chicken productivity and these data are summarised in *Table 2*. From an average of twelve eggs produced per batch, one egg was consumed or lost and eleven eggs were set under the hen. Farmers indicated that from about ten hatched chicks, approximately eight survived up to two months of age.

CONSUMPTION OF CHICKEN PRODUCTS

Overall a large proportion (93%, n=276) of farmers ate their own chicken meat. Home grown chicken was consumed in all villages, but the amount of meat consumed differed between the 10 villages (Kruskal Wallis test, Chi-square=148,144, df=9, $p<0.001$). The amount of home-produced chicken meat was not normally distributed. The median

amount of home-produced chicken meat consumed was 5 viss (95% CI 4-9 viss) or 8.1kg per household per year. In only 7% of households (n=21) and in only 4 of the 10 villages visited, purchased chicken meat was consumed.

Home-produced eggs were only eaten in 7% of households (n=20), while purchased eggs were eaten in 18% (n=53) of households. The average purchase price for eggs was 36 Kyat per egg (95% CI 24-38 Kyat). Considering only households eating eggs, the median amount of home-produced eggs consumed per year was 20 eggs (95% CI 10-30) and the median amount of purchased eggs consumed per year was 30 eggs (95% CI 20-30).

Chicken meat was eaten by all family members. Within 84 households specifying egg consumption, in 85% households all family members ate eggs, in 14% of households eggs were only eaten by children and 1% of households only by men.

MARKETING OF VILLAGE CHICKENS AND EGGS

In 92% of households (n=272) chickens were sold, with 44% of households selling birds only once or twice a year (*Table 3*). In contrast, only 7% (n=20) of households purchased live birds to be incorporated into the flocks. Home-produced eggs were seldom sold (n=3). Where eggs were sold prices ranged from 35-40 Kyat per egg. A total of 16% of households (n=47) purchased eggs for consumption.

Of the 272 cases specifying sale destination of chickens, a total of 53% of households (n=144) sold birds directly at the markets, about 47% of households (n=127) sold birds to middle men and less than 1% to neighbours (n=1). Within the 20 households purchasing live chickens, 55% (n=11) bought chickens from local markets, 25% (n=5) from neighbours, and 10% (n=2) from either relatives or middle men.

The average number of birds sold per household was 9 birds (SD=6) per year (*Table 4*). The number of male and female birds of different age classes sold per year is shown in *Table 4*. A total of 37% of farmers (n=109) sold roosters, 44% (n=131) sold hens, 83% (n=246) sold male growers, 71% (n=211) sold female growers and only 10% (n=29) sold chicks within the last year. The sale prices for adult birds and growers are listed in *Table 5*.

There were two periods per year when lower prices for the sale of chickens occurred:

1. March-May: The main reason specified for low prices was the ‘hot weather’ and/or the ‘occurrence of disease’ among birds (n=157).
2. May-July: The main reason specified was ‘flooding and the presence of plenty of fish’ (n=65). Another reason specified was ‘chicken diseases during flooding’ (n=20).

There was only one main period per year when high sale prices occurred. In October and November the majority of farmers considered the occurrence of ceremonies or festivals as the reason for high prices (n=222). Only a small proportion (n=7) mentioned that high prices were common during April, when the Buddhist New Year or the water festival is held.

Chickens or eggs were never barter-traded in or out of households in any of the farms surveyed.

HEALTH STATUS OF VILLAGE CHICKENS AS OBSERVED BY FARMERS

A total of 92% (n=273) of farmers reported respiratory problems in their flocks. The distribution of different respiratory signs in different age groups is shown in *Figure 3*. About 60% of respiratory signs were observed in chicks, 30% in growers and 10% in adults. The most frequent respiratory sign observed in chicks was nasal discharge, while growers showed primarily heavy breathing.

Intestinal problems were indicated by 72% (n=212) of farmers among their birds. A majority of chicks showed whitish diarrhoea, while diarrhoea was often greenish in growers and adults (*Figure 4*).

Only 66% of farms (n=195) reported nervous signs among their birds, with the predominant sign observed being twisting of the neck, in particular in chicks (*Figure 5*).

