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Highlights on potentials of small ruminants' traditional raising system in Qatar

Fahad Al-Ali Ahmed¹, Muzzamil Atta^{1, 2*}, Mohammed Tag-Eldin Ibrahim³, Abdul-Aziz Mahmoud Al-Zayara¹ and Ahmed Ibrahim Al-Hosani¹

¹Department of Animal Resources, Ministry of Municipality and Environment, Qatar

²College of Animal Production, University of Bahri, Sudan

³Faculty of Animal Production, University of Sudan for Sciences and Technology, Sudan

*Correspondence: muzzamilata@yahoo.com Received 18-04-2021, Revised: 28-05-2021, Accepted: 01-06-2021 e-Published: 02-06-2021

This study aimed to assessing of effect of holding (Ezab) type on flock composition and use in Qatar. A survey was conducted to sheep and goats' holdings. The questionnaire information included holdings' area, supervisor education level, flock's type, age, and sex composition and use of production. Survey sample size was 380 holdings. Data was tested for significance of variation between holding types using chi square for qualitative traits and one-way analysis of variance for quantitative data. With no variation among types, holdings rearing mixed flocks were 68.1% of total. Percentages of females/flock, adult males to adult females, female offspring of all offspring, offspring below one year/flock and flocks' breeding value were not different among holdings. Roving Ezab had the largest total area, whereas, compound Ezab had the smallest total area. Compound Ezab had the largest values of barn area/animal and percent of shaded barn part. All the type of holding mainly use their production for only slaughter to their own needs except Roving Ezab type that also practiced selling their production. 90% of all holdings types except farms had the education level of supervisor between no education and primary education, whereas, 20% farms had supervisor's education was secondary and above. It is concluded that small ruminants were raised mainly in mixed sheep and goats' flocks. Sex and age compositions of flocks was not variable among holding types. Holding area was not used efficiently for animal production. The study availed marked highlights about potential of traditional system of small ruminants' national flock.

Keywords: smallholders, Ezab, goats, sheep

INTRODUCTION

Sheep and goats are the most important livestock types raised in Qatar. The annual report of the Department of Animal Resources for the year 2020 (DAR 2021) stated that livestock population in Qatar reached about 1.7 million heads of which 64.1%, 25.8%, 7.7% and 2.4% were sheep, goats, camels and cattle, respectively. Livestock in Qatar are raised under a fanciers' traditional system (small holders) and commercial company farms (large scale farms). Ninety-five percent of the total population of

livestock was raised at the fanciers' traditional level. All the national herd of camel, 98.9% of the flock of goats, 94.3% of the flock of sheep and 67.8% of the herd of cattle were raised under the traditional level.

In general animal production systems are classified into open and closed systems. Steinfeld and Maki-Hokkonen (1995) stated that in the open system, animals are loose in the pasture, whereas, in the closed system feed ingredients are mainly introduced from outside. They added that the latter system concentrated mainly in

western Asia and northern Africa. The main livestock production system in Qatar is the closed system (Al-Marri and Atta 2014). They added that integrated livestock and agriculture system is very limited in the country. According to Atta (2016) animal resources in Qatar were raised mainly in traditional special holdings (locally named Ezab) in addition to traditional farms. The area of Ezab does not allow the existence of land for grazing. The most important requirement for licensing of the Ezab is presence of a tight fence that does not allow the presence of animals outside. Always in these holdings, feed sources are from outside. This situation made animal feeding to be the main constraint in this system.

Smallholder livestock farming is a key to livelihoods, food and nutrition security and employment for rural communities (Tarawali 2015). They added that smallholder livestock systems are known as the low-input systems. These systems include pastoral and agrosilvopastoral systems, family poultry, backyard farming, and mixed crop-livestock production systems (rain-fed or irrigated). According to FAO (2015), in these systems, livestock flocks have multiple functions. They provide food for household consumption, products for income generation and quick cash when emergencies and external shocks occur (i.e. climatic disasters, diseases, price volatility, etc.). They are important assets, critical to the multiple needs of their owners, while also having cultural and spiritual values and being unique descriptors of the identity of specific pastoralist groups.

