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Evaluation of the Sudanese Native Chicken Production System and Major Constraints

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Abstract
The objective of this study was to assess the production system of the Sudanese native chicken kept under traditional conditions. The study was conducted in three different regions: namely Kordofan, Blue Nile and Gedaref. However within each region three to five districts were randomly selected and similarly two to five villages from every district were also considered. A total of 209 households were interviewed and a structured pre-tested questionnaire was administered to them. The statistical software SPSS was used to obtain descriptive statistics, while ANOVA and Duncan Multiple Range Test were applied for comparing and separating means among the surveyed regions, respectively. The study revealed that native chickens were predominantly raised under the extensive production system (98.4%). Among the livestock diversity kept by the households, chicken exhibited the lowest ranking priority. On the other hand women were classified as the highest contributors to chicken ownership, management and decision making within the families. The flock size and cock: hen ratio ranged from 25.4 to 37.0 and 1: 2.24 to 1: 3.34, respectively. The main purposes of native chicken keeping in this study were meat provision and cash generating. As indicated by respondents, prevalence of infectious diseases, predators and lack of veterinary services and heath care were considered to be the major constraints facing the Sudanese native chickens keeping under the extensive system.
Key words: native chicken, production system, major constrains. Household Survey

المستخلص
هدفت هذه الدراسة إلى تقييم نظام تربية الدجاج البلدي السوداني المربأة تحت الظروف التقليدية. أجريت هذه الدراسة في ثلاث مناطق سودانية مختلفة وهي كردفان و النيل الأزرق والقضارف وقد اختيرت في كل منطقة ثلاث إلى خمس محليات عشوائياً وبنفس القدر اختيرت في كل محلية أثنين إلى خمس قرى. تمت مقابلة مائتين وتسع اسرة منتجة كما ملئت استبانات محكمة ومختبرة مسبقاً. حللت البيانات احصائياً باستخدام برنامج الحزمة الاحصائية (SPSS) بينما طبق جدول تحليل التباين واختبار دنكن ذو الاختبارات المتعددة للمقارنة والفصل بين متوسطات المناطق الممسوحة على التوالى. أوضحت الدراسة أن نظام التربية التقليدية المفتوح هو السائد بنسبة (98.4%). أما من بين انواع الحيوانات المتنوعة المربأة، حصل الدجاج على الترتيب الأدنى من حيث الأولوية، ومن ناحية أخرى من بين أفراد الأسرة المرأة صنفت على أنها الأكثر ملكية لقطعان الدجاج ولها مشاركة مقدرة وفاعلة في رعايتها واتخاذ القرارات المتعلقة بالاستهلاك والتسويق، يتراوح حجم القطيع ونسبة الديوك إلى الدجاج بين 25.4 إلى 37.0 و 1: 2.24 إلى 3.34 على التوالي، أظهرت هذه الدراسة أن الغرض الرئيسي لتربية الدجاج البلدي توفير اللحم وزيادة دخل الأسر، أشار المستجيبون للدراسة إلى أن الامراض الوبائية المعدية و المفترسات و نقص الخدمات البيطرية و الرعاية الصحية يعتبر من المهددات الرئيسية التي تواجه تربية الدجاج البلدي السوداني تحت النظام التقليدي.

Introduction

The traditional poultry production in Sudan as well as in other developing countries plays an important socioeconomic role (Alders, 2004; Mekki *et al*., 2005 and Harun *et al.,* 2001). Local chickens are the main source in supplementing the rural community with highly nutritive food for family consumption, in addition to increasing households income, which considered as one of the most important tool in poverty alleviation. Moreover, native chickens play an active role in pest control and are used for traditional ceremonies and festivals (Alders and Spradbrow, 2000). The extensive production system which is dominant in most African countries is mainly based on

scavenging with occasional supplementation of few scattered cereals (Natukunda *et al.,* 2011). In this system, chicken ownership is shared among family members but women are exclusively the major contributors. Predators and infectious diseases were considered to be the largest threat to village chicken production (Leta and Bekana 2010). In Sudan, native chicken is widely spread across villages and town dwellings representing 80% of chicken population in the country. This is because of its high adaptability to harsh managerial conditions, in addition to its role in maintaining household's food security and cash generating. Despite the vital role of native chicken, little effort has been exerted towards investigating and characterizing its production system as part of attempts for genetic and phenotypic improvement. Therefore, the objectives of the present study were to:

