

HEALTH AND MANAGEMENT CONSTRAINTS TO FAMILY POULTRY DEVELOPMENT IN MOROCCO

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Abstract

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A field survey was carried out in 73 farms from 11 villages distributed in 2 areas of Morocco during the dry season 1999 and the wet season 2000. Data on husbandry, farm socio-economics and health status of the flocks were collected. Flocks were clinically examined and sick/dead birds were subjected to pathological and parasitological investigations. The results showed that most flocks were raised in a traditional extensive system with a low stock density and weak production records. The management system was precarious and labour and financial input was very poor in most of the surveyed farms. Feeding system was poor, unreliable and arbitrary. Mortality was high and reached 70% in some flocks. Gumboro disease and Newcastle disease were among the major diseases diagnosed besides helminth and ectoparasite infestations. All constraints were prevailing in the absence of any institutional or corporate interventions.

1. INTRODUCTION

Moroccan poultry production plays a vital role in narrowing the animal protein supply-gap. The share of poultry in the total meat consumption in Morocco increased from 17.2% in 1970 to more than 37.7% in 1980 and to over 44% in 1996 [1]. Most of this production is realized by the commercial sector, which is concentrated around a few large urban centres. On the other hand, the remote areas rely mainly on small-scale poultry and traditional family poultry production.

Local family poultry or the so-called "Beldi poultry" is an integrated component of nearly all rural households. Besides providing valuable protein, it generates income particularly for rural women who are the managers and principal beneficiaries. The existence of nation-wide domestic markets (souks) able to absorb family poultry products has contributed to the maintenance of this type of production. Furthermore, family poultry products (eggs and meat) are well priced and appraised for their taste and quality by local urban consumers and the demand for these products increases during special events such as the holy month of Ramadan, birthdays and other national and religious holidays. Despite great potential and opportunities, family poultry production is very precarious and permanently threatened by disease outbreaks. Thus, the purpose of this study was to investigate the major health and management constraints to the development of family poultry in two rural areas of Morocco.

2. MATERIALS AND METHODS

2.1. Field surveys

Family poultry farms distributed in villages in two different ecological zones were surveyed during two periods of the year, the dry and the wet season. The villages and the farms with traditional poultry activity were selected according to the cooperation by the owner and easy access to the farm.

Data on husbandry (flock size and structure, housing and feeding system, ownership and labour, breeding system, etc), farm socio-economic information and health status of the flocks (occurrence and frequency of diseases, mortality, treatments, veterinary interventions) were collected using a survey questionnaire.

Flocks were clinically examined. Twenty-five sick/dead birds from two villages (Ouled Salem and Ouled Said) were necropsied. The lesions were recorded and tissue samples were collected and placed in 10% neutral buffered formalin (NBF) for histopathological examination. The gastrointestinal tract was examined for the presence of helminths. Birds in the flocks were examined for the presence of ectoparasites particularly during the warm period of the dry season and when farmers mentioned that the flock was infested with ectoparasites. If present, ectoparasites were placed in vials containing 10% NBF for further identification.

The location of the selected farms during the dry and the wet season was as follows: during the dry season the survey was conducted from March to August 1999, in two different ecological zones (Table I).

Ecological zone 1: An area close to an urban area with little commercial poultry production, the area of Sidi Bettache (45 Km south east of Rabat).

Ecological zone 2: A remote area without any commercial poultry activity: the area of Khémisset-My Bouaazza (90 and 160 Km away from Rabat).

During the wet season: the survey was conducted from November 1999, to April 2000, in two ecological zones (Table I).

Ecological zone 1: the area of Sidi Bettache (the same zone surveyed during the dry season) with one more village (three villages were surveyed instead of two).

Ecological zone 2: the area of Tifelt was selected, which is close to the area of Khémisset (the area surveyed during the dry season), because problems were encountered to conduct the survey in the same farms as during the dry season. Six villages were sampled in the study area, which is located 85 Km North-east of Rabat.

TABLE I. DISTRIBUTION OF FARMS SURVEYED IN VILLAGES AND ZONES DURING THE DRY AND THE WET SEASON

	Zone 1		Zone 2	
	Villages (Douars)	Number of farms	Villages (Douars)	Number of farms
Dry season	Douar Ouled Salem	13	Douar Houderrane	4
	Douar Ouled Said	4	Douar Ait Chaou	2
			Douar Ait Haddou	10
Wet season	Douar Ouled Salem	13	Douar Zabala	9
	Douar Ouled Said	6	Douar Ait Mallouk	4
	Douar Oulja	2	Douar Ait Idir	9
			Douar Ait Ichi	4
			Douar Ait Kouisseem	8

2.2. Laboratory investigations

2.2.1. Histopathology

NBF-fixed tissues were processed according to standard methods. Tissues were dehydrated in alcohol baths and embedded in paraffin wax. Five μ -sections were performed and stained with hematoxylin and eosin (H&E) and Gram technique for histopathological examination. Sections from different organs were examined under light microscope, microscopical changes recorded and a morphological diagnosis established.

