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Original Research

Relationship between rural population patterns and administrative unit characters for the distribution of domestic animal species in the middle of Iraq

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ABSTRACT:

The aim of this study was to investigate the relationship between rural population patterns and administration characters for the distribution of domestic animals such as sheep, goat, cows, buffalo and camels in the middle of Iraq. Eight administrative units were chosen in this study and three patterns of population were determined in each administrative unit using the nearest neighborhood quantitative procedure. Results showed a significant difference ($P<0.05$) among population patterns in total animals distribution ratio. The highest percent of animals was found in the administrative units which is characterized as a linear pattern (41.72%) while the lowest percent was in the dispersion pattern (22.56%). Results also showed a significant difference ($P<0.0001$) among the population patterns in animal species distribution ratio. The highest percent of sheep, goat, cattle, buffalo and camels were found in linear patterns namely, 41.99, 41.17, 41.08, 44.33 and 38.66% respectively while the lowest percent were found in dispersion pattern namely, 22.91, 21.83, 22.10, 19.02 and 24.39 respectively. Animal species varied significantly ($P<0.0001$) according to the administrative units, the highest percent of sheep was in G while the lowest percent was in E (19.91 and 1.42% respectively). In addition, to goats the distributed significantly in these units, the highest percent was in D (Nuffer) and the lowest was in E with 21 and 0.56% respectively.

Keywords:
Rural patterns, Domestic animals.

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INTRODUCTION

Domestic animals are the most important economical source for the rural household in many countries around the world and plays a crucial role for food supply and other purposes (Bettencourt *et al*., 2013). Human beings started domesticating animals as soon as intelligence dawned upon him. The relationship of humans with domestic animals began from a long history and there were many evidence about animal's presence at homes for different purposes (Grandgeorge and Hausberger, 2011). Many studies referred that domestic animals distribution is affected by many factors such as ecology, food availability, diseases, animal tractions and cultural preferences (Blench, 1999). Hunter (2007) referred that the biodiversity was affected significantly by human civilization especially after the industrial revolution.

In Iraq, many kinds of domestic animals belonging to tropical and sub-tropical regions are found and distributed on three major areas (north, middle and south) depending on many geographic and social factors such as availability of pastures, rivers, rainfall, intensity of human settlements and market demands (Sawsan *et al*., 2003).

The rural settlements in Iraqi alluvial plain are of different patterns and these rural communities are either nucleated or depressed settlements (Jaradat, 2002). Generally, there are many patterns of population in Iraqi country such as linear pattern which is characterized as a linear villages along to rivers or paved streets. The second pattern is called convergent which resulted from small farms near the urban centers. Third pattern is known as dispersion or random which is characterized as small and divergent settlements in wide farms and this pattern is resulted from the availability of wide farms, saltiness of soil and absence of the governmental planning in the rural colonies.

Recently, many studies were carried out investigate the relationship between population and the animals in the same region because animals share the land

