

Full Length Research Paper

Production systems of village chickens in the Abu-Dhabi Emirate, UAE

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The study was undertaken to establish the village chicken (VC) production systems and to generate information on VC utilization, management practices, opportunities and challenges, using a survey. Only 20% of VC owners were females. The VC are raised mainly (80%) as dual purpose, eggs and meat. The average flock size is 457 layer hens, with 7:1 hens to cocks. Chickens houses were semi-closed cages (47%) partly shaded (20%), and shades with open range (32%). The hired labor was the sole person taking care of chickens and making the mating decisions in 85 and 68% of the properties, respectively. Selection is practiced by 37.5, 3, and 5% of large, medium and small flocks' owners, respectively. Cocks and hens replacements are from the same flock (97%). At least 61% of culling for hens and cocks is practiced for old age, 44% for low productivity and 5% for diseases. Thirteen VC breeds and crossbreds were found; the most available of which is the Emirati local breed which is found in 71% of the farms. Body weight was significantly ($P < 0.001$) affected by the interaction between breed and region. Daily egg productivity was 32.4%, with average hatchability of 75.9%. The VC was reared mainly as a hobby and for home consumption, since most of the Emirati people prefer the taste of VC and to ensure that both their meat and eggs sources are additives free. The VC has poor productivity under the existed conditions.

Key words: Village chickens, production system, management practices, flock size.

INTRODUCTION

Many meanings are found from the term village chickens (VC) in literature, though it can be defined as those chickens kept under traditional system of raising for multiple purposes with no identified description (FAO, 2012; Aklilu et al., 2013; Liyanage et al., 2015). Raising VC has several purposes in many regions of the world which include; local consumption, extra income, pest

control and manure production (Muchadeyi et al., 2004; Mtileni et al., 2009). In developing countries, 70% of the world's rural poor (2 billion people) depend on raising livestock as an important component of their livelihoods (Hoffmann and Scherf, 2005). VC is more adaptive to their climatic conditions, which is classified by small size and low egg production. In addition, Bondoc (1998) and

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Table 1. Distribution of gender of ownership property type and flock size by region.

Region	Overall	Abu-Dhabi	Al-Ain	Al-Dhafra	P-value
Total n	59	20	28	11	-
Gender ownership (%)	20.3	15.0	21.4	27.3	0.7051
Property type	-	-	-	-	0.0036
Registered animal farm (%)	22.0	30.0	25.0	0	-
Random animal farm (%)	13.6	0	28.6	0	-
Mixed farming (%)	64.4	70.0	46.4	100	-
Flock Size	-	-	-	-	0.1027
Small =< 100 layer (%)	32.2	35.0	21.4	54.6	-
Medium 101 - 500 layer (%)	54.2	45.0	71.4	27.3	-
Large > 500 layer (%)	13.6	20.0	7.1	18.2	-

Alshawabkeh and Tabbaa (2001) indicated that VC are used to utilize farm by-products and are mostly resistant to diseases and parasites.

Several production systems exist for chicken production, due to differences found in the environment and socio-economic situations of the traditional chicken growers in the world (Kitaly, 1996). Although most of the chickens' production systems are mainly based on free range (Dwinger et al., 2003), VC production in the United Arab Emirates (UAE) is mostly dependent on providing feed supplements. Housing of VC is variable under the UAE conditions (Unpublished data).

In general, even if VC breeds have low production rates, they are more adapted to their environment and may reserve essential and special genes or traits that may not be found in commercial breeds. No previous studies are available in the UAE regarding the production system of local breeds of chickens. Therefore, this study was undertaken to evaluate the VC production systems and to generate information on village based VC utilization, management practices, opportunities and challenges.

MATERIALS AND METHODS

The study area

The study was carried out in Abu-Dhabi Emirate which is located between 22°40' and 25°N and 51° and 56°E and was accomplished between March 2015 and June 2016, in 18 villages randomly selected from each municipality (Abu-Dhabi municipality (6), Al-Ain municipality (8) and Al-Dhafra municipality (4)). The Emirate is characterized with hot desert climate, low rainfall, and mostly clear skies all-year-round. Average maximum annual temperature is above 39°C with high humidity during the period from June to September, while cooler temperature (19°C) are experienced from November to March.