2.2.2. Direct identification of parasites

Helminths and ectoparasites were identified under light microscope according to their morphological characteristics [2].

3. RESULTS

3.1. Flock size and structure

The mean flock size in villages of both zones 1 and 2 during the dry season varied from 21.5 to 27.2 birds/flock. Most of them were chicks (Table II). The mean flock size in farms surveyed during the wet season varied from 8–21 birds/flock in Zone 1 and from 9–42 in Zone 2 (Table III). The mean number of hens ranged from 4–9 birds/flock, that of chicks reached 24 birds/flock and that of growers did not exceed 7 birds/flock. For cocks means were from 0.5–1.5 birds/flock (Table III).

Examining the flock size of family poultry farmers, it was evident that most farmers (75%) own very small-sized flocks of 2–20 chickens, 15% own up to 40 birds and only 5% of farmers own more than 40 chickens (Fig. 1).

TABLE II. FLOCK SIZE AND STRUCTURE DURING THE DRY SEASON

Zones	Villages	Farms surveyed	Number of chickens			
			Hens and cocks	Chicks	Total	Mean birds/farm
Zone 1	Ouled Salem	13	141	212	353	27
	Sidi Betache	4	42	44	86	22
Zone 2	Houdrane	4	68	42	110	28
	Tifelt and M. Bouazza	2	22	28	50	25
Total		23	273	326	599	26

TABLE III. FLOCK SIZE AND STRUCTURE DURING THE WET SEASON

Zones	Villages (Number of farms)		Number of birds				
			Total	Cocks	Hens	Growers	Chicks
Zone 1	Ouled salem (13)	Total	248	18	84	76	67
		Mean	19.1	1.4	6.5	5.8	5.2
	Ouled said (6)	Total	128	9	48	28	43
		Mean	21.3	1.5	8	4.7	7.2
	Oulja (2)	Total	16	2	8	2	4
		Mean	8	1	4	1	2
Ait Hadou (10)	Total	91	10	81	22	185	
	Mean	9.1	1	8.1	2.2	18.5	
Zabala (9)	Total	158	9	73	37	40	
	Mean	17.6	1	8.1	4.1	4.4	
Ait Malouk (4)	Total	71	4	23	20	26	
	Mean	17.8	1	5.8	5	6.5	
Zone 2	Ait Idir (9)	Total	377	11	82	64	220
		Mean	41.9	1.2	9.1	7.1	24.4
Ait Ichi (4)	Total	57	2	14	18	22	
	Mean	14.3	0.5	3.5	4.5	5.5	
Ait Kouissem (8)	Total	245	9	74	35	127	
	Mean	30.6	1.1	9.3	4.4	15.9	

The presence of other avian species was limited to turkeys and guinea fowls in the farms surveyed during the dry season. The total number was 30 and 6 birds including all the villages in zones 1 and 2 (Table IV). During the wet season, besides turkeys and guinea fowl, a small number of ducks and pigeons were raised in a few farms (Table V).

TABLE IV. TOTAL NUMBER OF TURKEYS AND GUINEA FOWLS IN FARMS IN ECOLOGICAL ZONES 1 AND 2 DURING THE DRY SEASON

Zones	Villages	Farms surveyed	Number of turkeys		Guinea fowl
			Adult	Pullets	
Zone 1	Ouled Salem	13	1	0	0
Sidi Betache	Ouled Said	4	4	2	6
Zone 2	Houdrane	4	3	25	0
Tifelt	Ait Chaou	2	5	0	0
M. Bouazza					
	Total	23	13	17	6

TABLE V. PRESENCE OF OTHER AVIAN SPECIES AND THEIR MEAN NUMBERS IN VILLAGES DURING THE WET SEASON

Zones	Villages	Ducks	Guinea Fowl	Turkeys	Pigeons
Zone 1	Ouled salem	0.2	0.1	0.1	-
	Ouled said	0.3	-	0.2	-
	Oualja	-	-	-	-
	Ait Hadou	0.1	-	-	-
	Zabala	0.2	-	-	0.2
Zone 2	Ait Malouk	-	-	-	-
	Ait Idir	0.1	-	-	0.1
	Ait Ichi	0.5	-	-	-
	Ait Kouisseem	0.3	-	-	0.1