1/ Characterize Sudanese native chicken traditional production system

2/ Identify the major constraints facing this production system.

Material and Methods

Study area and design

The geographical features of the study area represented three different agro-ecological zones namely Kordofan (Sandy), Blue Nile (Clayey) and Gedaref (Clayey). These regions are located at 11° 47 N to 14° 24 N latitude, 28° 26 E to 35° 47 E longitude and 1371 ft to 1965 ft altitude above sea level. The average temperature varies from 27°C to 29°C, whereas the annual rain fall ranges from 318 ml to 713 ml. The climatic feature ranges from tropical in Kordafan region to tropical forest in Blue Nile and Gadaref regions. A survey was conducted in the three regions where in each region 3-5 districts were randomly selected and from every district, 2-5 villages were also considered.

Questionnaire distribution

A structured pre-tested questionnaire was used to collect data about the Sudanese native chickens reared under traditional conditions from households, where a total of 209 of them were interviewed. Households were selected according to their traditional ability to breed their own native chickens and showed the desire to participate in data collection. The sampled data included information about specific aspects of indigenous chicken, household profile, production systems, flock size, purposes of chicken keeping, management practices, major constraints facing indigenous chicken keeping, and factors affecting decision making for selling and consuming chicken products. Moreover, direct observations and participatory farmer' group discussions were considered as secondary approach for data collection and verification.

Statistical analysis

Data were analyzed using statistical software SPSS Verion-16 to obtain descriptive statistics for sampled populations, however, ANOVA was used to compare data obtained from different regions while means were separated by Duncan's Multiple Range Test. Also the Chi square (χ^2) test for independence to detect differences between regions was used.

Results and Discussions

Table 1 shows the households gender, main activity and ranking of income sources in the surveyed regions. The present study revealed that females represented 42.6% of the respondent households to the structured questionnaire whereas males were 57.4%. Chi square analysis for farmer's sex associated to regions was found to be significant ($P \leq 0.05$); which indicates that males and females contribute significantly to the households' income activities and resource controlling. Furthermore the present study indicated that the main activity practiced by respondent farmers was agriculture (82.7%), whereas livestock rearing represented only (17.3%). This result agrees with Muchadeyi *et al.* (2007). Regarding income sources where the least mean value was ranked as the best source, crop production seemed to be the most important income source across the regions followed by private works. On the other hand the relatively low rank given to livestock production as a source of income generation may be due to the high risks facing this sector as the result of infectious diseases prevalence, low turnover of livestock species and long generation intervals (with exception of poultry), inefficient health control strategies and absence of marketing channels compared to those in crops marketing (Muchadeyi *et al.*, 2007; Omamo, 1998 and Tisdell, 2003).

Table 1: Households gender, main activities and income sources ranking

	Regions				
	Kordofan	Blue Nile	Gedaref	Overall	Sig
Households gender (%)					
Male	45.7	63.5	75.0	57.4	***
Female	54.3	36.5	25.0	42.6	***
Farmer main activity (%)					
Livestock	16.3	25.5	11.5	17.3	N.S
Agriculture	83.7	75.6	88.5	82.7	N.S
Source of income Ranking (mean± SD)					
Crops	1.29^{a}±0.50	1.74^{b}±0.71	1.26^{a}±0.44	1.35±0.55	***
Home industry	2.67^{a}±0.64	2.21^{a}±0.98	-	2.50±0.80	N.S
Salary	2.00^{a}±1.04	2.23^{a}±1.09	2.12^{a}±0.84	2.09±1.01	N.S
Livestock-production	1.99^{a}±0.63	1.81^{a}±0.74	1.92^{a}±0.67	1.93±0.67	N.S
Private work	-	1.44^{a}±0.78	2.20^{a}±0.92	1.71±0.90	**

a,b, c, ***= highly significant, N. S. = Not significant with the same letters within the same row.
The least mean rank is the most important one.
*chi square at $P \leq 0.05$ associated to regions.