The productivity of livestock sector in Qatar is challenged by the scarcity of natural resources in terms of feed and water. This threatens sustainability of the traditional part of the sector, however; the government subsidizes the traditional system with some feed ingredients and drinking water cost. In the same context, Sid-Ahmed et al. (2000) noted that inadequate and poor-quality feed resources (especially during the dry season) is the most serious constraint to animal production under the mobile and the sedentary systems of middle east and north Africa. Katiku et al. (2013) added that small ruminant farmers in the semi-arid lands of Kenya also face other constraints including lack of markets and marketing systems.

Livestock sector in Qatar is the most undeveloped sector. There were no scientific studies conducted to classify these resources according to their production potential and to examine the obstacles those hindering them to

express their maximum potential. According to the statistics of DAR (2021) the total amount of red meat available for consumption during the year 2020 was about 60 thousand tons of which 79.1% were sheep and goats and the self-sufficiency ratio was only about 17%. This makes it necessary to evaluate the current situation of small ruminants' system to develop programs aimed at developing their productivity.

The objective of this research is to document for some of flock composition traits of sheep and goats raised in the traditional system in Qatar as affected by the type of animals' holding. This information is very essential for the development and improvement of the small ruminants in Qatar as source of livelihood and income generation.

MATERIALS AND METHODS

2.1. Site of research

Animal resources on traditional system in Qatar were raised in different types of traditional holdings. DAR (2020) reported that there are about seven thousands and seven hundred traditional animal holdings in Qatar, 76.6% of which raised small ruminants. Among the holdings those raise small ruminants there are 669 farms, representing about 11.3% and the rest are the Ezab. There are 3 types of Ezab: compounds, Roving and outside planning types. Therefore, the small holdings in Qatar are grouped as:

Traditional farm where land ownership is private, and source of drinking water is the farm's well that means no cost of drinking water. The integrated agriculture and livestock system, in the known sense as the presence of free animals in the pasture on a regular basis is not practiced. Most of the agricultural land is used in the production of vegetables or fodder for the central market. Agricultural by products may be used as animal feed.

Compound Ezab are holdings collected in a compound. They are licensed and supervised by the government. Land ownership is governmental. There are 9 compounds of Ezab in the country. Each holding has a limited area of not more than 2500 square meter (50 m x 50 m). Animal feed and drinking water brought from outside the holding.

Roving Ezab are movable animal holdings on governmental land in open area. Constructions are of non-permanent materials. The land area is not limited.

Outside planning Ezab are extension to a rural house or a farm. The land is governmental,

adjacent to a farm or a house of the animals' owner. The holding's permit is renewed annually. Area is not limited (according to availability). Bricks' building is not allowed.

Others' holdings those are single barns or chalets in a private ownership of permit renewed annually. Area is not limited (according to availability). Bricks' building is not allowed.

Methodology

A survey of the different holdings (farms and Ezab) at the different municipalities of Qatar was conducted to provide data about holding type and area, type (employee or owner) and education of supervisor, type of flocks, age and sex composition of flocks and the use of the raised animals.

The sample size of the current study (SS) was determined according to modification of Cochran's sample size formula (formula 1) for the population of 5901 holdings (formula 2) (Bartlett et al., 2001) (SS = 380):

$$n_0 = \frac{z^2 pq}{c^2} \quad \text{formula 1}$$

$$SS = \frac{n_0}{1 + \left(\frac{n_0 - 1}{N}\right)} \quad \text{formula 2}$$

Where:

n_0 = Cochran's sample size

$Z = 1.96$ for 95% confidence level

p (proportion of the population which has the attribute in question) = 0.5

$q = 1 - p$

c (margin of error) = 0.05

SS = sample size of the current study

$N = 5901$ holdings

The questionnaire was prepared to provide information about the holding including its type (farm, compound, roving, outside planning Ezab or others), area of land allowed for animals in the holding, area of pens, area of shade in the pens. The questionnaire also tested information about the raised flock, including type of herding (sheep alone, goats alone or sheep and goats together), size of flock in the holding and age and sex details of the flock (number of adult males and females, weaned and un-weaned female and male offspring). The questionnaire also included questions about the education level of supervisor (secondary and above, primary or no education) and his relation to the holding (owner or an employee). Questions on the use of animals reared in the holding for self-use (slaughtered) or on commercial basis (sold) were also asked.