General problems as a combination of different clinical signs were observed frequently among mature birds, with the dominating age group with any of these signs being the group of growers. Ruffled feathers were the most frequently observed general sign in all age groups. Sudden death was the most common sign in adults, but also discolouration of the comb was observed frequently in growers and adults (*Figure 6*). The main other problems described were sores on eyes and head and pox marks. The most frequent other problem observed in adults was the occurrence of ectoparasites (*Figure 7*).

Newcastle disease and Fowl pox were the best known chicken diseases among farmers, followed by general descriptions of disease like 'diarrhoea' and 'sickness' (*Figure 8*).

MAIN CAUSES OF MORTALITY

The retrospective data recorded permitted an estimate of chicken mortality in the different age groups. About 40 farmers specified causes of mortality for chicks and 296 farmers reported on mortality of growers and adults (two different questions in the questionnaire). About 24% of chicks died within the first two months of age; the estimated mortality for growers was about 19% and for adults 5%.

The relative proportional chicken mortality is displayed in *Table 6*. Disease as a cause of mortality became more prominent with age of the birds, while predation was a major cause of mortality in younger birds. Exposure to environmental conditions seemed to be a major cause of deaths in chicks, while theft increased with the age of the birds. The most important predators killing chickens were ranked as follows: birds of prey (32%), rats (31%), snakes (17%), dogs (15%), cats (3%) and others (2%).

NEWCASTLE DISEASE

Of 294 valid responses 11% (n=31) reported Newcastle disease outbreaks in their own flocks, 48% (n=142) reported no outbreaks and 41% of farmers (n=121) were not sure if Newcastle disease was present in their flocks in the past. A total of 83% of farmers indicated that outbreaks occurred only once a year, while the remaining proportion of farmers indicated Newcastle disease outbreaks two or more times per year. Most outbreaks occurred from March to May as indicated by 76% of farmers, with the predominant outbreak month being the month of March. Total chicken mortality during Newcastle disease outbreaks was estimated from 30 households with reported outbreaks (one farm could not recall the number of birds dying) to be 68% (95% CI 57-79%). During an outbreak, sick or infected birds were sold and/or consumed by 40% (n=12) of these 30 households. The most common sign observed during outbreaks was sudden death. Other common signs described were depression and twisting of the neck. A total of 5% of farmers (n=15) tried to treat their chickens during Newcastle disease outbreaks, with two farms using Paracetamol® and 33% (n=5) using Turmeric powder as a treatment. Other local remedies used were juice of lemon grass (n=2) and alcohol (n=1).

A total of only 5.4% (n=16) of all 296 farms visited in the study region conducted vaccinations against Newcastle disease within the previous year. These included 8 farms with reported Newcastle disease outbreaks. Vaccine was supplied by the local veterinarian free of charge (n=5) or for a purchase price of one (n=3) or two (n=8) Kyat. A total of 14 farms used I-2 vaccine, while the two other farms did not know which vaccine was applied. All vaccinations were conducted by eye drop. On 10 farms vaccine was applied every 3 months, on two farms every six months and on four farms only once per year. A total of 4 farms reported no losses following vaccination, 8 farms indicated reduced losses following vaccination compared to previous Newcastle disease outbreaks, one farm indicated increased losses following vaccination (one farm could not recall if losses or no losses occurred following vaccination) within the previous year.

CONSTRAINTS SPECIFIED BY FARMERS TO VILLAGE CHICKEN PRODUCTION

The most important constraints specified by the 296 farmers were the occurrence of chicken diseases (n=144, 49%), followed by exposure of chickens to extreme weather conditions (n=15, 5%) and occurrence of predators (n=11, 4%). The most important areas to assist farmers in improving village chicken health were indicated to be vaccinations (n=109, 37%), the supply of new breeds (n=46, 16%) and extension work (n=32, 11%).

Discussion

The study evaluated the perceived economic potential of chicken production and the importance of chicken keeping compared to other wealth earning activities among a sample of village households in Myanmar. Chicken production was largely classified as being of lesser importance than crop production, indicating that chicken production is not the major income source, but provides some additional income to rural families. This has to be considered if extension programmes and intervention strategies to improve village chicken production are introduced in the rural environment in Myanmar. That chickens or eggs were never barter traded by any of the farms surveyed indicates that such barter trading of chicken or chicken products has no importance in Myanmar, which is in contrast to many African societies (George , 1992). Also the use of village chickens as ceremonial sacrifices common in African societies such as Ethiopia (Tadelle Dessie and Ogle, 2001) and Burkina Faso (Kondombo *et al.*, 2003) was not observed in the Myanmar villages in this study.