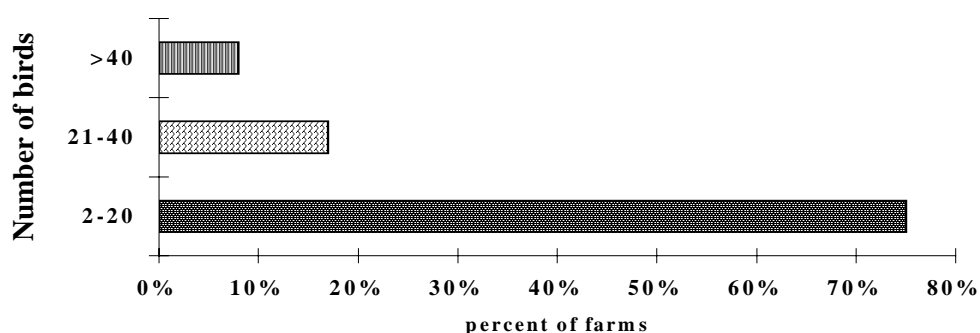


FIG.1. Distribution of flock size among surveyed farms.

3.2. Nutrition characteristics and housing systems

The birds in the surveyed farms were scavenging chickens. They roamed around the homestead and fields in search of feed and remaining cereal grains. The stubble fields (wheat and barley fields) were the major feed resources available to family chickens particularly during summer time after harvesting the crops. However, during drought years it becomes very hard for the chickens to get access to enough feed. Cattle litter and manure are other feed sources, which are available the whole year for the chickens in most farms. The chickens may roam in the barns to dig up waste and undigested grains in the litter or search in heaps of manure.

Most of the supplementary feeds used by farmers were barley and kitchen leftovers (97 and 100% of farms) followed by old dry bread and wheat bran in 58% and 49% of the farms, respectively. These supplementary feeds were not given regularly to chickens. They were distributed in very limited quantities when there was no feed available in the fields. Barley was locally harvested and was given to chickens as grains. Old dry bread and bran were purchased from the weekly local market. They were soaked in water and put onto a metal surface or in a jar to be used by chickens. In general the feeding resources in all the farms were limited. Hence, the local feeding system may be considered as poor, is not in favour of the development of family poultry and constitutes a major constraint to that development.

Drinking water was provided to the chickens mainly by children or women. All farms used water from local wells without prior water treatment. All farmers had access to wells except one farm in Douar ait Chaou where water was used from a nearby spring. As drinking containers pots may be used or very commonly rubber tyres cut medially into two halves, and placed somewhere in the vicinity of the house. This system ensured that water could be easily reached by both young and adult chicken.

Housing for poultry was of a traditional type. No concrete poultry houses were seen during the survey and most farmers (54%) left their chickens overnight in trees or bushes. Night shelters used by some of the farmers (29%) were huts made out of 3–4 tree branches (cut from the oak forest) crossed and tightened together and covered with a plastic sheet. They were generally located in an area near the farm house or close to the sheep shelters. In some of the huts sticks were placed horizontally crossing the previous ones so the birds could hang on at night. Farmers cut trees and shrub branches from the forest (oak trees and *Cistus* shrubs) and placed them around huts or close to the house to allow young chicks to hide between branches in order to escape predators such as hawks. Other types of housing included baskets, cages made out of wire mesh and wooden sticks/plastic roof, little squared house made out of stone and plastic or even old cars (Fig. 2).

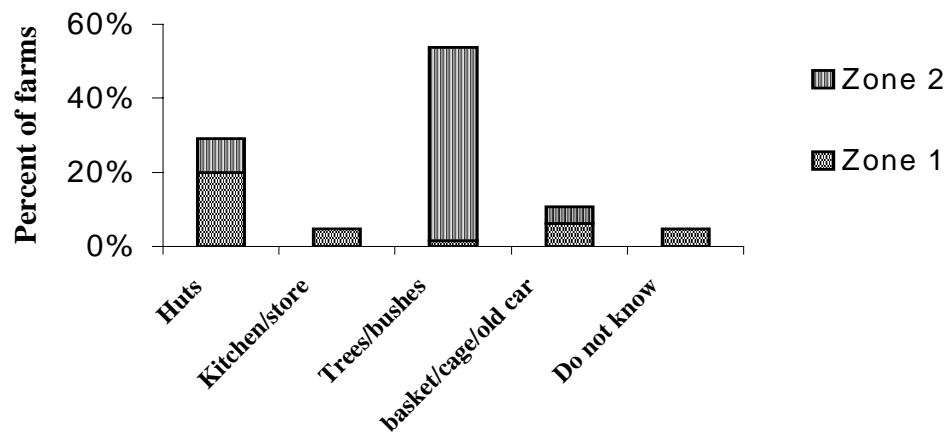


FIG.2. Types of housing for family poultry in farms in two different ecological zones.