Table 2 presents ranking means of types of livestock keeping and crops grown by farmers across the regions. The livestock kept were cattle, goats, sheep and chickens. The results indicated that goats and sheep were the most popular species across the regions, whereas cattle and chickens were significantly different ($P \leq 0.05$) associated to regions. Cattle ranked first as the most important livestock species kept in Blue Nile and Gedaref region; in contrast to goats which were highly ranked in Kordofan. These discrepancies could be attributed to the role of agro-ecological system that defines the species of livestock kept by households. Despite the lower ranking chickens socio-economic role in rural societies, Mapiye *et al.* (2008) and Mlambo *et al.* (2011) stated that the low returns of village chicken production in the rural areas can be attributed to luck of empirical case studies, the use of conventional and sometimes inappropriate economic models to measure production and financial returns as well as the failure to consider all uses of chickens multiple non-cash outputs such as manure, traditional purposes, home consumption, social obligations and status. The present results indicated that among crops grown by households, sorghum received the highest ranking in Blue Nile and Gedaref; however millet was the highest ranking crop in Kordofan. Sorghum and groundnut were significantly different ($P \leq 0.05$) associated to regions. This emphasizes the variation of environmental conditions among different regions which play major role in specifying the type of crops grown in certain areas. The present study revealed that 98.4% of households across the regions used extensive production system which could be described as the most suitable low input-low output system. Several authors reported similar results for most African countries (Leta and Bekana, 2010; Kugonza *et al.,* 2008; and Fisseha *et al.,* 2010). The results showed variation among households' family members who headed the flocks across surveyed regions. However, women in Kordofan region, have remarkable contribution on headed flocks. The results indicated that women in this region may have their rights attached to gender issue and/or may be due to the comprehensive implementation programs done by developmental organizations which were encouraging and enhancing women for better life's welfare and provision of the urgent family needs. In contrast to largely family headed flocks (67.3%) in Gedaref, this indicates that local chickens has greater role in households food security. In sub-Saharan Africa, indigenous chickens are owned and managed by women and children and often essential part of female-headed households (Ahlers *et al.,* 2009). Promotion of indigenous chicken production therefore, economically empowers the rural youth and women (Guèye, 2009).

Table 3 presents chicken flock structure and mean flock size in various regions. The average chicken flock size/household was found to be 31.18 birds. The flock consisted of chicks

(11.6%), pullets (6.1%), cockerels (4.7%), hens (5.4%) and cocks (2.0%). This result is in accordance with those reported by Nakkazi *et al.* (2014) in North Uganda. Results shown in Table 3; were greater than those reported by Gondwe and Wollny (2004); Gueye (1997) and Wani *et al.* (2014). The study revealed significant difference (P≤0.05) among chicken age groups (pullets, cockerels and hens) across the regions; this may reflect the variation among farmers' production objectives, flocks dynamics and prevalence of diseases.

Table 4 shows the ranking means of chicken keeping purposes and types of supplemented feed and predators. The results revealed that meat production was the most important purpose for keeping chickens in all the regions of the study, followed by the purpose of cash income. These results are in line with those reported by Muchadeyi *et al.* (2007) and Sharma (2004).

