Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2019 16(2): 1925-1935. **OPEN ACCESS**

Impact of outreach and fair compensation on brucellosis seroprevalence of large ruminants and householder's knowlege, attitude and practices in Upper Egypt.

Nader R. Nassar[1], Hassan M. Sobhy[2], Ibrahim G. Ibrahim[1], Mohamed S. El-Garhy[1] and Wafai Z. A. Mikhail[2*]

[1] Animal Reproduction Research Institute, Agriculture Research Center, Giza, **Egypt**.
[2] Dept of Natural Resources, Faculty of African Postgraduate Studies, Cairo University. **Egypt**

***Correspondence:** wafai47@hotmail.com **Accepted: 21** May. 2019 **Published online:** 04 June. 2019

This study aims to assess the impact of fair compensation and veterinary outreach on cattle and buffalo householders' knowledge attitude, practices (KAPs) and animal brucellosis seroprevalence in a village in Upper Egypt, trying to find a successful example for brucellosis control. Blood samples were collected from a total number of 772 animals, 434 cattle and 338 buffalos. Households were divided into four groups for the purpose of the present study during 2018. Samples were examined serologically by Buffered Plate Antigen Test (BPAT), Rose Bengal Test (RBT) and Complement Fixation Test (CFT). Data about knowledge, attitude and practices (KAPs) of animal householders was collected in two questionnaires with one year interval in between. Veterinary Outreach about Brucellosis was given to the only targeted two groups all over the year. Seroprevalence was significantly lower in the two groups subjected to fair compensation. They were (1%, 1%, 1%) and (1.8%, 0.9 %, 0%) versus (3.8%, 3.8%, 1.9%) and (2.7%, 2.7%, 2.7%) in the other two groups by BPAT, RBT and CFT. Seroprevalence was significantly lower in the two groups subjected to veterinary outreach than corresponding two groups. KAPs especially notification about positive animals changed positively due to Fair compensation and veterinary out reach.

Keywords: Brucellosis control – seroprevalence – compensation – veterinary outreach - Egypt.

INTRODUCTION

It is likely that brucellosis was an endemic disease in Egypt from the era of Pharaohs and for thousands of years till now. There is evidence of sacroiliitis in pelvic bones, spondylitis and osteoarticular lesions in 5.2% of remnant bones (750 BC), which considered common complications of brucellosis (Pappas and Papadimitriou, 2007). A scientific report from Egypt in 1939 reported brucellosis in Egypt for the first time (Refai, 2002). Brucellosis is still endemic in many Egyptian Governorates in spite of continuous efforts of General Organization of Veterinary Services to control it. Effective control of animal brucellosis requires continuous surveillance to identify infected animals and slaughter positive animals to eliminate the reservoirs (Menshawy et al., 2014; Hosein et al., 2018). Massive economic losses occur in animal production in Egypt due to Brucellosis, moreover, it is a zoonotic disease transmitted from animals to humans worldwide (Holt et al., 2011).

Small-scale family farming is the fundamental animal husbandry and agricultural production

units in Egypt due to negative effect of land fragmentation on rural production as the Egyptian farming system depends mainly on integration between crop and livestock production. About 70.5 % of small agricultural holders in 1990 had large ruminants (cows and/or buffalo) and the same percent in 2010.About 81.3 % of landless holdings had large ruminants in 2010. The main threat to small holder and landless house holder is the endemic animal diseases. The average number of animal heads per holding was 2.12 for large ruminants. The small holders suffer from decline in community spirit and teamwork (FAO, 2017)**.** The majority of livestock in Egypt is owned by small house holders, animals kept with the owner in the same small house holding and its milk production which ranges between 1 to 6 kg/day consumed in his house as milk or dairy products or sold in the local market without any heat treatment (Aidaros, 2005). After more than 30 years of implementation of the control program in Egypt, brucellosis is still endemic among ruminants and recent studies illustrate that the incidence of infection may be increasing (Jennings et al., 2007). Low and delayed compensation for livestock owners in Egypt leads to slaughtering of only 0.2% of animals have Brucellosis seropositivity (Hegazy et al., 2011).