Cleaning of the poultry premises was rarely done. In 58% of the farms where huts were used as chicken shelter (7 out of 19 farms), no cleaning was practiced (Fig. 3).

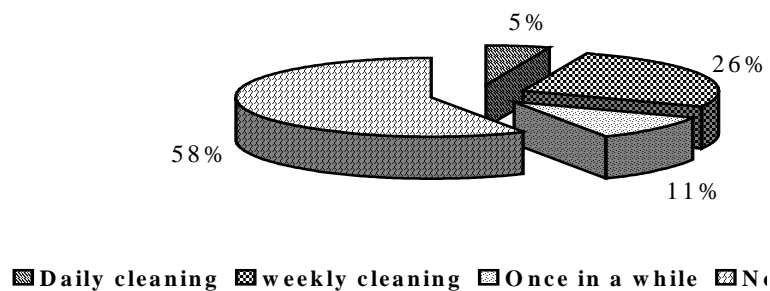


FIG. 3. Cleaning practice of chicken shelters.

In the remaining farms cleaning was done daily, weekly or once in a while (Fig. 3). The floor of the huts was swept using a local bloom (made out of *Cistus* or oak branches) by women or children and disinfectants were never used.

3.3. Breeding and production parameters

Breeding stock was mainly obtained from hatching on the farm. Mating took place naturally at the homestead without any particular intervention from the farmers. Birds raised were of indigenous stock. However, breeds/strains of birds were not well characterized being a mixture of pure indigenous and crossbreds. On the basis of breeding records of 1 hen/farm it was found that the mean number of clutches/year was 1.8 (Table VI).

TABLE VI. PRODUCTION PARAMETERS OF FAMILY POULTRY

	Clutches per year	Eggs per clutch	Clutch eggs incubated	Chicks hatched	Chicks reared
Mean	1.8	14.2	14.2	10.9	7.1
SE	0.4	1.0	1.0	1.7	1.3
Min.	1.0	12.0	12.0	8.0	4.0
Max.	2.0	16.0	16.0	14.0	10.0

Se = standard error; Min. = minimum; Max. = maximum

Hens laid eggs in any place at the vicinity of the house. The eggs were collected daily by the women. They were kept in small baskets and placed in a relatively cool area in the house (such as an old kitchen or room) until used for local consumption, sold or hatched. When women noticed that a hen was ready to hatch eggs (like when she isolated herself and laid down frequently), they caught her and placed her over an egg clutch. Most farmers used clutches of about 14–18 eggs which were put in a basket or a box with straw bedding like a nest. Once hatched, the chicks were kept with the brooding hen within the premises of the house.

Ninety-two % of farms kept at least one cock in their farms, whereas 8% did not at all. Farm ratios of cocks/hens were quite satisfactory and they ranged from 0.05–0.5. Ratios up to 0.1 were found in 20% of farms and ratios between 0.11–0.2 were recorded in 44% of farms (Fig. 4). It should be noted that cocks were kept for breeding as well as for trade. Most farmers reported that at times they borrowed a cock from neighbouring households to mate with their hens.

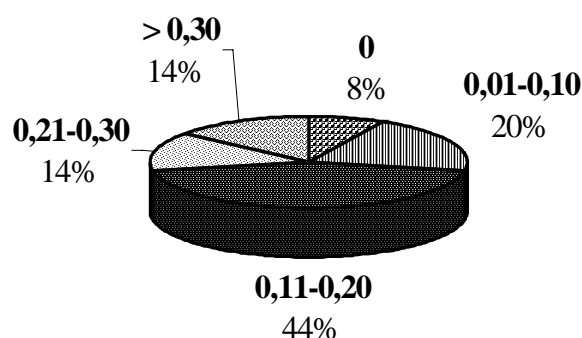


FIG. 4. Distribution of male/female ratios in surveyed farms.