Table 2: Livestock ranking, crops grown, production systems and households ownerships in the studied regions

Item	Kordofan	Blue Nile	Gedaref	Overall mean	Sig
Livestock Ranking	**(mean**± SD)				
Cattle	2.88^{b}±1.13	1.17^{a}±0.41	1.11^{a}±0.33	1.74±1.10	***
Goats	1.37^{a}±0.55	1.42^{a}±0.61	1.61^{a}±0.56	1.43±0.56	N.S
Sheep	1.57^{ab}±0.63	1.25^{a}±0.45	1.64^{b}±0.76	1.54±0.65	N.S
Chickens	2.33^{b}±0.74	1.83^{a}±0.79	2.16^{b}±0.90	2.16±0.82	***
Corps grown	**(mean**± SD)				
Sorghum	2.79^{b}±1.41	1.15^{a}±0.37	1.28^{a}±0.72	1.89±1.28	***
Millet	2.09^{a}±1.31	1.50^{a}±0.58a	2.27^{a}±0.83	2.11±1.18	N.S
Sesame	2.19^{a}±1.20	2.00^{a}±0.78	1.92^{a}±0.35	2.08±0.97	N.S
Groundnut	2.17^{a}±0.95	1.88^{a}±0.64	3.21^{b}±0.70	2.29±0.97	***
Roselle	3.42^{a}± 1.29	3.00^{a}±0.00	-	3.41±1.28	N.S
Vigna	4.72^{a}± 1.23	-	2.67^{a} ±1.53	4.56±1.35	N.S
Watermelon	3.44^{a}± 1.18	-	4.50^{a}± 0.71	3.50± 1.08	N.S
Production systems (%)					
Extensive	99.1	98.04	98.1	98.4	N.S
Semi-intensive	0.9	2.0	1.9	1.6	N.S
Intensive	0.0	0.0	0.0	0.0	N.S
Households Ownerships (%)					
Women	50.5	32.7	6.1	35.4	***
Head	10.5	25.0	24.5	17.5	***
Children	3.8	11.5	2.0	5.3	***
Family	35.2	30.8	67.3	41.7	***

a,b, c means *** highly significant, N. S. = Same letters within the row are not significant.
The least mean rank is the most important one. *chi square at P ≤ 0.05 associated to regions.

Table 3: Chicken flock structure and mean flock size per household in the studied regions

	Chicken age group						
Region	Chicks Mean±SD	Pullets Mean±SD	Cockerels Mean±SD	Hens Mean±SD	Cocks Mean±SD	Hen: cock Ratio	Flock size
Kordofan	10.8^{a}±7.1	4.7^{a}±3.4	3.7^{a}±2.0	4.4^{a}±2.5	1.8^{a}±1.2	2.4 : 1	25.4
Blue Nile	10.6^{a}±7.3	7.2^{b}±5.3	4.7^{ab}±3.6	6.8^{b}±3.4	2.0^{a}±1.1	3.4 :1	31.3
Gedaref	14.2^{a}±13.6	7.8^{b}±6.5	6.7±7^{b}.62	6.0^{b}±6.6	2.3^{a}±1.7	2.6 : 1	37.0
Overall	11.6±9.4	6.1±5.0	4.7±4.7	5.4±4.2	2.0±1.3	2.7 : 1	31.18
Sig	**N.S**	***	***	***	N.S		

a,b, c, *** = highly significant., N. S. = same letters within the same column is not significant.

The cash income and food purposes were the primary goals of indigenous chicken keeping in developing countries (Sonaiya and Swan (2004). The results ranked sorghum as the most important type of feed provided to the local chickens in all regions, flowed by millet. However the kitchen wastes received the least ranking due to the fact that rural farmers depend on a very simple meal without enough remainders. On the other hand, the study indicated that there was no formulated ration supplemented to indigenous chickens; this explains their tendency for acquiring scavenging behavior to compensate the required deficient elements. This result is similar to those reported by Leta and Bekana (2010) and Halima (2007). The spread of several types of predators (cats, snakes and falcons) presented significant difference among the surveyed regions. However the participatory group discussion claimed that cats were the major chicken predator, flowed by Zorilla (locally called *abuefein*). These results were similar to findings reported by Halima *et al.* (2007), in addition to Bell and Abdou (1995) who stated that predation was one of the major village chicken production constraints that causes a large proportion of village chickens losses in some African countries.