Cattle and buffaloes Brucellosis seroprevalence was almost higher in Beni-Suef Governorate comparing with other Upper Egypt Governorates (Refai, 2002; Samaha et al., 2008). Recently, farmer's husbandry practices and veterinary outreach became on spot as important factors influencing the spread of animal disease (Cleland et al., 1995). Community based animal health outreach programs for other diseases, such as avian influenza (AI), has been helpful for policy makers to make surveillance and develop control strategies and health education campaigns (FAO, 2011). In developing countries, an educational outreach campaigns done by veterinary extension, could aid in declining the incidence of brucellosis, and it is an essential constitute for success of control and prevention programs (Reddy et al., 2014). Knowledge, attitudes, and practices (KAP) surveys are an effective tool in estimating the sensibility of livestock owners to livestock diseases, especially in resource-scarce settings (WHO, 2008).

Health programs are unlikely to succeed if community participation is not an integral part of the structure and execution of these programs at local level. Laws, regulations and veterinary policy measures alone will not bring the desired results. The whole community needs to be involved through health education in such health programs (WHO, 2006). Incorrect perception of the smallholders reflects the need for outreach programs to ensure uptake of good preventive practices (Arif et al., 2017).

The Nongovernmental Organizations (NGOs) role is important in providing services, assisting needs, implementing policy, establishing a link between the community and the government, and sharing their expertise (Keen, 2006).

The most common used diagnostic methods for diagnosis of brucellosis are based on serology (Kaltungo et al., 2014). In a comparison of serological tests like BPAT and RBT, the CFT have the best specificity, proved the minimum false positives taking into account that the BPAT and RBT positive samples should be confirmed by CFT test. The most veritable method for diagnosis of brucellosis till now is serology and currently there is no single test can be reliable for brucellosis detection at the level of individual animal. BPAT (Buffered Plate Antigen Test) and RBT (Rose Bengal Test) are substantially recommended for screening and CFT (Complement Fixation Test) is recommended strongly for confirmation of positivity in individual animals (Al Dahouk et al., 2003; Hosein, 2017).

Belefia village contains a herd distributed among the disabled small house holders and some widows by Dar-Alorman Charity Society. Dar-Alorman Charity Society is one of the largest charity associations of the civil society and one of nongovernmental organizations (NGOs). It is interested in helping the poor people through animal production developmental Projects. Dar-Alorman Charity Society herd is about 55000 head of cows and buffaloes allover Egyptian Governorates from year 2000 till now. The main project is known in the media as the pregnant buffalo (Al Gamosa Al Oshr) (Dar-Alorman, 2018).

Depending on all of the above, as there were no studies in Egypt on brucellosis seroprevalence in the flocks distributed by the NGOs, which gives immediate satisfactory compensation by giving the recipient another pregnant buffalo or cow, immediate notification, and slaughtering of the confirmed *Brucella* positive buffalo or cow. The impact of these services on the brucellosis seroprevalence of the flock isn't studied till now. There are no studies have been conducted to assess impact of compensation and outreach on brucellosis serosurveillance of animals neither kept in small

holders nor distributed by NGOs. This study aims to assess the impact of immediate compensation, veterinary extension outreach and the role of NGOs on brucellosis seroprevalence in an endemic village of brucellosis in Upper Egypt, trying to give a successful example of brucellosis control can be modified for future application on the national level.

MATERIALS AND METHODS

Ethical approval

All clinical samples in this study were collected as standard sample collection procedure, without any harm or stress to the animals. The present work was approved by the Ethical Committee for Medical Research at: Faculty of African Postgraduate Studies, Cairo University; Animal Reproduction Research Institute (ARRI, Haram), Agricultural Research Center (ARC) and the administration of Dar-Alorman Charity Society.

Study area and herds

Belefia is a village in Beni-Suef district which is the capital of Beni Suef Governorate. Beni Suef Governorate has a location within Egypt Coordinates: 29°04′N 31°05′E, located to the south of Greater Cairo along the Nile Valley. This village was chosen as it includes the two types of large ruminants' householders, the recipients of Dar-Alorman Charity Society (DACS) project and other small householders.

In Belefia village there are 214 recipients of DACS project. Their animals submitted to a follow-up included, 6 months periodical serosurveillance for animal reproductive conditions and sexually transmitted diseases including brucellosis within two years from granting one pregnant buffalo or cow to the recipient. The veterinary care is given also to the progeny of the granted buffalo or cow during these two years. There is a database to this herd contains census, identification and other data about this herd. DACS compensates immediately its recipient in case of positivity to brucellosis of granted animals or its progeny, as they grant him another pregnant buffalo or cow and slaughters the positive animal. In the same village there is the herd of other small house holders which subjected only to the compensation system of general organization of veterinary services which may be delayed for several months and is less than 20% of the market value for the animal. There was no accurate census to the herd of small holders in the village.