Home produced eggs were consumed very seldom, while purchased commercial infertile eggs had a higher importance as a protein source and were consumed more frequently. The reasons for this behaviour were gathered during interviews with farmers. One explanation advanced for this is that Buddhism, the predominant religion in Myanmar, prohibits the taking of life. As home grown eggs are fertilized, to eat them would destroy life. The large majority of respondents indicated that for this reason, they would not sell to, or purchase eggs from, other villagers raising chickens under scavenging conditions. In contrast, since commercial eggs are mainly produced by unmated hens, farmers believe that there is no impediment to the consumption of these eggs. Since all eggs not consumed by the family or sold were placed under the hens to produce chicks, the low egg consumption and sale resulted in a strong emphasis on the rearing of birds for meat production.

The mean flock size of about 30 birds is essentially similar to that recorded in Burkino Faso (33.5 birds, Kondombo *et al.*, 2003) and Zimbabwe (30 birds, Mapiye and Sibanda, 2005), but different to observations in Ethiopia where only 15 birds comprised an average flock (Tadelle Dessie and Ogle, 2001), and in Malaysia (Ramlah, 1996) and Vietnam (Tran Dinh Tu, 2002) with flock sizes of 15-20 birds. Flock size appeared to change over time, but this needs to be further evaluated in a longitudinal study.

The number of birds specified as sold (mean=9) within the previous year was lower than expected. Considering the mean flock size of about 30 birds, with approximately two new batches of birds produced per year and the figures for chicken consumption and mortality, the number of birds to be sold would be expected to be higher. Possible reasons for under-reporting the number of sales could be difficulties in remembering the number of birds sold or intentionally under-reporting sales. Despite assurances by the interviewers that collected data would be handled confidentially, farmers might have underreported sales because of fear of further taxing by government institutions (considering also that this was the first time that such a survey was conducted in Myanmar).

Low prices for the sale of chickens from March until May coincide with reported peaks

of Newcastle disease outbreaks. Newcastle disease has probably a high incidence during this period and the particular hot climatic conditions during this might favour the occurrence of disease. Birds surviving outbreaks of disease might be in poor condition resulting in low market prices. Low prices could also occur as demand is low at the time. Other payments may perhaps fall at this time resulting in reduced expenditure on chicken meat.

Low prices in May until July seem to be market driven; an increased supply of alternative food (fish) is likely to have driven the price down. Disease in chickens might also result in poor body condition of birds and therefore low prices for these birds during that period. High prices in October and November occur as there is a high demand for chicken meat during this period, because they are given to monks as donations or they are eaten by farmers in religious celebrations during this period.

Home grown chicken is an important protein source and is consumed in all villages and in nearly all households, whereas in contrast, purchased chicken meat is consumed rarely. It appears that limited financial resources do not allow households to increase the amount of chicken meat purchased.

Live chickens were purchased in only 7% of households. Therefore in terms of the epidemiology of Newcastle disease, the risk of introduction of live, infected birds into the flocks from other sources is relatively low. More consideration needs to be given to other possible sources of virus introduction and disease spread.

Different causes of mortality were prominent in different age groups. Exposure to extreme weather conditions and predation were considered to cause considerable losses among chicks, while older birds (growers and adults) often succumbed to disease. However, diseased birds may also be more easily preyed upon and therefore the cause of death is probably not easy to determine in many cases. This information will be used to evaluate prophylactic opportunities to enhance survival of village chickens and will help to support sustainable animal health programmes for village chickens in the future.

Data presented in *Figure 8* on knowledge of chicken diseases must be interpreted with caution, as specific disease terms were probably named by the veterinarian conducting the interview. However, this gives us some indication about the general knowledge of chicken diseases, as they are probably the most prevalent diseases.

Newcastle disease is a viral disease of poultry with mortality rates up to 80% in household poultry in Africa (Permin and Bisgaard, 2000) and is considered to be the most destructive and economically important disease of indigenous chickens in South-East Asia (Aini, 1990) . In Myanmar, Newcastle disease outbreaks occur mainly in the hot period, from March to May. One of the disease signs described in more mature birds was green diarrhoea, which is often observed in Newcastle disease infected birds (Alexander, 2003).