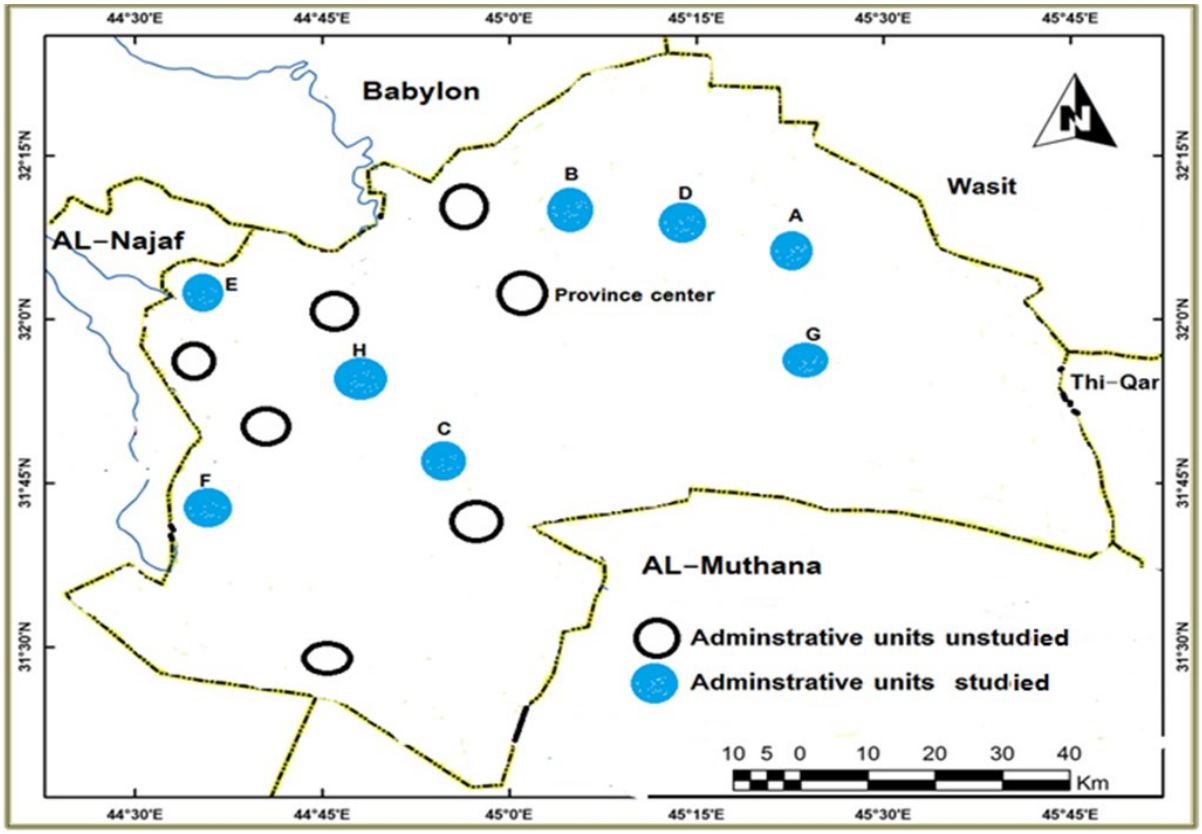

Figure 1. Study region (IAU, 2010)

with the people and people sometimes share their houses with animals (Batson, 2008). Nowadays we can see more than 1.5 million cattle and 2 billion poultry birds worldwide (FAO, 2013). The purpose of this paper was to determine the effect of some natural and socio factors (administrative unit characters and population patterns) in domestic animals distribution and use results as a guideline for choosing the suitable animal kind according to the population pattern which leads to increase production and safeguard food security.

MATERIALS AND METHODS

Study region and description : The region border of the study included AL-Qadissiya province that is located at the middle part of Iraqi plan, between 17-3º latitudes and 24 - 32º longitudes. The area was 8153 km^2 (Figure 1) constituted 1.9% of total Iraqi area (434128 km^2) excluding the regional water. The climate is determined by the seasonal movement of semi- tropical zone which leads to the contrasting hot and cold seasons with an average annual rainfall of 97.5mm (AL-Salhi *et al*., 2014). The administrative structure of the province composed of 15 administrative units distributed among four districts and 11 sub-districts. The rural population (producers of animal products) constituted about 44% while the urban centers population (consumers of animal products) constituted about 56% of total population (IAU, 2010).

Eight administrative units were chosen in this study (Figure 1) and determine three patterns of population in each administrative unit using the Nearest Neighborhood quantitative procedure using the following formula:

$R = D / O$

where, 'R' Nearest neighborhood; 'D' The overall mean of distance between the settlements and its neighbor in practical distribution; 'O' Expected distance between settlement and nearest neighbor in random (theoretical) distribution:

$$O = {}^{1+2}\sqrt{S}$$

$$S = \sqrt{\frac{No.of\ settelments}{erea}}$$

(Guo *et al*., 2014)

Animals species numbers (cattle, buffalo, sheep, goat and camels) were determined for each administrative unit within each population pattern at the year 2015 depending on the records from agricultural departments and direct survey.

Statistical analysis

Data were analyzed by SAS (2012) computer program using completely randomized design (C.R.D) according to linear model:

$Yijk = \mu + Ai + Bj + (AB)ij + eijk$

where, 'Yijkl' is the value of any observation in the study; 'μ' is an overall mean; 'Ai' effect of population pattern (linear, convergent and dispersion); 'Bj' effect of administrative unit (1 – 8); '(AB)ij' :effect of interaction between population patterns and administrative units.