Table 5 presents the households' members who participate in chickens marketing, drugs purchasing and chickens and eggs consumption decision as well as general decision making. The results showed significant differences ($P \leq 0.05$) in households' activities ranking across the three regions. Furthermore, in contrast to men the study revealed that women play a major role in contribution to all households' chickens' activities including decision making, particularly in Kordofan and Blue Nile regions. This fact could be explained with regard to the historical traditions of jobs assignments in rural societies of Sudan, where men usually devote themselves to hard tasks such as agriculture, pasture, building houses, security and other community reconciliation affairs; leaving women to take much responsibilities towards chickens keeping activities. On the other hand it seemed that children have no spread remarkable contributions attached to local chicken in Sudan. These findings are in agreement with those reported by Mapiye and Sibanda Fentie *et al.* (2013) and Wondu *et al.* (2013)

Table 4: Ranking of chicken keeping purposes and types of feed supplementation and predators

	Kordofan	Blue Nile	Gadaref	Overall mean	Sig
Chicken keeping Purposes (mean± SD)					
Meat	1.62^{a}±0.86	1.70^{a}±0.73	1.51^{a}±0.69	1.62±0.79	N.S
Eggs	2.62^{b}±0.86	2.50^{a}±0.91	2.97^{b}±0.97	2.67±0.91	N.S
Feather	4.00^{a}±2.83	2.00^{a}±0.00	-	3.33±2.31	N.S
Manure	4.07^{a}±0.88	3.86^{a}±1.22	-	4.00±0.98	N.S
Cash from sales	2.66^{c}±1.01	1.74^{a}±0.95a	2.21^{b}±1.02	2.30±1.07	***
Cultural	2.60^{a}±1.18	2.92^{a}±0.94	2.71^{a}±1.00	2.69±1.09	N.S
Types of feed (mean± SD)					
Sorghum	1.06^{ab}±0.25	1.00^{a}±0.00	1.10^{b}±0.30	1.05±0.23	NS
Millet	1.57^{a}±0.57	2.25^{b}±0.50	1.37^{a}±0.50	1.55±0.58	***
Sesame	1.95^{a}±0.38	2.08^{a}±0.28	2.06^{a}±0.44	2.02±0.44	NS
Kitchen waste	2.19^{a}±0.45	2.17^{a}±0.39	2.35^{a} ±0.67	2.22±0.50	NS
Predators (mean± SD)					
Cat	1.67^{b}±0.79	1.41^{ab}±0.66	1.15^{a}±0.36	1.42±0.66	***
Mouse	2.00^{a}±1.10	1.83^{a}±0.70	2.50^{a}±1.29	1.93±0.83	N.S
Snake	1.67^{a}±1.16	1.57^{a}±0.54	3.00^{b}±0.00	2.07±0.88	***
Mongoose	2.20^{a}±0.84	1.00^{a}±0.00	2.14^{a}±1.46	2.00±1.18	N.S
Civet	1.95^{a}±0.84	-	1.00^{a} ±0.00	1.91±0.85	N.S
Zorilla	1.69^{a}±0.62	2.00^{a}±0.00	1.80^{a}±0.45	1.70±0.60	N.S
Falcon	1.75^{a}±0.87	2.45^{b}±1.13	2.00^{a}±0.50	1.90±0.85	***
Hedgehog	2.29^{a}±0.91	1.00^{a}±0.00	-	2.20±0.94	N.S
dogs	2.25^{a}±0.89	2.88^{a}±1.64	-	2.56±1.32	N.S

a,b, c means *** highly significance. N. S. not significance with the same letters, within the same row. The least means rank is the most important one.