Sampling procedure

Households who raise more than 10 VC and willing to participate in the study within Abu-Dhabi Emirate were randomly selected. Keepers considered were those who keep VC under traditional

system of raising, for multiple purposes with no identified description, regardless of the flock size.

A stratified random sample of 59 chicken keepers in the three municipal regions (Abu-Dhabi (20), Al-Ain (28) and Al-Dhafra (11)) were interviewed; based on expected number of chicken keeper in Abu-Dhabi Emirate (Table 1). This sample represents 10% of the expected size of chicken keepers' population.

Data collection

A survey was conducted to study the production systems of VC' populations of the Abu-Dhabi Emirate. A field questionnaire was developed with the list of attributes and levels, including socio-economic information and chicken productivity. Descriptive information was collected on common flock sizes and structures, as well as on the uses of animals (FAO, 2012).

Statistical analysis

Statistical analysis was performed on qualitative survey data using the Chi-square test PROC FREQ procedure (SAS Institute, 2009). Least squares analysis of variance was utilized to study, the effect of the region, gender of VC keeper, sex, flock size and breed of chicken on quantitative data using GLM procedure (SAS Institute, 2009).

Flock size was classified as small if it was one hundred or less layer hens, medium with 101 to 500 layer hens and large flocks with more than 500 layer hens. This was based on previous study which shows that these sizes are related to utilization of VC production for home consumption, selling surplus or commercialization of production (unpublished data). Gender of VC keeper was tested in the initial analysis and found not significant on any of the studied criteria; therefore, it was removed from subsequent analyses. All possible interactions were also tested though only their two-way interactions were left in the final statistical model. Means for significant effects were compared at $P < 0.05$ using t-test.

RESULTS AND DISCUSSION

Socioeconomic role

Due to high income of the Abu-Dhabi Emirate people only 20% of VC owners were females and this was not different throughout the regions (Table 1). At the same

Table 2. Distribution of goal and purpose of raising chicken by region, property type and flock size.

Variable	n	Goal of raising			Purpose of raising		
		Home consumption (%)	Selling (%)	Selling surplus (%)	Egg (%)	Meat (%)	Dual purpose (%)
Overall	59	59.3	5.1	35.6	11.9	8.5	79.7
Region P-value	-		0.2850			0.0234	
Abu-Dhabi	20	60.0	0	40.0	30.0	10.0	60.0
Al-Ain	28	67.9	7.1	25.0	3.6	10.7	85.7
Al-Dhafra	11	36.4	9.1	54.6	0	0	100
Property type P-value	-		0.3610			0.0781	
Registered animal farm	13	61.5	15.4	23.1	30.8	15.4	53.9
Random animal farm	8	62.5	0	37.5	0	0	100
Mixed farming	38	57.9	2.6	39.5	7.9	7.9	84.2
Flock size P-value	-		0.0765			0.5511	
Small =< 100 layer	19	68.4	0	31.6	21.1	5.3	73.7
Medium 101 - 500 layer	32	56.3	3.1	40.6	9.4	9.4	81.3
Large > 500 layer	8	50.0	25.0	25.0	0	12.5	87.5

time, gender of owner has no effect on any of the studied criteria. Though, VC are essential in countries with high poverty since they play a major role as a starter capital, economic buffers, source of animal protein as meat and eggs, standby cash and social activity enforcer (Dinka et al., 2010; Mtileni et al., 2013; Chrishanthan et al., 2014; Haoua et al., 2015). Therefore, the majority of VC ownership in the poor countries were women and children and were given the responsibility for management and production as an agribusiness activity for income generating (Dinka et al., 2010; Nduthu, 2015).

Also, VC in the UAE is not linked to the religious or socio-cultural practices as in most Muslim countries (Abdelqader et al., 2007). Though, in other parts of the world it is linked to religious functions (Gueye, 1998; Fotsa et al., 2007; Dinka et al., 2010; Nduthu, 2015). The visited properties in this study were registered as animal farms all owned by males, random animal farms 50% owned by females and mixed farms 21% owned by females. Gender was considered as a factor in the initial statistical analysis; however, it has no effect on any of the studied criteria.