All data collected were entered in the computer using Microsoft Excel. Further data were synthesized. The produced data included percentage of females of total flock, Breeding value (number of offspring below one year/100 adult females), ratio of adult males to 100 adult females, young ratio (percentage of offspring below one year of the total flock), females off spring ratio (percentage of female offspring of the total offspring), total area/head, barn area/head, shed area percentage in the barn, percent of heads slaughtered or sold of the total flock/year and sheep flock percent in the holding.

2.2. Statistical analyses

Statistical analyses were conducted according to Statsoft (2011) to test the significance of effect of the different holding types on the collected data. Chi-square test was used for qualitative data and one-way analysis of variance was used for quantitative data. Separation of means for the affected quantitative traits was done by Duncan's multiple range test.

RESULTS AND DISCUSSION

Three hundred and eighty holdings responded to the questionnaire. Table (1) shows the numbers and percentages of the different types of the participating holdings.

Table 1: Frequency of holding type

	Count	Percent
Compound Ezab	245	64.5%
Roving Ezab	56	14.7%
Farms	30	7.9%
Outside planning Ezab	31	8.2%
Others	18	4.7%
Total	380	100%

3.1. Composition of small ruminants' flock in the different types of holdings

In the current study, small ruminants were observed to be raised mainly in mixed sheep and goats' flocks. Holdings rearing both sheep and goats were the major (68.1% of the total holdings), followed by those rearing sheep alone (24.3% of the total holdings), whereas those rearing only goats were minor (7.7% of the total holdings). This trend of distribution was not affected ($p > 0.05$) by the type of holdings (Table 2). The reason why fanciers keep more sheep than goats is that they are entirely subsisting on

them (Katiku et al. 2013, Kibiru 2007).

Small ruminants' flocks

Table (3) shows sex and age composition of small ruminants' flocks per holding. The average flock size (total animals) was affected ($p < 0.05$) by type of holding. Compound Ezab had lower average flock size than the other types those had similar flock size. This may be because compound Ezab had limited land area.

Sex composition of flocks was not affected by type of holding. Percentages of all females in the total flock, adult males to adult females and female offspring of the total offspring were not different among the groups of holdings. The age composition of the small ruminant flocks per holding showed no differences among holding types. Percentages of offspring below one year of the total flock were the same for all types of holdings. Flocks' breeding value did not show variation between holding types.

Total area of the holding, barn area/head and shed area (%) were variable ($p < 0.05$) among the holding types. For the total area, roving Ezab had the largest area allowed for animals' rearing facilities. Farms, outside planning Ezab and others holding types were higher than the compound Ezab that had the lowest area allowed. Land area available for animal raising usage (total holding area/total flock size) ranged between 4.9 to 6.9 square meters/ head. For the barn area and percent of shaded area in the barn, compound Ezab excelled all types of holdings. Owner of compound Ezab usually use almost the entire area available to construct the barns. The area allowance in the barns for head of small ruminants was above that stated for sheep and goats in the literature (1.8 to 2.5 square meter/ head).

The average percent of heads of animal consumed as meat animal (slaughtered for self-use or sold) of total flock was not affected ($p > 0.05$) by holding type. Holdings rear mixed flocks (sheep and goats) were 158, 45, 25, 19 and 13 of compound Ezab, roving Ezab, farms, outside planning Ezab and others' types, respectively. Among the holdings' types, the percent of sheep in the total mixed small ruminants' flocks was always above 60% and it was not different ($p > 0.05$) among the holding types.

Sheep flock

Table (4) shows sex and age composition of sheep flocks. The average flock size was affected ($p < 0.05$) by type of holding. Compound Ezab had

the lowest average sheep flock size. Percentages of all females in the total flock, adult males to adult females, percentages of offspring below one year of the total flock and breeding value did not show variation ($p > 0.05$) between holding types. Percentage of female offspring of the total offspring was affected ($p < 0.05$) by the type of holdings; other type of holding showed the lowest percent. Animals holdings those practiced selling their production among the surveyed holdings were 57, 23, 7, 9 and 5 compound Ezab, roving Ezab, farms, outside planning Ezab and others' types, respectively. Those practiced slaughtering were 177, 43, 26, 17 and 15 compound Ezab, roving Ezab, farms, outside planning Ezab and others' types, respectively. The average of numbers of sheep sold/holding/year was the same ($p > 0.05$) for all holdings, however, farms had higher ($p < 0.05$) average of number of sheep slaughtered/holding/year than the other types of holdings.