3.4. Labour profile and marketing of chicken products

Women were the main owners and managers of family poultry in all surveyed farms. They accomplished most of the production tasks from construction of shelters to treatment of sick birds. Children provided also manpower particularly in cleaning hen shelters (Fig. 5). Women were generally not educated and never attended school. They had no background in modern poultry keeping.

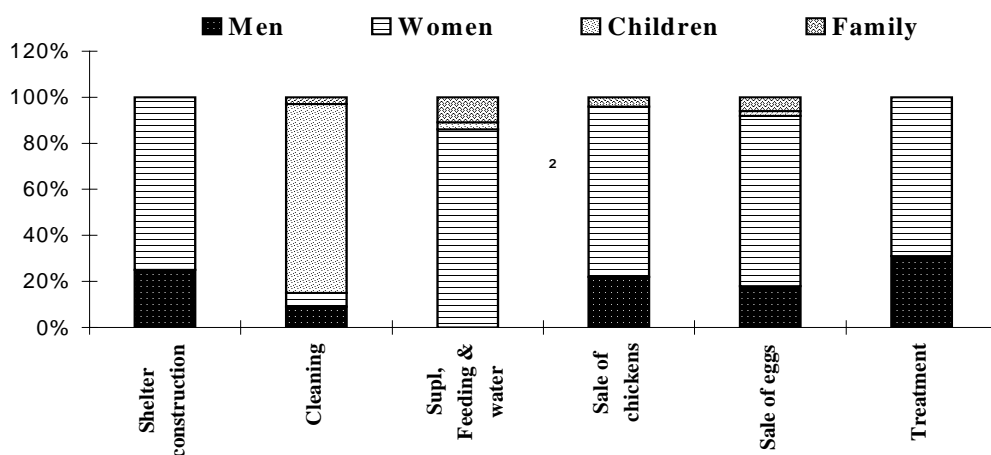


FIG. 5. Division of tasks between household members with regard to family poultry management.

Poultry products were marketed in the local weekly markets, the “souks”, by 100% of the farmers. Souks are rural markets that are very common in all regions of Morocco. In general, souks are located in the nearest small town with a limited number of houses and shops. The distance between farms in surveyed villages and their respective souks varied from 15–25 km. Chicken products were also traded in neighbouring villages or in the same village (Fig. 6). There were also other ways to trade chicken products, such as selling to tradesmen, relatives, itinerant salesmen or to consumers (in 68%, 68%, 18% and 18% of the cases, respectively). Souks offered a great advantage for the farmers to sell their products, but constituted a major sanitary concern since chickens could easily get infected with infectious diseases such as NCD and thus transport viruses back to the farm.

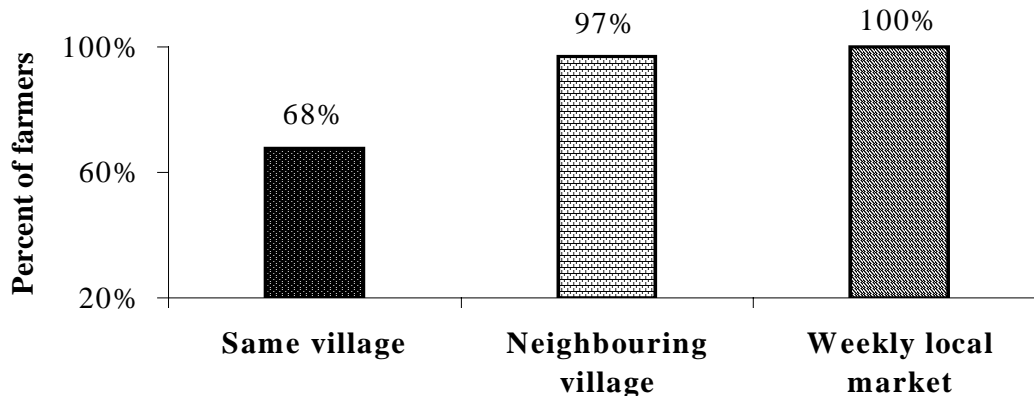


FIG. 6. Marketing of chicken products.

Women were the main sellers of poultry products. Each week, they would go to the market with other members of their family (either husbands and/or children when they were not at school). They would bring for sale whatever had been produced during the preceding week. In each souk, there was a particular area (or corner) where both commercial and traditional poultry products were marketed.

Chickens and turkeys were the type of poultry most frequently found in markets. It was rare to see guinea fowl. Male chickens were most often sold at markets. The hens were kept for laying and hatching eggs.

The income derived from selling poultry products was used by women for buying goods for themselves and their children.