The municipality registered animal farms are established as group by the municipalities and distributed among the local people, while the random animal farms are established in random places, may found in a group or single, and they are unregistered. Both registered and random animal farms are allowed to raise different species of animals but not to grow trees or crops, on the other hand, the mixed farms are registered farms and are allowed to grow trees, crops and vegetables besides raising animals.

In the overall, more than 64% of chicken keepers are under the mixed farming system, while under the Abu-

Dhabi municipal 70% are under mixed farming and all in Al-Dhafra municipal are under mixed farming. In comparison with other countries such as Sri Lanka, only 25% of VC keepers are under the mixed farming system (Chrishanthan et al., 2014).

Goal and purpose of rearing

People in Abu-Dhabi Emirate rear VC mainly as a hobby and for home consumption, since they prefer the taste of VC and ensure that the source of their chicken meat and eggs are additive free. In this study, more than 59% of the surveyed owners are rearing the chickens for home consumption only, with another 35% rearing for home consumption and sell surplus product of eggs, chicks and chicken, while only 5% of the owners are rearing their chicken for selling (Table 2).

However, VC in other parts of the world plays a vital function in the nutritional, socio-culture and economy of the rural people, since VC are sold at higher prices than commercial chickens (Abdelqader et al., 2007; Mtileni et al., 2013; Alem et al., 2014). In many countries, the majority of farmers keep VC for selling or as gifts and presents for visitors, while few farmers keep chicken for home consumption (Haoua et al., 2015; Mutombo et al., 2015; Nduthu, 2015). In this study, region and property type were not affecting goal of VC rearing, though numerically, as flock size increases more VC keepers are specialized in selling their products or selling surpluses. In other countries, differences in goals of rearing among different regions were reported due to heterogeneity of flock population (Alem et al., 2014).

The VC in Abu-Dhabi Emirate is raised mainly (80%) as

Table 3. Some flock structure and productivity characteristics of sampled flocks and chickens.

Variable	n	Hen to Cock Ratio	Hens (%)	Cocks (%)	Chicks and growers (%)
Overall	59	7.0±0.83	53.0±3.58	11.2±1.09	34.0±3.99
Region P-value	-	0.2713	0.6269	0.7436	0.5598
Abu-Dhabi	20	7.0±1.69	64.1±7.39	12.2±2.40	22.9±8.67
Al-Ain	28	8.5±1.37	55.9±6.01	10.9±1.95	33.4±7.12
Al-Dhafra	11	11.1±2.47	63.0±10.79	9.6±3.51	22.7±12.21
Property type P-value	-	0.2040	0.1589	0.9766	0.3246
Registered animal farm	13	7.9±1.95	55.4±8.55	10.6±2.78	33.8±10.05
Random animal farm	8	11.8±2.56	75.2±11.19	10.8±3.64	12.9±13.23
Mixed farming	38	7.0±1.12	52.4±4.89	11.3±1.59	32.2±5.51
Flock size P-value	-	0.1323	0.0746	0.8891	0.4201
Small =< 100 layer	19	6.1±1.57	47.6±6.87	11.7±2.23	33.8±7.57
Medium 101 - 500 layer	32	8.9±1.56	60.3±6.85	10.4±2.23	29.2±8.06
Large > 500 layer	8	11.6±2.42	75.1±10.59	10.6±3.44	15.9±12.50

dual purpose for both eggs and meat, regardless of flock size (Table 2). Differences in VC rearing purposes were reported around the world. In Ethiopia for instance, Alem et al. (2014) found that the main purpose for chicken rearing was meat than egg production, while in Jordan and Kenya, the main purpose for chicken rearing was for eggs than meat production (Abdelqader et al., 2007; Mutombo et al., 2015). In the current study, significant differences ($P < 0.05$) in VC rearing purposes were found through regions. All Al-Dhafra keepers raise their chicken as dual purpose, while 60 and 85% of the keepers in Abu-Dhabi and Al-Ain regions, respectively, raise their chicken as dual purpose. Similarly, Alem et al. (2014) reported differences in rearing purposes between VC keepers living in different agro-ecological regions of Ethiopia, in addition to differences in rearing purposes due to gender of keepers.