Goats flock

Table (5) shows sex and age composition of goats' flocks. The average flock size was affected ($p < 0.05$) by type of holding. Compound Ezab had the lowest average goats' flock size. Percentages of all females in the total flock, percentages of offspring below one year of the total flock, breeding value and female offspring of the total offspring did not show variation ($p > 0.05$) between holdings' types. Whereas ratio of adult males to adult females was affected ($p < 0.05$) by the type of holdings. Roving and outside planning Ezab types showed the lowest percentages. Among the holdings those use their production of goats, the average of numbers of goats sold/holding/year was the same ($p > 0.05$) for all holdings' types. However, compound Ezab had lower ($p < 0.05$) average number of goats slaughtered/holding/year than the other types of holdings. Some owners of compound Ezab and chalets (others' type) resort to raising goats not for the purpose of making use of their meat, but for show competitions and for the continuation of the licensing of the holding. Therefore, males will not be sold or slaughtered, this leads to an increase in the numbers of males within possession to reach a high percentage of the total flock. As for farms and outside planning Ezab, managers resort to take advantage of males to meet the needs of red meat considering the holding as a commercial project. Among the surveyed holdings, those practiced selling of goats were 31, 19, 6, 5 and 4 compound Ezab, roving Ezab, farms, outside

panning Ezab and others' types, respectively. Those practiced slaughtering of goats were 106, 35, 22, 15 and 8 compound Ezab, roving Ezab, farms, outside panning Ezab and others' types, respectively.

Consumption of holdings production:

The relationship between the type of holding and the consumption of small ruminant for red meat production is shown on table (6). The consumption of small ruminants for slaughter (self-use) or selling to consumer was variable ($p < 0.05$) among the different types of holdings. All the type of holdings mainly consumed their production for self-use except roving Ezab type that also practiced selling of production to create a margin of simple profit. Table (7) shows the relation between the species of consumed small ruminants (sheep, goats or both) and the holdings' type. All the types of holdings mainly used both sheep and goats' production except others and to some extent compound Ezab those mainly consumed sheep flock. Sorensen et al. (2006) noted that sheep meat is still the most internationally traded type of meat. Lamb meat is, on average, the most expensive type of meat worldwide. However, production systems vary between countries.

The type and education of supervisor of animals in the holdings

The supervisor at the holding may be owner

himself or an employee. Table (8) shows the distribution of type of supervisor in the studied holdings. Among the different holdings' type, 93.5 to 100% of holdings have an employee supervisor, except the others' type of holding where the supervisor is the owner himself for 22.2% of the holdings. This is because fanciers' home in others type of holdings (usually it is a single barn or chalet) is either inside the holding itself or within the area of the holding.

The relationship between the education level of the supervisors and the holdings' types is shown in table (9). Supervisor's education level was variable ($p < 0.05$) among the different holding types. Above 90% among all types, except farms, had the education level of supervisors between no education and primary. For farms, 20% of holdings had the supervisors' education was secondary and above. This is because the farms usually contain other agricultural production projects and farms' owners usually benefit from the available expertise in management of animals in the farm. Similarly, FAO (2015) stated that the traditional small holder system usually has lower access to technologies, inputs, information and training than large scale intensive production system in farms. As a result, the economic involvement of smallholder systems is increasingly difficult, with inhibited access to the growing consumer market.

Table 2: Type of small ruminants' flocks as affected by the type of holding

		both	sheep	goats	Row Totals
Compound Ezab	Number	156	70	18	245
	Row %	63.9%	28.7%	7.4%	
Ezab	Number	45	6	5	56
	Row %	80.4%	10.7%	8.9%	
Farms	Number	25	4	1	30
	Row %	83.3%	13.3%	3.3%	
Outside planning Ezab	Number	19	8	4	31
	Row %	61.3%	25.8%	12.9%	
Others	Number	13	4	1	18
	Row %	72.2%	22.2%	5.6%	
Column Totals	Number	258	92	29	380
	Row %	68.1%	24.3%	7.7%	
Chi-square		13.0			
Prob.		0.11			