Not all poultry products were marketed, but also used by farmers for their own consumption. Chickens were used for special occasions such as birthdays, religious events or for guests. Most eggs were used for hatching, but some were used for local consumption, generally for children.

3.5. Disease occurrence

The survey showed that all farmers knew Newcastle disease (NCD) and had experienced its occurrence in their own village and farms (Fig. 7). The common name of NCD is “Bouchnik”. According to farmers, the disease was recognizable by its rapid course and clinical signs including greenish to whitish diarrhoea, coughing and twisted neck, and high mortality. The farmers noticed that NCD mostly occurred during the wet season from November to December. They pointed out that NCD outbreaks occurred when new chickens were purchased and brought to the village.

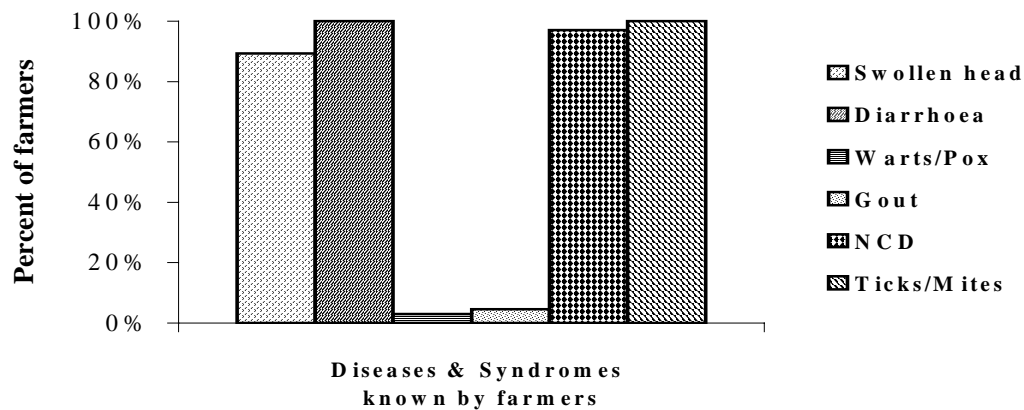


FIG. 7. Clinical signs and diseases of poultry recognised by farmers in Morocco.

Other clinical signs and diseases frequently recognised by farmers were swollen head, diarrhoea and external parasitic diseases such as caused by ticks (called “Isifane” in the local language). They had no knowledge of infectious bursal disease or other infectious diseases. Causes of mortality in poultry other than diseases were predators and accidents. The major predators in the areas surveyed were sparrow hawks, which were particularly dangerous for young chickens.

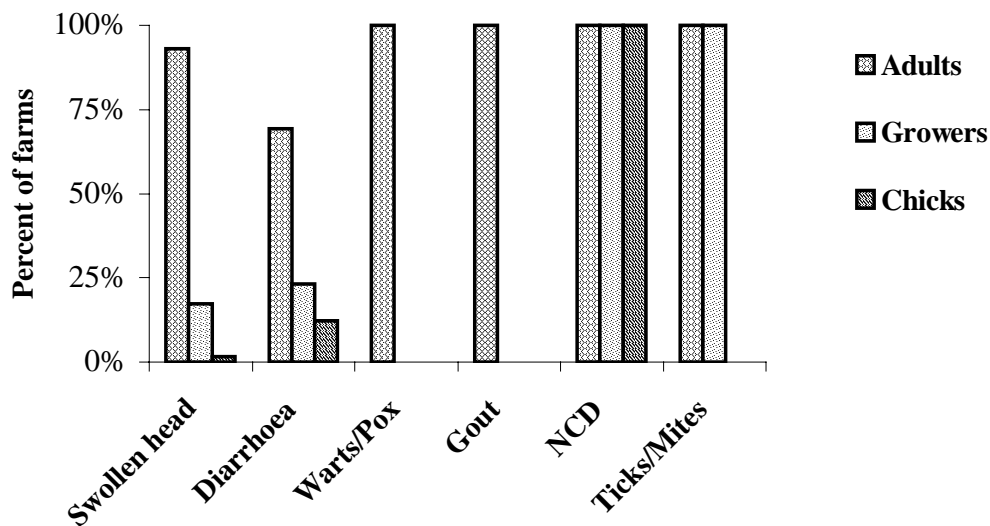


FIG. 8. Prevalence of clinical signs and diseases according to age groups.

3.6. Interventions

The survey showed that family poultry did not benefit from any veterinary intervention (neither public nor private). No national program had been implemented for this sector nor were any sanitary or preventive disease measures such as vaccinations or anti-parasitic drugs used on the farms that were involved in the survey. However, farmers did use local treatments (Fig. 9).