Flock size and structure

Flock sizes of VC were ranging from small with one hundred or less layer hens (32%), medium with 101 to 500 layer hens (54%) and large flocks with more than 500 layer hens (14%) (Table 1). The overall flock size average is about 457 layer hens and total of 1008 birds of all ages, with overall sample population total of 25,614 layer hens and 59,462 heads. It was observed that flock sizes for Abu-Dhabi and Al-Ain regions were medium, while more than 54% of the Al-Dhafra flocks were small size reared under mixed farming, although differences were not significant. Much smaller average flock sizes were reported by researchers in other countries (Abdelqader et al., 2007; Dinka et al., 2010; Mtileni et al., 2013; Chrishanthan et al., 2014; Nduthu, 2015). The average flock sizes reported were ranging from 5 to 50

heads. The main reason behind the very large average flock size in Abu-Dhabi Emirate comparing to other countries, maybe due to most owners, who prefer the flavour, texture and freshness of VC meat and eggs over the commercial.

Gender of owner in this study has no influence on flock size however, in South Africa Mtileni et al. (2013) reported that male VC keepers kept larger flocks than that of females. Results showed that on the basis of a property in Abu-Dhabi Emirate, the average hen to cock ratio is 7 to 1 with a range of 1.25 to 35 to one. This range is very large; the low represents the uneconomical and the high represents the infertile. However, many owners keep too many cocks to slaughter them as they need. The average hen to cock ratio in this study is similar to that reported by Abdelqader et al. (2007) and Mopate and Lony (1999). Although not significant ($P > 0.1$), as flock size increases hen to cock ratio numerically also increase to become more economical (Table 3). While hens represents 53% and cocks represents only 11%, chicks and growers represent 34% of the flock (Table 3). Hens percentage tend ($P < 0.1$) to increase as flock size increased. Different percentages for the distribution of chickens' categories were reported around the world (Abdelqader et al., 2007; Mtileni et al., 2013; Haoua et al., 2015).

Housing and management system

Chicken in this study were raised in semi closed cages (47%), partly shaded (20%), and shades with open range (32%) regardless of region, property type or flock size (Table 4). Housing provides chickens with protection against predators, theft, extreme weather conditions and provides shelter for egg laying (Dinka et al., 2010). For

Table 4. Distribution of chicken housing types and some management measures by region, property type and flock size.

Variable	n	Semi close cages (%)	Partly shaded (%)	Shade and open range (%)	Owner share with chicken care (%)	Owner making mating decisions (%)	Presence of hatchery (%)
Overall	59	47.5	20.3	32.2	15.3	32.2	78.0
Region P-value	-		0.2607		0.7902	0.0216	0.2197
Abu-Dhabi	20	50.0	30.0	20.0	15.0	10.0	65.0
Al-Ain	28	53.6	14.3	32.1	17.9	39.3	85.7
Al-Dhafra	11	27.3	18.2	54.6	9.1	54.6	81.8
Property type P-value	-		0.2787		0.1360	0.2742	0.5589
Registered animal farm	13	69.2	15.4	15.4	30.8	46.2	84.6
Random animal farm	8	62.5	12.5	25.0	0	12.5	87.5
Mixed farming	38	36.8	23.7	39.5	13.2	31.6	73.7
Flock size P-value	-		0.7421		0.1037	0.3148	0.1951
Small =< 100 layer	19	52.6	10.5	36.8	5.3	21.1	68.4
Medium 101 - 500 layer	32	46.9	25.0	28.1	15.6	34.4	78.1
Large > 500 layer	8	37.5	25.0	37.5	37.5	50.0	100

the first two housing types, keepers must provide enough feeding to cover all nutritional needs, while the third type of housing provide the ability for the chickens to scavenge during daytime part of their requirements.