Table 3: Mean values for small ruminants' flocks' sex and age composition

	Compound Ezab	Roving Ezab	Farm	Outside planning Ezab	others	SEM	Prob.
Number ofholdings	244	56	30	31	18		
Total flock,heads/holding	112 ^b	294 ^a	255 ^a	216 ^a	224 ^a	29	0.00
Percentage of females of total flock, %/holding	80.9	83.1	81.6	82.4	80.5	1.65	0.60
Breeding value (number of offspring below one year /100 adult females)/ holding	66.4	52.4	57.3	55.3	51.6	11.06	0.52
Number of adult males to 100 adult females /holding	9.3	5.0	7.2	6.4	6.1	1.94	0.01
Young ratio (percentage ofoffspring below one year of the total flock/holding)	58.3	49.9	53.4	51.6	48.8	5.23	0.27
Females offspring ratio (percentage of femal offspring of the totaloffspring/holding)	58.1	55.6	57.8	55.7	46.8	3.73	0.30
Holding total area, square meter	417 ^c	1568 ^a	1151 ^b	1187 ^b	883 ^b	108	0.00
Total area/head, square meter/head	4.9 ^c	6.9 ^a	5.5 ^{bc}	6.4 ^{ab}	4.7 ^c	0.47	0.00
Barn area/head, square meter/head	2.8 ^a	2.3 ^{ab}	2.6 ^{ab}	2.3 ^{ab}	2.0 ^b	0.22	0.01
shed area%	54.7 ^a	44.5 ^b	50.7 ^{ab}	51.8 ^{ab}	47.1 ^b	2.43	0.00
Percent of heads slaughtered or sold of total flock/year	12.9	13.1	14.0	14.6	10.0	1.28	0.38
sheep flock%	61.3	70.5	60.7	60.4	70.1	5.03	0.20

^{abc} Means in the same row without common letter are different at P<0.05

Table 4: Mean values for sheep flock composition

	Compound Ezab	Roving Ezab	Farm	Outside planning Ezab	Others	SEM	Prob.
	224	51	29	27	17		
Total flock, heads/holding	87 ^b	234 ^a	192 ^a	179 ^a	189 ^a	27	0.00
Percentage of females of total flock, %/holding	78.7	78.6	78.0	78.0	76.0	2.08	0.93
Breeding value (number of offspring below one year /100 adult females)/ holding	64.6	70.4	52.6	57.4	52.8	11.7	0.73
Number of adult males to 100 adult females /holding	8.5	4.5	8.0	8.1	5.8	1.56	0.06
Young ratio (percentage of offspring below one year of the total flock/holding)	33.7	33.0	31.1	32.8	31.9	2.32	0.87
Females offspring ratio (percentage of female offspring of the total offspring/holding)	50.7 ^a	43.3 ^{ab}	46.0 ^a	42.9 ^{ab}	31.5 ^b	4.59	0.02
Number of sheep sold/holding/year	13	25	13	14	10	6	0.17
Number of sheep slaughtered/holding/year	9 ^b	20 ^{ab}	24 ^a	16 ^{ab}	18 ^{ab}	4	0.00

^{abc} Means in the same row without common letter are different at P<0.05

	Compound Ezab	Roving Ezab	Farm	outside planning Ezab	others	SEM	Prob.
	177	49	26	23	14		
Total flock, heads/holding	47 ^b	92 ^a	86 ^a	83 ^a	63 ^{ab}	11	0.00
Percentage of females of total flock, %/holding	80.1	83.9	81.6	83.7	80.4	1.84	0.11
Breeding value (number of offspring below one year/100 adult females)/ holding	74.2	63.0	74.3	69.8	58.6	9.21	0.54
Number of adult males to 100 adult females /holding	13.6 ^a	8.3 ^b	10.6 ^{ab}	6.7 ^b	14.0 ^a	2.55	0.04
Young ratio (percentage of offspring below one year of the total flock/holding)	37.2	35.2	38.0	35.3	32.9	2.79	0.73
Females offspring ratio (percentage of female offspring of the total offspring/holding)	66.0	68.0	67.5	65.5	62.4	3.47	0.88
Number of goats sold/holding/year	8	11	6	6	10	3	0.57
Number of goats slaughtered/holding/year	5 ^b	8 ^{ab}	13 ^a	13 ^a	9 ^{ab}	2	0.00
^{abc} Means in the same row without common letter are different at P<0.05							