Whilst Newcastle disease can be controlled by the use of appropriate vaccines (Spradbrow, 1993), only a small proportion of farms surveyed conducted vaccination, with varying results. Further education programmes are necessary to increase farmers' awareness of the benefits of vaccination. Protection of the chicken population through vaccination programmes results in increased numbers of chickens, which leads to higher consumption of poultry meat or increased income from the sale of poultry products. The key beneficiaries from programmes that control Newcastle disease in chickens are the village people who rely on poultry products for food security and/or disposable income.

Based on the results of this study, two strategies should be considered to improve village chicken production in Myanmar: These are vaccination as a means of protecting birds against Newcastle disease and confinement rearing and supplementary feeding of chicks, as a means of reducing the attrition rate of young chicks. These procedures have been included in a subsequent intervention study of village poultry production systems in Myanmar which will be reported on at a later time.

Acknowledgements

We are grateful to the Director General of LBVD, U Maung Maung Nyunt, for his support during this research project. We thank the veterinarians for conducting the interviews in the Yangon division, all farmers for supplying their answers and Dr Yin Yin Thein and Dr Kyi Mar Aung for organising the field and office work. We also thank Dr Arlene Rutherford for her comments on the questionnaire design. Finally we would like to acknowledge the Australian Centre for International Agricultural Research (ACIAR) which provided the funding for this project.

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Table 1 Flock structure of village chickens kept in 296 households in the Yangon division of Myanmar in May and November 2003. Growers were specified as birds between 6 weeks and 6 months, while chicks were birds younger than 6 weeks. Rooster and hens were older than 6 months of age.

Parameter	Rooster		Hens		Male growers		Female growers		Chicks		TOTAL	
	May-03	Nov-03	May-03	Nov-03	May-03	Nov-03	May-03	Nov-03	May-03	Nov-03	May-03	Nov-03
Mean	1.9	1.6	5.0	4.0	8.4	6.2	8.5	6.4	13.5	12.1	37.1	30.3
Std. Deviation	2.3	1.8	3.8	3.1	7.0	5.4	5.7	5.8	7.7	7.8	17.0	18.2
Median	1.0	1.0	4.0	3.0	9.1	5.0	8.0	5.0	12.0	12.0	38.0	30.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	14.0	12.0	27.0	25.0	30.0	20.0	40.0	30.0	40.0	60.0	91.0	78.0

Table 2 Productivity of village chickens among 276 households in the Yangon division of Myanmar.

Parameter	Mean	95% CI
No. batches produced per hen per year	2.9	2.8-3.0
No. eggs produced per batch	11.9	11.6-12.1
No. eggs set under each hen per setting	11.1	10.9-11.3
No. chicks hatched per batch	9.7	9.5.-9.9
No. chicks per batch surviving up to 2 months of age	7.8	7.6-8.1

Table 3 Frequency (in %) of households selling and purchasing live chickens and eggs among 296 households in the Yangon division of Myanmar over a period of one year.

	Never	once or twice a year	three to six times a year	six to nine times a year	more than nine times per year
Sale of chickens	8.1	43.6	19.9	18.2	10.1
Purchase of chickens	93.2	5.1	1.4	0.0	0.3
Sale of eggs	99.0	0.0	1.0	0.0	0.0
Purchase of eggs	84.1	1.4	10.8	1.7	2.0

Table 4 Number of birds sold per year specified retrospectively by 296 households in the Yangon division of Myanmar.

	Number of birds sold					
	Rooster	Hen	Male grower	Female grower	Chick	Total
Mean	0.5	1.0	3.6	3.3	0.5	8.9
Std. Deviation	0.9	1.5	3.2	3.3	1.5	5.6
Minimum	0.0	0.0	0.0	0.0	0.0	0.0
Percentile 25	0.0	0.0	2.0	0.0	0.0	5.0
Median	0.0	0.0	3.0	3.0	0.0	8.0
Percentile 75	1.0	2.0	5.0	5.0	0.0	11.0
Maximum	6.0	10.0	30.0	20.0	10.0	35.0

Table 5 Sale prices (in Kyat) of chickens specified by 296 households in the Yangon division of Myanmar.