Similar to other countries, poor sanitary condition and insufficient protection were mostly provided for VC by most houses types (Abdelqader et al., 2007; Mtileni et al., 2013). No artificial light was provided in chicken houses, all VC keepers rely on the natural light. Some large flocks' owners were advised to provide artificial light to increase lighting period up to 16 to 17 h, these owners produced 30% more eggs than the other owners, accompanied with an increase in feed intake by the layer chickens.

Keepers of VC in this study usually provide commercial feed rations available in the UAE market to their chickens according to age. Chicks and growers are provided with broiler rations while older hens and cocks are provided with layer

rations. Hussein et al. (2014) provided nutrient composition to many broilers and layers feed rations available in the UAE market, which are also used to feed VC in Abu-Dhabi Emirate. However, VC in other countries was not provided with enough feeding. Most or all farmers allow chickens to scavenge the area around their places and offer some kind of supplement which might consist of kitchen leftover or household waste, cereal by-products and cereal grains resulting in low productivity of village chicken (Abdelqader et al., 2007; Dinka et al., 2010; Haoua et al., 2015). Scavenging might fulfil the nutritional requirements from energy, protein, vitamins and minerals depending on available area per bird, quality of scavenging feed resources, season, land fertility and physiological stage of the chicken. The birds scavenged whatever available on the ground such as worms, insects, crop residues, grasses and grains (Abdelqader et al., 2007). In some countries, chickens are only

scavenging the range with no supplementary feed at all or provided with kitchen leftovers only (Nduthu, 2015; Olobatoke et al., 2015). In other countries, most chicken keepers do not provide feed additives however; commercial feed mix is also provided especially to chicks and growers (Mtileni et al., 2013; Chrishanthan et al., 2014). Abdelqader et al. (2007) results showed that VC under higher management levels outperformed those under lower management.

Most poor countries taking care of VC is the responsibility of families' labor, since VC production is based primarily on scavenging and does not require high managerial skills (Abdelqader et al., 2007; Dinka et al., 2010; Chrishanthan et al., 2014; Nduthu, 2015; Olobatoke et al., 2015). In these countries, housing, feeding and general management of VC are the obligation for women and children while selling or feed buying are the responsibility of men (Dinka et al., 2010; Chrishanthan et al., 2014;

Nduthu, 2015). Though, in this study, the hired labor is the sole person taking care of VC in 85% without interference and contribution from the flock owners, regardless of the region (Table 4). However, numerically more than 30% of the owners of registered animal farms share in taking care of VC and as flock size increase more owners interfere with decision taking of the VC care. Also, in 68% of the farms the labors alone are making the mating decisions without interference by the owners. Though, this is significantly different ($P < 0.05$) according to region, more than 54% of the farm owners in the Al-Dhafra and 39% of the Al-Ain region are making mating decisions of VC and as flock size increase numerically more owners which are making mating decisions (Table 4).

Hatcheries are found in 78% of the farms regardless of regions, property type or flock size (Table 4). However, all large flocks have hatcheries and fewer hatcheries are found in the small flocks. In other countries, when the flock size is very small natural reproduction is the only tool for maintaining the flock besides brooding hens are responsible for hatching the eggs (Abdelqader et al., 2007; Nduthu, 2015). Farmers may provide brooding places and when chicks are hatched some extra care might be provided in family houses (Abdelqader et al., 2007).

Health management practices

Most of the VC owners in Jordan and Cameroon are not cleaning or disinfecting chicken houses or don't pay attention to health care (Abdelqader et al., 2007; Haoua et al., 2015). Similarly, keepers of VC in Abu-Dhabi do not use medicine except antibiotics if they have to and after the disease are wide spread in their flocks, in addition to vitamin supplements. In Kenya only 20% of the VC keepers are using the conventional disease control methods and 80% of the local traditional cure these methods (Mutombo et al., 2015). Only very few village keepers in many countries practice vaccination against Newcastle disease and infectious bronchitis (Abdelqader et al., 2007; Haoua et al., 2015).