Contraceptive pills were used frequently by farmers to treat swollen head and diarrhoea. They were also used to stimulate growth in sick chicks. The pills were made available to women through



FIG. 9. Common local treatments used by farmers.

national birth control programs. Antibiotic tablets for obstetric use in cattle were used to treat NCD, swollen head and diarrhoea. They were purchased by women from the local chemist, crushed and dissolved in water and given to chickens through the drinking water. Besides the ineffectiveness of this treatment, antibiotic resistance can constitute a serious disadvantage. Bleach was used by a small proportion of farmers to treat swollen head and diarrhoea. Used engine oil was used by 5% of the farmers to treat tick and mite infestations. The birds were wiped with the oil all over their body. According to the farmers the treatment was very effective and gave very good results. However, the birds remained unthrifty for several days following treatment.

3.7. Mortality

Total losses in the surveyed farms during the dry season reached 21.5% (Table VII). The highest losses were recorded in village Ouled Said (53.5%). Most of these losses were among chicks and growers (23.3%).

TABLE VII. MORTALITY FIGURES AMONG FAMILY POULTRY DURING THE DRY SEASON

Villages		Mortality (number of dead/total number of birds)		
		Chicks	Chickens	Total
Zone I	Ouled Salem	19% (40/212)	9% (12/141)	15% (52/353)
	Ouled Said	36% (16/44)	71% (30/42)	54% (46/86)
Zone II	Houdrane	31% (13/42)	13% (9/68)	20% (22/110)
	Ait Chaou	25% (7/28)	0% (0/22)	14% (7/50)
Total		23% (76/326)	17% (51/273)	21% (127/599)

During the wet season, mean mortality rates in the villages were very high. They reached 53% in ecological zone 1 and 48% in zone 2. No significant differences in mortality between dry and wet seasons were noticed.

Fifty percent of the farmers reported that losses of chickens occurred either during the dry or the wet season. Some farmers (26%) thought that most losses happened during the dry season and only 20% thought that during the wet season most losses occurred (Fig. 10).

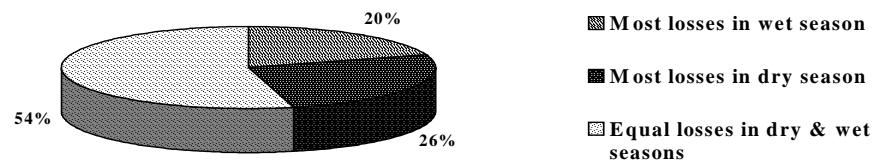


FIG. 10. Distribution of losses during the dry and wet season.

3.8. Pathological and parasitological findings

Pathological investigations (necropsy and histopathology) was carried out on 25 birds from ecological zone 1 (Table VIII). The results showed that nine birds had severe bursal lesions highly suggestive of Gumboro disease (GD). Six birds (24%) had severe respiratory changes and were suspected of having a viral infection, either NCD or infectious bronchitis. Bacterial infections (*E. coli* or *Salmonella* infections) were suspected in five birds showing bronchopneumonia, interstitial and perihepatitis, pericarditis or necrotic enteritis. Starvation and exhaustion were found to be the cause of death in three chicks. Severe hemolysis associated with icterus was found in one adult hen and gout in another one (Table VIII). The pathological findings showed that besides GD and NCD, other diseases were also prevalent and should be considered in any disease monitoring or prevention program concerned with family poultry.

TABLE VIII. PATHOLOGICAL FINDINGS

Main lesions	Number of cases	Age group affected	(Presumed) diagnosis
Peribronchitis/bronchiolitis Tracheitis	6	Chicks, growers and adult	Viral infection: NCD/IB
Bursal lesions: lymphoid depletion/necrosis	9	Chicks & growers	Gumboro disease
Bronchopneumonia, fibrinous/suppurative or pericarditis/hepatitis	5	Chicks	Bacterial infection <i>E. coli/Salmonella</i>
Dehydration and cachexia	3	Chicks	Hunger and exhaustion
Hemolytic icterus	1	Adult	Hemolysis
Visceral gout	1	Grower	Gout
Total of necropsied birds	25		

Furthermore, parasitic diseases should be considered among the major constraints to family poultry. During the necropsy of 25 birds, 12 (48%) had helminths in the intestinal tract. *Ascaridia* spp. *Heterakis gallinarum*, *Capillaria* spp. and *Raillietina* were among the parasites identified (Table IX).