	Sale prices for a single bird			
	Rooster	**Hen**	**Male grower**	**Female grower**
Mean	1684	1603	1245	1186
Std. Deviation	267	264	418	472
Minimum	1000	800	150	150
Percentile 25	1650	1400	720	600
Median	1800	1700	1400	1400
Percentile 75	1800	1800	1600	1600
Maximum	2000	1900	1800	1800

Table 6 Proportional mortality for different age groups of chickens in the Yangon division of Myanmar.

Cause of mortality	**Chicks**	**Growers**	**Adults**
Disease	20%	61%	73%
Predation	33%	18%	2%
Theft	0%	1%	6%
Exposure to extreme climate	42%	17%	15%
Other/Unknown	5%	2%	5%
No. of farmers responding	n=40	n=296	n=296

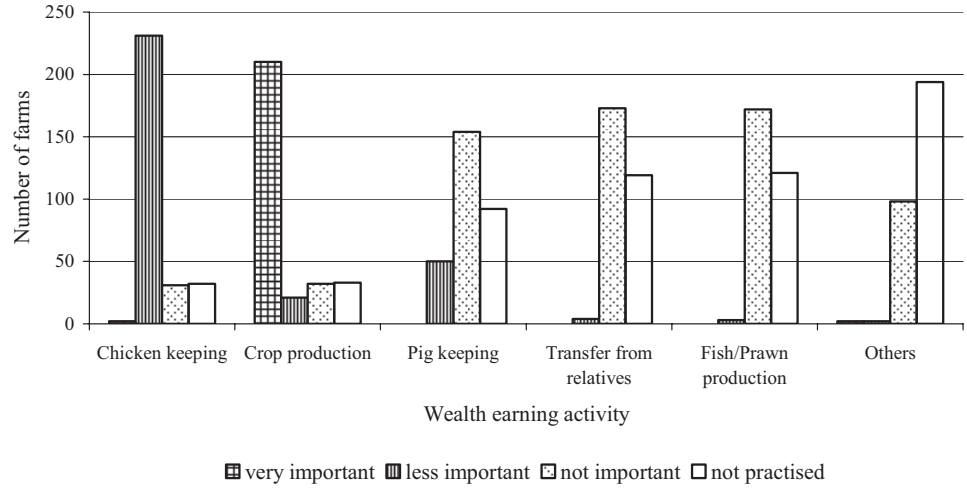

Figure 1 Importance of village chicken production among other wealth earning activities in 296 family farms surveyed in the Yangon division of Myanmar.n of Myanmar.

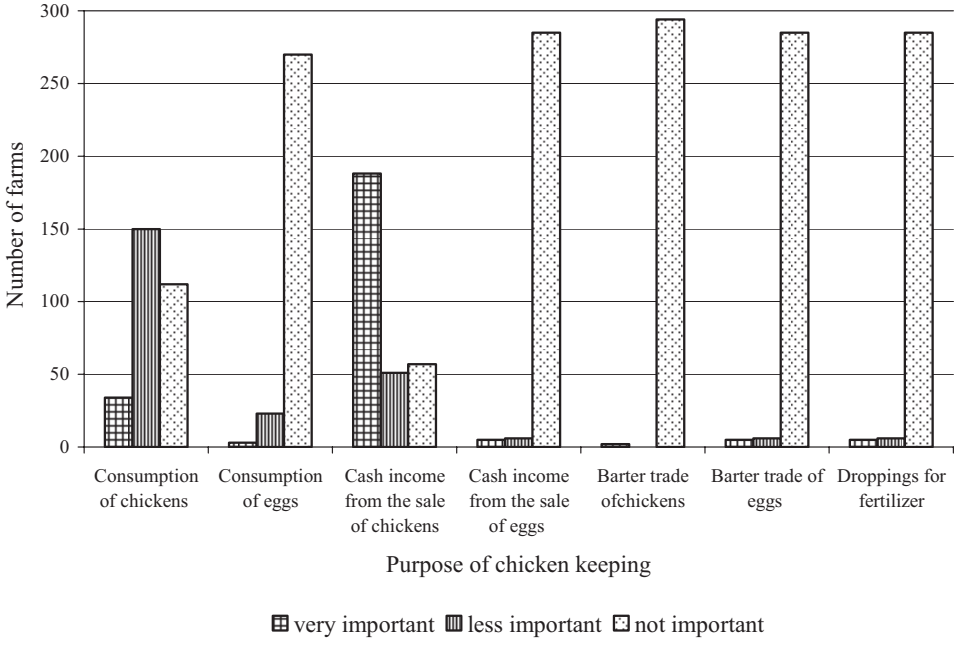

Figure 2 Importance of different purposes of chicken keeping for 296 family farms surveyed in the Yangon division of Myanmar.