Almost all VC keepers in Abu-Dhabi do not vaccinate their flocks. Farmers do these practices because they think this is more natural and organic production, since they mainly consume the production by themselves. Though, no immunization means increase the risk of chickens' exposure to diseases (Nduthu, 2015). However, rearing VC with minimum use of chemicals leads to organic eggs and meat which are on demand nowadays (Abdelqader et al., 2007; Mtileni et al., 2013).

Olobatoke et al. (2015) reported high disease prevalence among local chicken in Nigeria, this include Newcastle and Gumboro diseases. These diseases are also reported in other countries (Abdelqader et al., 2007; Haoua et al., 2015). It was noticed that the most

prevalent clinical symptoms in Abu-Dhabi Emirate were respiratory manifestations as cough and nasal discharge, eye swelling, eye lesions, diarrhea and pox lesions. Some VC keepers also reported drop in egg production. Similarly, farmers do not practice record keeping on diseases and mortality of their stock (Chrisanthan et al., 2014).

Selection and culling

Selection is only practiced in 8% of the flocks, with no differences between regions or property types, however, 37.5% of large flock owners are practicing selection in comparison to only 5% of small and 3% of medium flocks owners (Table 5). The VC keepers usually select their productive hens mainly based on body size, then on pedigree (Dinka et al., 2010). Some keepers consider finger space between the pelvic bones (Dinka et al., 2010), however, in this study, keepers were ignorant about it. Though, both cocks and hens are raised from the same flock (97%), (Table 5). This practice is general in other countries, such as in Jordan, where most VC keepers select hatching eggs from the same flock (Abdelqader et al., 2007). This would raise the inbreeding coefficient very high, especially for small flocks, and cause deterioration of the flock productivity largely; especially that selection is not correctly practiced.

However, in Jordan, some keepers exchange eggs with other farmers to improve flock performance and few even exchange cocks (Abdelqader et al., 2007). Culling, on the other hand, is mainly practiced for old age hens and cocks (61%), however, it is significantly ($P < 0.01$) different among regions, the most is in Al-Ain (82%), and among property types ($P < 0.05$), the most in random animal farms (100%), (Table 5). Similarly, researchers in other countries reported culling for old age hens and cocks or surplus chicks which are sold or slaughtered (Abdelqader et al., 2007; Mtileni et al., 2013). Low productivity is the second cause of culling reason practiced by VC keepers (44%), as they claimed. Though, no production records were kept by the keepers and they were unable to differentiate between laying and non-laying hens. Record keeping and identification for breeding purposes are not practiced by VC keepers in other countries (Abdelqader et al., 2007; Mtileni et al., 2013; Chrisanthan et al., 2014). However, culling due to productivity is significantly different ($P < 0.01$) among regions and the most is in Al-Ain (64%), it is also significant ($P < 0.05$) due to different property types and flock sizes (Table 5). More than 5% of keepers also cull for diseases. Culling for home consumption, giving as gifts and selling of VC is practiced by more than 40, 8 and 3% of the keepers, respectively. However, more than 6% of the keepers do not practice culling; they leave birds until natural death.

Thirteen VC breeds in addition to crossbreds were found in this study (Table 6). The most available breed is

Table 5. Percent practicing selection, replacement within the same flock and different culling reasons of village chickens.

Variable	n	Selection (%)	Replacements within flock (%)	Culling reason						No culling (%)
				Age (%)	Productivity (%)	Diseases (%)	Eating (%)	Gifts (%)	Selling (%)	
Overall	59	8.5	96.61	61.0	44.1	5.1	40.7	8.5	3.4	6.8
Region P-value	-	0.9373	0.3275	0.0064	0.0099	0.6586	0.1734	0.5327	0.0109	0.5672
Abu-Dhabi	20	10.0	95.0	40.0	30.0	5.0	55.0	10.0	0	10.0
Al-Ain	28	7.1	100	82.1	64.3	7.1	28.6	10.7	0	7.1
Al-Dhafra	11	9.1	90.9	45.5	18.2	0	45.5	0	18.2	0
Property type P-value	-	0.6196	0.5821	0.0442	0.0326	0.1526	0.7113	0.0898	0.5644	0.7140
Registered animal farm	13	7.7	92.3	61.5	69.2	15.4	46.2	23.1	0	7.7
Random animal farm	8	0	100	100	62.5	0	50.0	0	0	0
Mixed farming	38	10.5	97.4	52.6	31.6	2.6	36.8	5.3	5.3	7.9
Flock size P-value	-	0.0063	0.1870	0.6799	0.0359	0.5578	0.2980	0.1946	0.1870	0.6090
Small =< 100 layer	19	5.3	94.7	57.9	26.3	5.3	26.3	5.3	5.3	5.3
Medium 101 - 500 layer	32	3.1	100	65.6	59.4	3.1	46.9	6.3	0	9.4
Large > 500 layer	8	37.5	87.5	50.0	25.0	12.5	50.0	25.0	12.5	0