Table 5: Households members sharing chicken keeping activities

	Kordafan	Blue Nile	Gadaref	Overall	Sig
Who sell chickens (%)					
Women	70.4	39.4	32.4	51.2	***
Men	11.1	27.3	44.1	24.8	
Children	1.9	12.1	0.0	4.1	
Family	16.7	21.2	23.5	19.8	
Who make chickens selling Decision (%)					
Women	70.6	43.8	29.4	51.3	***
Men	17.6	21.9	38.2	24.8	
Children	0.0	12.5	2.9	4.3	
Family	11.8	21.9	29.4	19.7	
Who Purchase drugs (%)					
Women	60.0	21.1	9.5	36.0	***
Men	25.7	63.2	90.5	53.3	
Children	0.0	10.5	0.0	2.7	
Family	14.3	5.3	0.0	8.0	
Who make decision of chickens Consumption (%)					
Women	53.5	43.2	19.6	42.9	***
Men	21.2	22.7	39.1	25.9	
Children	0.0	2.3	2.2	1.1	
Family	25.3	31.8	39.1	30.2	
Who make decision of eggs Consumption (%)					
Women	59.8	44.2	23.8	47.5	***
Men	12.0	16.2	33.3	18.1	
Children	0.0	9.3	2.4	2.8	
Family	28.3	30.2	40.5	31.6	

*chi square at $P \leq 0.05$ associated to regions.

Figure 1 illustrates the husbandry practiced by respondents' households. The results indicated that most of the local chicken flocks in the studied regions were provided with supplementary feed, drinking water and cleaned houses; however, only 50% of the respondents provided their flocks with constructed shelters for night accommodation. The highest night shelter provision was in Gedaref (65%) and the lowest was in Kordofan (40%). This result indicates that most of the chicken owners are not aware with the importance of their local flocks.

Figure 2 presents the accessibility to veterinary services from government and private sector. The study showed that only 3.4% of village chicken owners received governmental veterinary services, whereas 35.4% of them were dependent on private veterinary services; while the majority (61.4%) did not receive any health care to their flocks. The inadequate and inappropriate veterinary services may emphasize the susceptibly of the Sudanese native chicken to some prevalent diseases, resulting in great losses. This result is in agreement with those reported by Moges *et al.* (2010) and Takele and Ali (2011) in Ethiopia.

Figure 3 shows the occurrence of Newcastle disease and external parasites in village flocks. It's obvious that Newcastle disease represents the major constrain affecting the rural poultry production in Sudan in addition to lack of governmental veterinary services and heath care (Figure 2). These findings were also confirmed by the participatory discussion group who also noted that Newcastle disease, parasites, poor feed supplementation and inadequate housing were the major constrains for village chicken production system in Sudan. Similar conclusion was reported by Illango *et al.* (2000) for Ugandan chicken and Otim *et al.* (2005) who mentioned that scavenging behaviour encourages the spread of Newcastle disease in village chickens.