Tick infestation was another health hazard detected in family poultry in Morocco. It occurred in all surveyed flocks mainly during the dry and hot period. Most chickens examined at that period were unthrifty and very pale and heavily infested by different types of parasites including ticks (*Argas* spp.

and *Rhipicephalus* spp.), skin mites (*Ornithonyssus bursa*) and sticklight fleas (*Echidnophaga gallinacea*).

TABLE IX. PARASITOLOGICAL FINDINGS

Nematodes/cestodes	Number of birds	Age group	Location in intestinal tract
<i>Asacridia</i> spp. alone	4	Chicks, growers	Small intestine
<i>Heterakis gallinarum</i> alone	3	Chicks, growers	Coecum
<i>Heterakis gallinarum</i> + <i>Capillaria</i>	1	Chicks	Coecum Small intestine
<i>Heterakis gallinarum</i> + <i>Capillaria</i> + <i>Raillietina</i>	2	Growers	Coecum Small intestine
<i>Raillietina</i>	2	Adult	Small intestine
Total of birds	12		

4. DISCUSSION

The results showed that the majority of farmers (75%) owned small-sized flocks of 2–20 chickens (Fig. 1). Farmers in ecological zone 2 seemed to own larger flocks than farmers in zone 1. This slight difference might be related to the location of each zone, since zone 2 was located close to major inter-city roads, while zone 1 was located in a more remote area of the countryside. The figures were similar to those reported in other countries [3, 4, 5]. However, the situation was quite different from that in countries like Mali [6], where the mean flock size was larger than reported for Morocco. The difference could be explained in part by the role of village and commercial poultry. In Mali, 95% of poultry production is fulfilled by village poultry, whereas in Morocco it is mainly fulfilled by the commercial sector.

Tables IV and V show that chickens were the most important type of family poultry in Morocco. This situation is similar to that reported for Botswana [4].

The mean number of clutches/year was 1.8 (Table VI). Higher figures were found in other countries of Africa and Asia reaching 3–5 clutches/year [4, 7, 8]. The mean number of eggs/clutch was 14.2, the mean number of eggs incubated was 14.2 and that of chicks reared was 7.1 for a mean of 10.9 hatched chicks. This gave a mean hatchability of 77%, which was slightly lower than that reported by Kingston [9] in Indonesia and Moreki [4] in Botswana (82% hatchability). On the other hand, only 50% of hatched chicks reached maturity. These losses could be attributed to mortality mainly due to NCD and GD or to very poor feeding resources. Other causes of chick losses were predators or accidents. Our findings agree with those of Moreki *et al.* [4], who suggested that reducing chick mortality represented an area of potential improvement for family poultry.

The mortality figures shown in Table VII and Figure 10 emphasize the heavy economic losses incurred by the family poultry production systems in the two ecological zones. This situation is similar to what has been reported in other developing countries where family poultry is a source of income to the rural population and where mortality of chickens is very high [10, 11, 4, 12]. On the other hand, the high mortality figures explain to a great extent why most farms owned small-size flocks since re-stocking is severely constrained and does not take place at a normal and regular pace.

Outbreaks of GD have been described previously in commercial poultry in Morocco [13, 14]. However, no reports of GD in Moroccan family poultry have been published previously. NCD has been reported to be highly prevalent in both commercial and family poultry in Morocco [15, 16] as well as in other parts of Africa and Asia [10, 17, 12]. No vaccination of family poultry is implemented in Morocco [18]. Our results indicated that GD and NCD were the most frequently diagnosed diseases during our survey and could be considered as major health hazards to family poultry causing heavy losses among chickens. However, other diseases should also be considered health constraints to family poultry including infectious bronchitis and parasitic diseases (endoparasites and ectoparasites).

Many traditional remedies were used by the farmers to treat sick birds. The use of such inappropriate treatments may be attributed to illiteracy, poverty, lack of knowledge of basic health and management practices, and lack of institutional interventions.

The helminth parasites detected in Morocco were also described in other countries of Africa. They were reported to be the most prevalent nematodes in the gastrointestinal tract of scavenging poultry in the Morogoro region, Tanzania [19]. However, the ectoparasites detected in Morocco were different from those found in Tanzania [19] probably due to ecological differences between the two countries.

In conclusion, family poultry in Morocco is raised in a traditional extensive system characterized by a small flock size, weak production records, few financial inputs and a poor feeding system. Flocks are owned by women, who are generally illiterate and lack basic skills in management and health of poultry. Consequently, the sector experiences high losses due to mortality and diseases including NCD, GD and parasitic diseases.

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