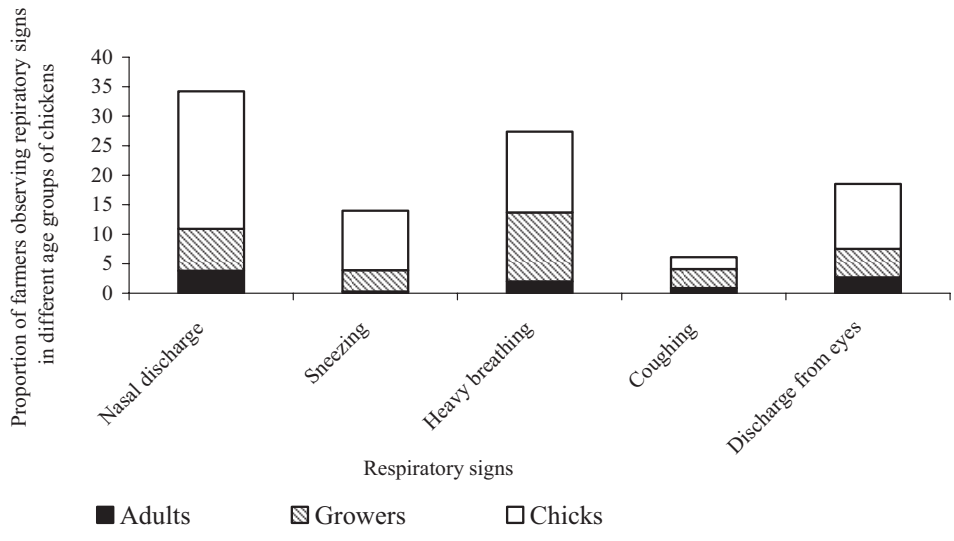

Figure 3 Distribution of respiratory signs observed by farmers among chickens in different age groups in the Yangon division of Myanmar.

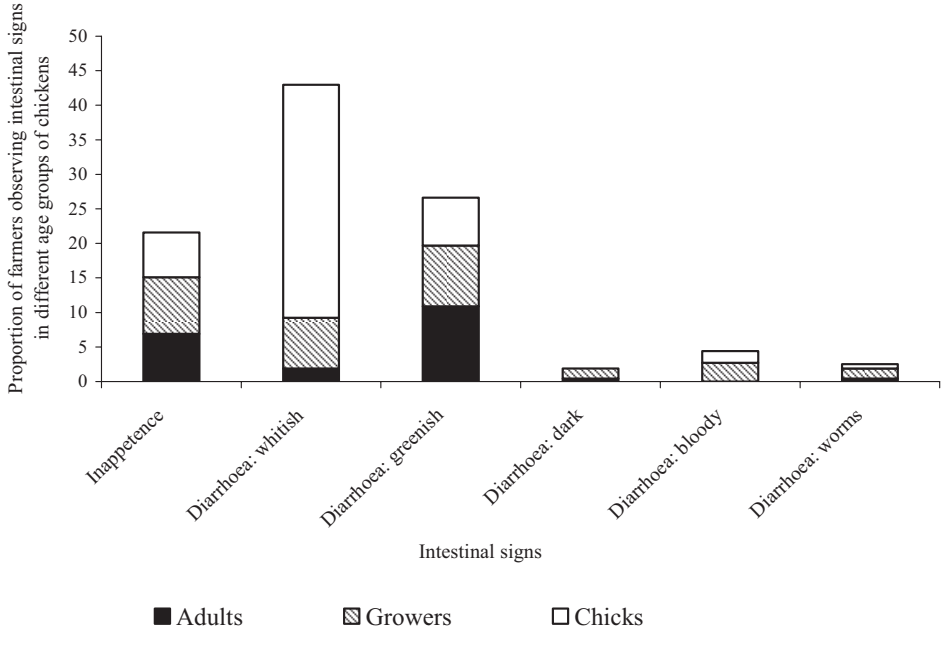

Figure 4 Distribution of intestinal signs observed by farmers among chickens in different age groups in the Yangon division of Myanmar.