the Emirati VC or what is locally called (Addar chicken) which is found in 71% of the properties. This breed comes with many shapes and colors and all has the same name. Although, indigenous genotypes are known as less productive, keepers prefer them, as they are more adapted to severe environmental conditions, have better maternal care, and produce leaner and tastier meat compared to exotic breeds (Mtileni et al., 2013). The second most available breed is Fancy or what is locally called French breed which is found in 36% of the farms. The breed is not similar to any of the known French breeds, however, because fancy is sound like French in Arabic, most keepers call this breed as French. The Fancy breed is of two colors one of which is very similar to New Hampshire Red and the second is very similar to Delaware breed. The third is the crossbred chicken (20%), which mainly with Fancy breed, secondly with Pakistani and then with other

breeds. The fourth is the Omani (12%) and the fifth is the Pakistani (10%). Other breeds are found in less than 10% of the visited sample farms.

Body weight and some productivity measurements

Body weight was significantly ($P < 0.001$) affected by the interaction between both breed and region and breed and sex (Table 6). However, the three-way interaction was not significant ($P > 0.1$). Local breed was heaviest in the Al-Dhafra, while Fancy breed was heavier in both Abu-Dhabi and Al-Ain than that in Al-Dhafra. However, Brahman was the heaviest breed in Al-Ain and was very moderate in the Al-Dhafra. Males were always heavier than females, differences were not consistent among breeds; male-female differences in some breeds

were not significant ($P > 0.05$), (Table 6).

The overall daily egg production is around 76 eggs per property per day with a very low productivity rate of 32.4%, wide range of 1.43 to 69.63% while both ends of the range are low to be economical (Table 7). Although, low productivity was reported by Chrishanthan et al. (2014) for local chicken in Sri Lanka which is higher than that found under Abu-Dhabi conditions. Similar to reports from other countries, low productivity might be due to several management, environmental and genetic factors. Some of which are weak experience in poultry keeping, low feed quality, lighting program, bad management, no record keeping, diseases infection (clinical and subclinical), hot climate, low culling rate, no selection and genetic makeup of the breeds (Chrishanthan et al., 2014; Nduthu, 2015). Although, daily egg production was significantly different ($P < 0.001$) among different flock sizes

Table 6. Body weight in grams of village chickens breeds as affected by the breed-region and breed-sex interactions of chicken.

Breed	Frequency		Breed*Region			Breed*Sex	
	%	Abu-Dhabi	Al-Ain	Al-Dhafra	Female	Male	
P-value			<0.0001			0.0004	
Local	71.19	1357±28 ⁱ	1423±23 ⁱ	1722±50 ^{cdef}	1288±21 ^f	1575±31 ^{de}	
Fancy	35.59	2119±30 ^b	2106±40 ^b	1677±96 ^{efg}	1819±28 ^{bc}	2359±43 ^a	
Crossbred	20.34	1551±54 ^{gh}	1706±49 ^{def}	1686±49 ^{defg}	1431±37 ^{de}	1876±51 ^b	
Omani	11.86	-	1388±44 ⁱ	-	1274±50 ^f	1502±78 ^{de}	
Pakistani	10.17	-	2210±280 ^{abcdef}	1935±101 ^{bce}	1596±112 ^{cde}	2320±174 ^a	
Brahman	8.47	1960±144 ^{bcdef}	2547±186 ^a	1116±99 ^j	1528±86.83 ^{de}	1514.29±147 ^{def}	
Kuwaiti	6.78	981±132 ^j	1173±77 ^j	-	1050±87 ^g	1200±112 ^{fg}	
Fayomi	3.39	-	-	1635±101 ^{fg}	1500±123 ^{def}	1770±174 ^{bcd}	
Karla	3.39	1783±154 ^{cdefg}	1305±117 ^{hij}	-	1344±129 ^{efg}	1614±147 ^{bcd}	
Other breeds ¹	8.47	-	1676±65 ^{fg}	1718±73 ^{cdefg}	1514±58 ^{de}	1874±89 ^{bc}	