Chi- square test was used to determine the significance of animals distribution according to the following equation:

Table 1. Effect of population pattern on distribution ratio of animals

S. No	Population patterns	Distribution of animals (%) ± SD					Total
		Sheep	Goat	Cattle	Buffalo	Camels	
1	Linear	41.99 ± 4.05	41.17±5.17	41.08±6.22	44.33±4.29	38.66±3.31	41.72±5.88
2	Convergent	35.10±3.66	37.00±5.02	36.82±4.29	36.65±2.85	36.41±2.94	35.72±4.75
3	Dispersion	22.91± 3.10	21.83±3.18	22.10±2.35	19.02±2.00	24.39±2.07	22.56±2.90
4	Total	100%	100%	100%	100%	100%	100%
5	P-Value	0.0001	0.0001	0.0001	0.0001	0.0001	0.05

Table 2. Effect of administrative units on distribution ratio of animals

S. No	Administrative units	Distribution of animals (%) ± SD					Total
		Sheep	Goat	Cattle	Buffalo	Camels	
1	A	13.27 ± 1.14	12.58±1.07	12.23±1.12	13.00±1.00	6.60±0.11	12.87±2.20
2	B	12.75±1.09	20.27±2.33	13.45±1.17	3.71±0.60	6.98±0.18	13.60±2.18
3	C	16.53±2.10	9.25±0.84	13.51±2.18	32.07±4.30	39.43±3.87	15.80±1.90
4	D	7.02±0.11	21.00±2.50	7.38±0.70	1.72±0.09	15.32±1.81	9.09±0.97
5	E	1.42±0.08	0.56±0.01	8.38±0.50	34.02±5.01	2.33±0.76	3.27±0.29
6	F	18.43±1.72	10.81±1.11	18.20±2.20	10.03±0.99	5.40±0.99	16.84±1.17
7	G	19.91±1.81	17.13±1.96	20.31±2.15	0.65±0.01	10.47±1.00	18.94±1.80
8	H	10.75±0.99	8.24±0.75	6.54±0.08	4.80±0.06	13.47±1.19	9.59±0.88
9	Total	100%	100%	100%	100%	100%	100%
10	P-Value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

$$X^2 = \sum \frac{(Observed\ No. - Expected\ No.)^2}{Expected\ No.}$$

Least Significant Difference (L.S.D) was performed for the comparison of mean differences.

RESULTS AND DISCUSSION

Results demonstrate a significant effect of population patterns in the animals distribution ratio (Table 1), the administrative units which characterized as a linear patterns contained the highest ratio of total animals compared with the units which characterized as a dispersion pattern namely, 41.72 and 22.56% respectively.

Results also showed a significant difference (P<0.0001) among population patterns in animal species distribution ratio. The highest percent of sheep, goat, cattle, buffalo and camels were found in linear pattern *viz*., 41.99, 41.17, 4.081, 44.33 and 38.66% respectively while the lowest percent were found in the dispersion pattern *viz*., 22.91, 21.83, 22.10, 19.02 and 24.39 respectively.

Results represented in Table 2 showed a significant effect (P<0.0001) of the administrative units on total animals ratio. The highest percent was found in G (AL-bdir) while the lowest percent were in E (Mahannawia) namely, 18.94 and 3.27% respectively.

Animal species varied significantly (P<0.0001) according to administrative units ,the highest percent of sheep was in G while the lowest percent was in E (19.91 and 1.42% respectively). In addition to the, goat distributed significantly in these units, the highest percent was in D (Nuffer) and the lowest was in E namely, 21 and 0.56% respectively. The highest percent of cattle was found in G while the lowest percent was found in the

Table 3. Effect of population pattern on distribution number of animals

S. No	Population patterns	Distribution of animals (No.) ± SD					Total
		Sheep	Goat	Cattle	Buffalo	Camels	
1	Linear	82262±300.9	17849±170.8	20918±140.7	3453±98.3	2176±30.6	12665±300.8
2	Convergent	68764±214.7	16043±100.3	18750±177.4	2855±87.1	2049±28.4	108461±287.7
3	Dispersion	44893±170.5	9465±90.8	11258±121.5	1482±50.2	1403±40.9	68501±173.5
4	L.S.D	974.60**	837.75**	1261.5**	499.8**	435.6*	3688.5**
5	Total	195919	43357	50926	7790	5628	303620