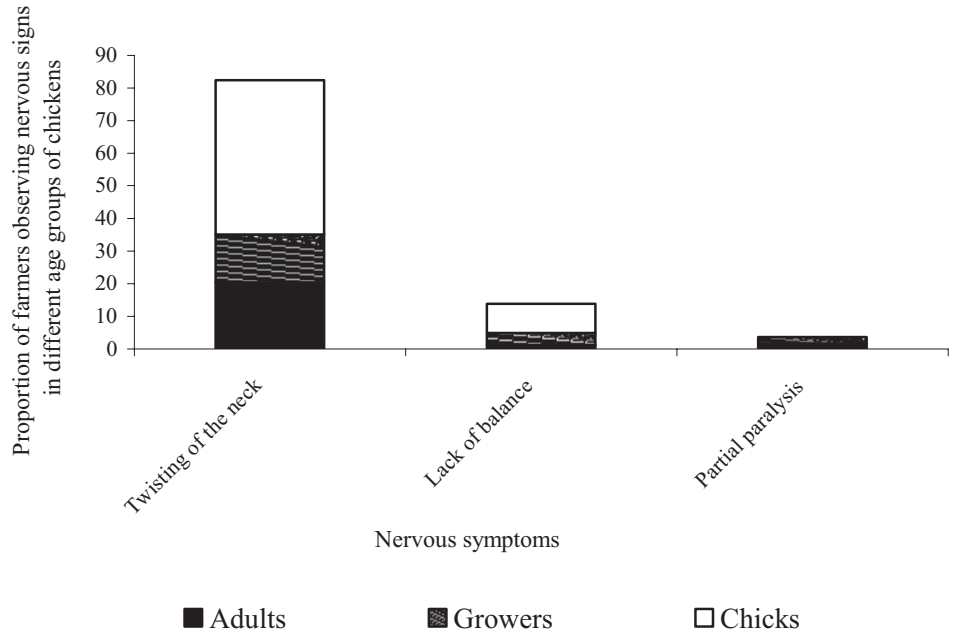

Figure 5 Distribution of nervous signs observed by farmers among chickens in different age groups in the Yangon division of Myanmar.

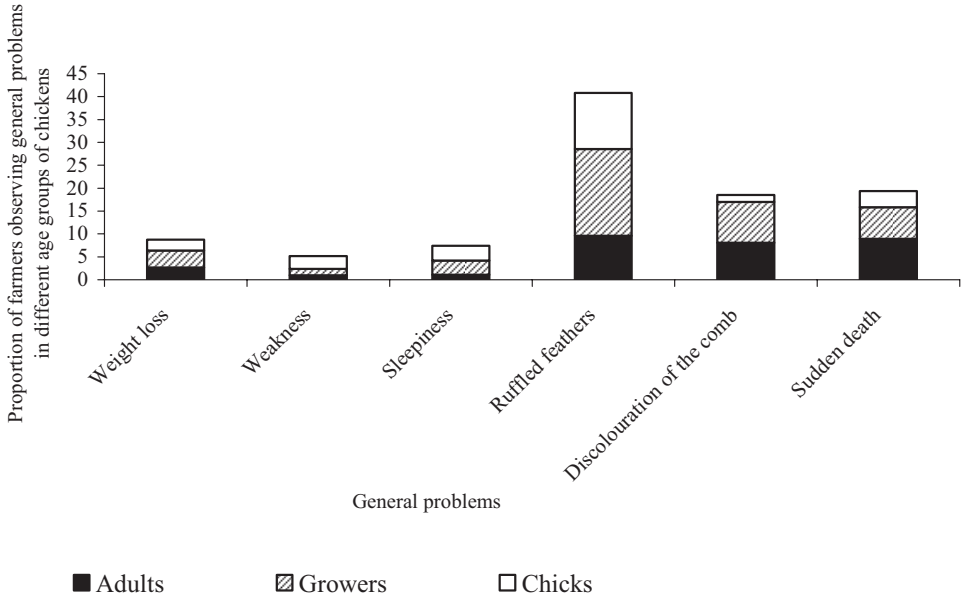

Figure 6 Distribution of general signs observed by farmers among chickens in different age groups in the Yangon division of Myanmar.