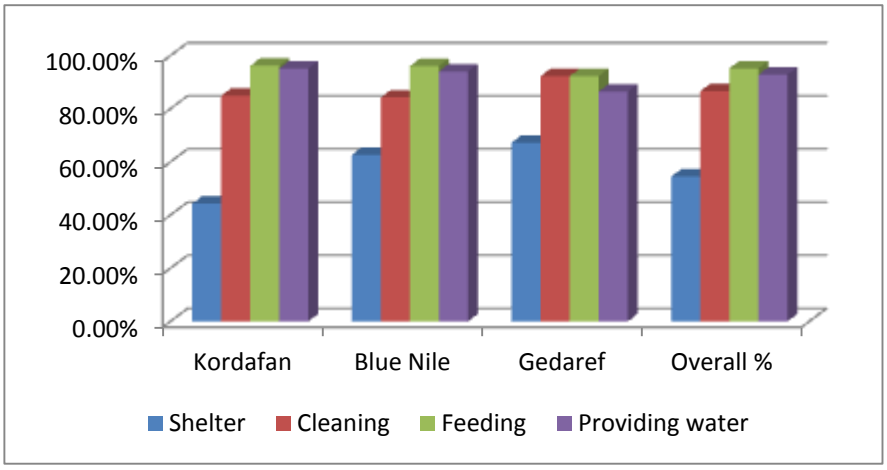

Figure 1: Husbandry practices in local chicken's production

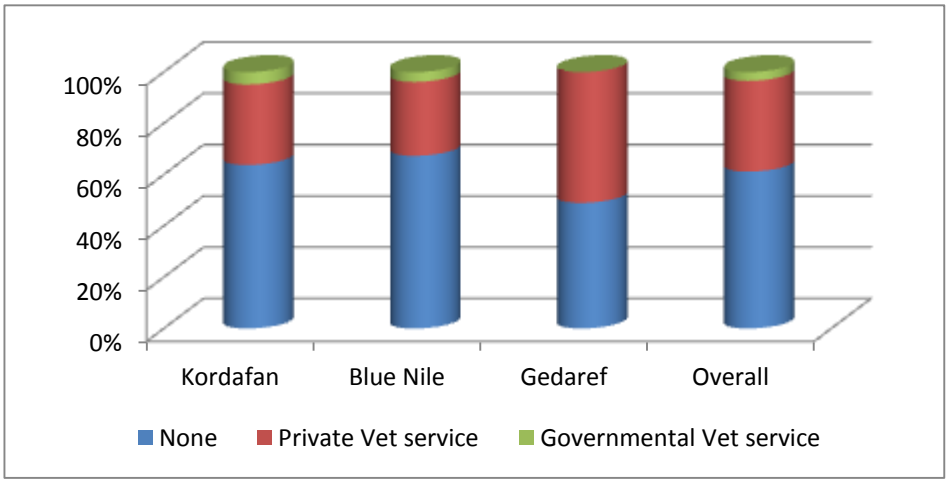

Figure 2 Accessibility to governmental and private veterinary services

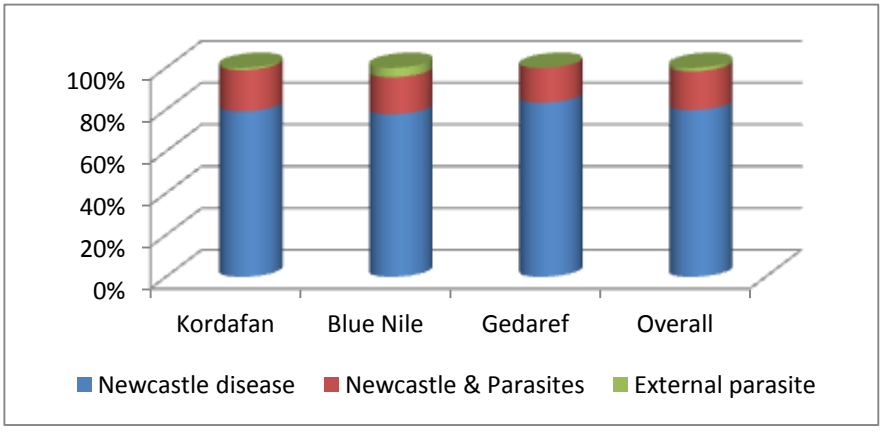

Figure 3: Occurrences of Newcastle disease and external parasites

Conclusion

The extensive production system was the most dominant chicken raising system adopted by households in the rural areas of Sudan. The main purposes for keeping chicken were meat provision and income generating. The major constraints for rural poultry keeping were prevalence of infectious diseases (mainly Newcastle disease) due to poor health care, lack of extension and veterinary services, predators and theft. Women in Kordofan as well as in other regions had remarkable contribution to local chicken production system.

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