Table 6: Consumption of production among holdings' types

		No use	Only slaughter	Selling and slaughter	Only selling	Row Totals
Compound Ezab	Number	38	140	62	5	245
	Row %	15.5%	57.1%	25.3%	2.0%	
Roving Ezab	Number	8	19	29	0	56
	Row %	14.3%	33.9%	51.8%	0.0%	
Farms	Number	2	20	7	1	30
	Row %	6.7%	66.7%	23.3%	3.3%	
Outside planning Ezab	Number	8	12	11	0	31
	Row %	25.8%	38.7%	35.5%	0.0%	
Others	Number	1	11	6	0	18
	Row %	5.6%	61.1%	33.3%	0.0%	
Column Totals	Number	57	202	115	6	380
	Row %	15.0%	53.2%	30.3%	1.6%	
Chi-square	26.0					
Prob.	0.01					

Table 7: Species of small ruminants consumed as affected by holdings' type

		Sheep	goats	both	Row Totals
Compound Ezab	Number	98	25	83	206
	Row %	47.6%	12.1%	40.3%	
Roving Ezab	Number	13	5	29	47
	Row %	27.7%	10.6%	61.7%	
Farms	Number	6	2	20	28
	Row %	21.4%	7.1%	71.4%	
Outside planning Ezab	Number	8	6	9	23
	Row %	34.8%	26.1%	39.1%	
Others	Number	9	2	6	17
	Row %	52.9%	11.8%	35.3%	
Column Totals	Number	134	40	147	321
	Row %	41.7%	12.5%	45.8%	
Chi-square	20.3				
Prob.	0.01				

Table 8: Type of animals' supervisor among the holding types

		employee	owner	Row Totals
Compound Ezab	Number	240	5	245
	Row %	98.0%	2.0%	
Roving Ezab	Number	55	1	56
	Row %	98.2%	1.8%	
Farms	Number	30	0	30
	Row %	100.0%	0.0%	
Outside planning Ezab	Number	29	2	31
	Row %	93.5%	6.5%	
Others	Number	14	4	18
	Row %	77.8%	22.2%	
column Totals	Number	368	12	380
	Row %	96.8%	3.2%	
Chi-square	24.8			
Prob.	0.00			

Table 9: Supervisors' education level among holding types

		primary	secondary and above	no education	Row Totals
Compound Ezab	Number	151	6	88	245
	Row %	61.6%	2.4%	35.9%	
Roving Ezab	Number	37	0	19	56
	Row %	66.1%	0.0%	33.9%	
Farms	Number	18	6	6	30
	Row %	60.0%	20.0%	20.0%	
Outside planning Ezab	Number	15	3	13	31
	Row %	48.4%	9.7%	41.9%	
Others	Number	11	0	7	18
	Row %	61.1%	0.0%	38.9%	
Column Totals	Number	232	15	133	380
	Row %	61.1%	3.9%	35.0%	
Chi-square	30.1				
Prob.	0.00				

This study documented for the structure of small ruminants' flocks and their management system in Qatar. Small ruminants are raised mainly in small mixed flocks. The area available were not used efficiently for animal production (holding area /head of animals in the holding ranged between 4.9 to 6.9 square meters). However small ruminants resemble about 90% of the national livestock herd of Qatar still it was raised under traditional system. More efforts are needed to raise the awareness about commercialization of the production of these traditional holdings to increase their share to the national food security. In the same context FAO (2015) reported that Smallholders and pastoralists have been coping and adapting to challenges posed by climate change, rapid urbanization, population growth, marketing barriers and health risks for centuries. They further mentioned that innovation is necessary in order to support livestock keeper communities to cope with and adapt to new challenges.

CONCLUSION

It can be concluded that the current study availed marked highlights about the potential of small ruminants' national flock and the impact of management system on its potential. The study results constituted a database for further research of small ruminant in the country. This may assist in proper designing of adequate policy or institutional innovation to improve the system. There is a great need of further studies on the possible ways to improve the productivity of the practiced systems especially at the moment when the concept of commercialization is being promoted.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

FAA, MA and MTI initiated the concept and designed the research proposal; AMA and AIA achieved logistics; FAA and MA followed data collection, management and analysis; MA prepared original draft

of manuscript; MTI reviewed the manuscript; All authors read and approved the final version .

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