** (P<0.01) * (P<0.05)

Table 4. Effect of administrative units on distribution number of animals

S. No	Administrative units	Distribution of animals (No.) ± SD					Total
		Sheep	Goat	Cattle	Buffalo	Camels	
1	A	26004±289.6	5454±33.8	6230±34.7	1013±60.7	372±18.8	39073±131.7
2	B	24980±311.9	8788±73.0	6843±72.1	289±27.4	393±22.6	41293±298.8
3	C	32376±294.5	4009±62.4	6882±60.0	2498±41.2	2219±59.0	47984±3.87.5
4	D	13747±108.7	9103±39.4	3759±29.6	134±10.6	862±42.8	27605±476.9
5	E	2626±42.3	242±9.7	4270±33.7	2650±31.7	131±8.66	9919±177.3
6	F	36099±79.4	4685±28.5	9268±58.5	781±19.2	304±19.7	51137±472.9
7	G	39016±205.7	7504±58.0	10341±89.4	51±4.9	589±35.1	57501±504.7
8	H	21071±185.0	3572±32.9	3333±69,9	374±22.3	758±16.4	29108±326.5
9	L.S.D	729.3**	622.9**	495.10**	277.05**	594.7*	6778.98*
10	Total	195919	43357	50926	7790	5628	303620

** ($P<0.01$); * ($P<0.05$)

administrative unit H (Shafiya) *viz.*, 20.31% and 6.54% respectively. Results indicated that the highest percent of buffalo was in administrative unit E while the lowest percent was in G namely, 34.02 and 0.65% respectively. Finally, camels differed significantly and the highest percent was in C (39.43) and the lowest was in E (2.33%).

Results represented in Table 3 referred to a significant difference among animal numbers associated with the population pattern. The highest total number was in the linear pattern (126658 head) compared with the dispersion pattern (68501 head). For all species, the highest numbers of animals were found in the linear pattern namely, 82262, 17849, 20918, 3453 and 2176 heads respectively compared with the dispersion pattern which contain 44893, 9465, 11258, 1482 and 1403 head respectively.

Total and species animal numbers were differed significantly according to the administrative units (Table 4). Highest total number increased significantly in administrative G (57501 head) compared with the lowest number (9919) in a E.

Sheep and goat numbers increased significantly in administrative G and D namely, 39016 and 9103 heads respectively. G and D units characterized in the availability of wide lands covered with principal plant species and sand links make it suitable for this animals which are well adapted to the harsh conditions especially the local breeds such as Awassi and Arabi sheep breeds and local black goat breed. G and F units characterized in the availability of green feed such as alfa alfa and clover which embolden farmers for increasing in cattle herds epically dairy cattle which require a large amount of bulky fibrous feed in there diets. As a result, dairy herds need to be close to source of their feed more than the other domestic species. Water is essential for all species, and is important for both animal welfare and production. Water requirements of each species (amount and quality) are different and these requirement also differs between classes in the same species. Brown (2006) reported that buffalo are well adapted to high temperature and high humidity in many tropic and semi tropic areas but they are also affected by heat stress. Therefore, the highest number of buffalo was found in administrative E in this study because of generosity of water and wide farms of rice where we can get big amount of roughages easily. Results also showed that camels are widespread in administrative units C, D, and H namely, 2219, 862 and 758 heads respectively. These regions are abutting to the desert, characterized in poor pastures and scarcity of water. This results is similar with the report of Roberts *et al*. (1986) who referred that

Table 5. Effect of interaction of population pattern x administrative unit on distribution of animal