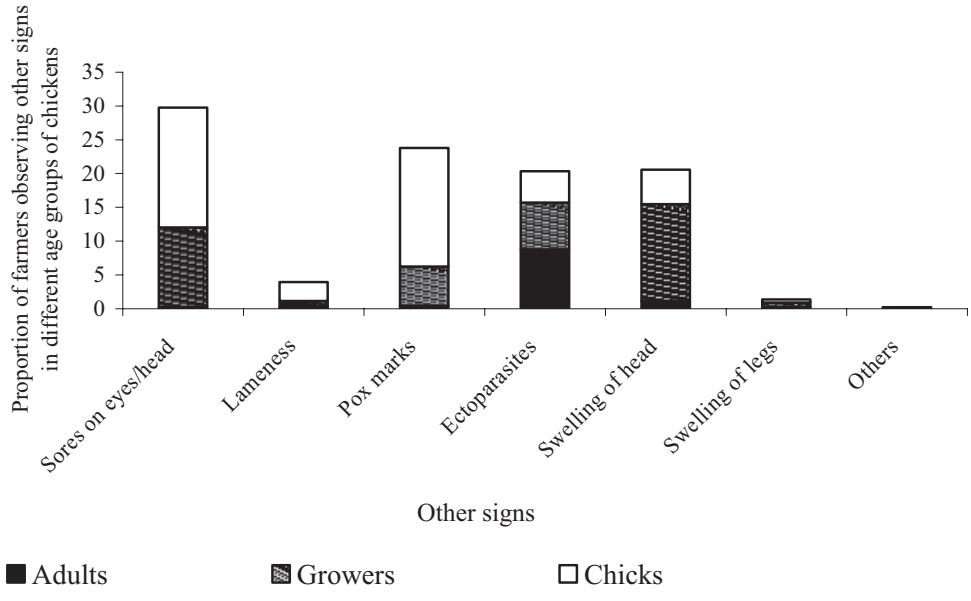

Figure 7 Distribution of other symptoms observed by farmers among chickens in different age groups in the Yangon division of Myanmar.

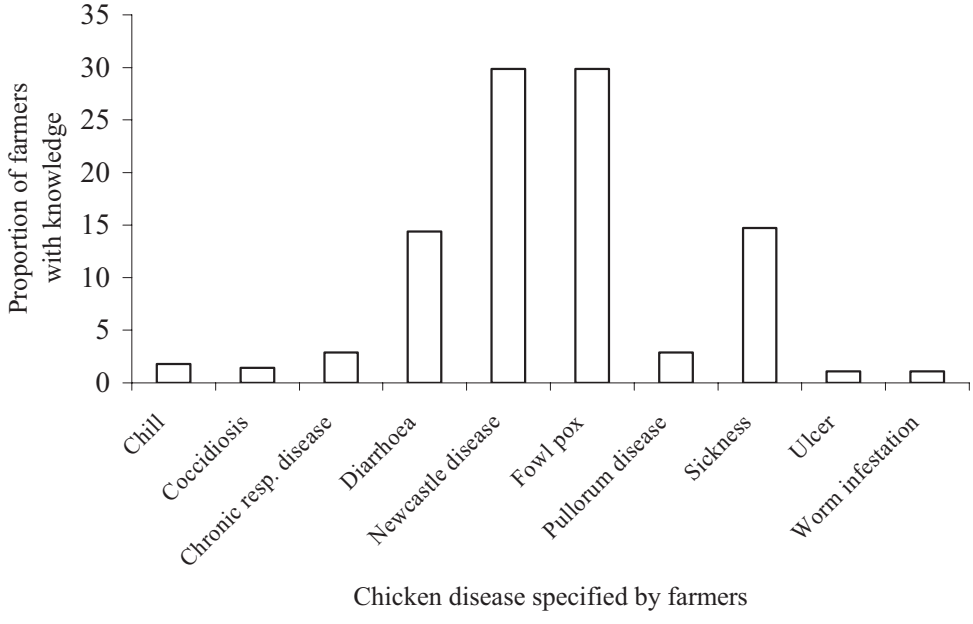

Figure 8 Proportion of farmers with knowledge about particular chicken diseases in the Yangon division of Myanmar.