¹Other breeds: uncommon breeds that are claimed to be Holland, Australia, Japan, Habhab and Abu-Dhabi. ^{a,b,c,d} Different superscripts within an interaction indicate significant differences (P<0.05).

Table 7. Some productivity characteristics of sampled flocks of village chickens.

Variable	n	Daily eggs production	Eggs productivity (%)	Hatchability (%)
Overall	59	75.6±9.68	32.4±2.50	75.9±1.77
Region P-value ¹	-	0.6145	0.2043	0.8836
Abu-Dhabi	20	99.2±15.61	27.5±4.73	71.6±3.25
Al-Ain	28	94.5±12.50	32.1±3.75	69.8±2.53
Al-Dhafra	11	74.4±24.45	18.2±7.36	70.5±4.74
Property type P-value ¹	-	0.5060	0.1424	0.0011
Registered animal farm	13	103.5±17.78	33.1±5.36	74.8±3.65 ^a
Random animal farm	8	73.8±23.65	17.6±7.10	58.4±4.84 ^b
Mixed farming	38	90.9±10.99	27.1±3.35	78.7±2.04 ^a
Flock size P-value ¹	-	<0.0001	0.0129	0.3703
Small =< 100 layer	19	21.2±15.54 ^c	37.5±4.78 ^a	67.9±3.48
Medium 101 - 500 layer	32	68.0±13.69 ^b	27.7±4.12 ^a	73.3±2.79
Large > 500 layer	8	178.9±23.61 ^a	12.7±7.11 ^b	70.8±4.09

and larger flocks have higher daily production, eggs productivity which was significantly (P<0.05) higher in smaller flocks. This could be due to more care taken for smaller flocks than that for larger ones. Keepers receive higher prices for eggs from VC than commercial eggs, since the demand on VC eggs is high due to preferences of flavour, dark yellow yolk, and the organic production of chicken (Abdelqader et al., 2007; Mtileni et al., 2013).

The overall hatchability rate using artificial hatcheries is (75.9%), far lower than that found in commercial hatcheries (Table 7). In other countries, using natural brooding and hatching practices for VC, keepers may obtain higher hatchability with an extremely lower number of hatched chicks (Abdelqader et al., 2007; Mtileni et al., 2013; Chrishanthan et al., 2014). Significantly (P<0.01)

lower hatchability was found in random animal farms in comparison with registered farms or mixed farming. High hatchability may be obtained due to a shorter period of egg storage before incubation, and selecting the best eggs in terms of weight and health status and performance of hens (Abdelqader et al., 2007). Differences in hatchability were reported for different breeds of VC (Chrishanthan et al., 2014).

Conclusion

The VC in Abu-Dhabi are reared mainly as a hobby and for home consumption, since the Emirati people regard the taste of VC and to ensure that sources for both their

meat and eggs are free from additives. The studied production measurements revealed poor productivity under the existed rearing conditions of Abu-Dhabi Emirate. Several factors might have affected their productivity under the existed conditions and should be controlled, including feed quality, lighting program, management, health status, climate conditions, culling rate and selection, in addition to genetic makeup of chicken breeds.

The current study confirms the need for extra efforts in the execution of effective extension programs to owners and labours, to improve management and health conditions and apply certain level of genetic improvement in order to improve productivity of VC. Genetic evaluation of VC breeds of Abu Dhabi Emirate is needed to test for the purity of these breeds. There is an urgent need for executing and implementing a national research program to collect, conserve and improve the VC in order to enhance the traditional poultry production in the country.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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