S. No	Population patterns	Administrative units	Distribution of animals (No.) ± SD					Total
			Sheep	Goat	Cattle	Buffalo	Camels	
		A	12280±199.0	2557±55.6	2413±71.0	494±25.5	176±11.0	17920±418.0
		B	12436±181.9	3581±61.9	2788±64.8	118±19.7	160±13.2	19083±466.5
		C	11680±114.5	1445±47.8	2481±80.3	969±39.0	800±28.1	17375±381.6
1	Linear	D	6316±97.5	4183±91.0	1727±75.9	63±4.5	396±19.6	12685±226.2
		E	1261±62.7	117±28.2	2050±100.6	1297±41.8	63±4.7	4788±123.7
		F	15951±287.4	2071±50.9	4095±122.7	384±27.7	134±5.5	22635±389.5
		G	17070±325.2	3002±72.5	4524±109.4	23±4.0	258±9.6	24877±299.0
		H	5268±81.7	893±78.8	840±55.3	105±9.5	189±14.2	7295±92.6
		A	6500±75.5	1372±133.4	1557±74.2	261±17.8	93±5.3	9783±68.4
		B	4630±49.2	2929±39.7	2281±76.7	96±8.2	131±6.9	10067±175.5
		C	10900±387.8	1352±46.7	2320±88.0	906±18.4	748±27.0	16226±254.0
2	Convergent	D	5202±193.6	3444±51.8	1423±51.2	51±6.3	326±35.5	10446±111.7
		E	945±92.5	87±9.5	1537±90.0	973±42.3	47±3.8	3589±51.8
		F	15111±292.8	1961±32.9	3880±107.5	363±22.6	127±7.9	21442±344.6
		G	16257±331.4	3335±64.4	4309±62.3	21±3.7	245±18.5	24167±279.1
		H	9219±117.6	1563±28.5	1443±38.0	184±15.0	332±27.4	12741±300.9
		A	7224±99.9	1525±29.1	2260±44.1	258±20.1	103±8.8	11370±208.8
		B	7914±115.7	2278±45.0	1774±80.4	75±4.3	102±8.0	12143±200.5
		C	9796±190.3	1212±33.1	2081±123.5	623±25.7	671±44.5	14383±411.0
3	Dispersion	D	2229±71.0	1476±48.2	609±57.0	20±2.9	140±10.0	4474±79.3
		E	420±32.6	38±6.6	683±49.1	380±30.7	21±2.2	1542±18.9
		F	5037±45.0	653±31.8	1293±30.4	34±4.6	43±5.1	7060±58.3
		G	5689±79.7	1167±44.5	1508±39.6	7±0.9	86±4.7	8457±49.8
		H	6584±85.9	1116±39.6	1050±28.9	85±7.3	237±17.9	9072±61.7
	L.S.D		2099.7**	1726.6*	1785.7**	1230.9*	1163.2	9304*

** (P<0.01) * (P<0.05)

camels have a series of physiological adaptation that allow them to withstand long periods of time without any external source of water. In addition, Breulmann *et al*. (2007) demonstrated that to compare between camels and other livestock, camels lose only 1.3 liters of fluid intake every day while the other livestock lose 20 – 40 liters per day.

Results represented in Table 5 showed a significant effect of interaction between administrative unit and population pattern on animals distribution. The highest number animals was in linear pattern x administrative G and differed significantly ($P<0.05$) with the lowest number which was in dispersion pattern x administrative E. Interaction of linear pattern with administrative unit G was the best for sheep and cattle distribution (17070 and 4524 head respectively) while the best interaction for goat was the linear pattern x administrative unit D (4183 head) and differed significantly ($P<0.05$) with the other interactions. Buffalo number also differed significantly ($P<0.05$), the highest number was in linear x E (1297 head) compared with the lowest number which was in dispersion x G (7 head). The numbers of camels were also varied significantly according to interaction between this factors, the highest number was in linear x C while the lowest number was in dispersion x E namely, 800 and 21 head respectively.

Domestic animals performance such as survival, growth and reproduction are a complex trait affected by the interaction of many factors such as genotypes, weather and climate around and management systems (Hahn *et al*., 2003). In addition to geographic and environmental factors, people culture preferences affect strongly on animals distribution for instance, some of the people prefer a kind of animal because they believe that this kind achieve them good social inheritance.

CONCLUSION

Depending on the results of this study, we can conclude that the rural population pattern is a crucial factor on animal species distribution in opposite of the past studies which focused on the effect of environmental and nutrition factors on animal distribution and ignore the human factors therefore, we recommend to determine the suitable rural pattern for animal kind to improve the animals performance and to increase the income.

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