Study of population and sampling strategy

In Belefia village, there are no sampling frames, so systemic sampling which involves selection of sampling units at equal intervals was used. House holdings in this study are selected using this system. All buffaloes and cows in this house holding were sampled according to one-stage cluster sampling. For simple random sampling, target sampling size was estimated to be 138 for a level of confidence 95%, 5% desired absolute precision and an expected prevalence of 10%. In order to account for clustering within households, this was multiplied by a design effect of 1.2, which was estimated using expert knowledge, assumed that there are 2 animals per house holding with correlation coefficient intracluster of 0.2. Target sample size =1.2 (138) = 165.6. Therefore 166 individual animals or 83 house holdings were sampled. The total number of houses which hold buffaloes and cows in the village were estimated to be 3500 house holding, so every 42 house holding sampling is done.

By asking local vets and animal householders, all animals in the village weren't vaccinated against brucellosis earlier, for many years. For the purpose of this study animals were classified to four groups, two groups owned by small householders and the other two groups owned by the beneficiaries and recipients of Dar-Alorman Charity Society as the following :-

In the initial visit the first questionnaire was filled. After 12 month from the first questionnaire, and parallel to filling of the second questionnaire, all animals in the four groups were sampled at the same time.

Group (1); this group didn't receive any tailored specific combating brucellosis outreach or immediate compensation except that provided from General Organization of Veterinary Services (delayed payment and less than market value of the slaughtered animals). This group was considered as the control group. Animals in this group are owned by small holder and were selected by cross sectional study. In this group, 87 households were selected and 191 animals in these households were sampled, 53 (28%) of them are buffaloes and 138 (72%) were cows. As the center of the village was the mosque square, so the initial household or the sampling starting point was selected randomly at this square. Sampling is done every 42 house holding, taking the direction in the main street towards outer

boarder of the village then counterclockwise direction till the next main street then to the center again and so on. If the household wasn't contain any large ruminant the next neighbor household containing large ruminants was sampled.

Group (2); this group received a tailored outreach by the researching group 12 months before sampling but wasn't under the umbrella of immediate compensation provided by Dar-AlOrman Charity Society. There was no compensation except that provided from General Organization of Veterinary Services (GOVS). Animals in this group are owned by small holders and were selected by cross sectional study. In this group 86 households were selected, and 195 animals in these households were sampled, 74 (38%) of them were buffaloes and 121 (62%) were cows. The sampling starting point in this group was the household number 21 in the same direction of movement to sample in Group (1).Sampling done every 42 house holding in the same manner.

Animals in each of group (3) and (4) are owned by beneficiaries or recipients of Dar-Alorman Charity Society. The association was holding an updated database. All the animals was identified by ear tags and the total number of the animals was 386 animal (211 Buffaloes and 175 cows) in 214 households. Households were divided randomly into a pair of groups every group contains 107 households. All buffaloes and cows in every Household were sampled in the same time in which other groups were sampled.

Group (3); this group didn't receive a tailored outreach by the researching group but was under the umbrella of immediate compensation provided by Dar-Alorman Charity Society. All buffaloes and cows (181) in the selected 107 households were sampled, of them 102 (56%) buffaloes and 79 (44%) cows.

Group (4); this group was indoctrinated the same tailored outreach by the researching group, 12 months before sampling and was under the umbrella of immediate compensation provided by Dar-Alorman Charity Society. All buffaloes and cows (205) in the selected 107 households were sampled, of them 109 (53%) were buffaloes and 96 (47%) were cows.

Data collection:

Two pre structured questionnaires were filled by the target persons in every group after agreement to participate in a study related to animal health. The name of disease wasn't mentioned to exclude any bias in answers. The first questionnaire was filled at June 2017. After 12 month interval the second questionnaire was filled to monitor any change in large ruminant householder's householders' knowledge attitude and practices (KAPs). During the initial visit a structure designed questionnaire to assess the knowledge, attitude and practices of house holders was filled by animal care taker and the person who was responsible for milking the animal (2 persons) from every selected household.

During the second visit (after veterinary public health education and outreach to groups 2 and 4 only) the same sequence occurred in collecting data from the same 2 persons of the first questionnaire in the 4 groups. Two questionnaires were filled by the four groups to discover if there was any effect except that of veterinary outreach and rapid compensation on the four groups. In the same time animal blood sampling was occurred.

Serological tests

Blood samples were collected at June 2018 for routine diagnostic tests of brucellosis according to (Alton et al., 1988). Blood were collected after twelve months from the date of first Questionnaire in the same time of filling the second Questionnaire. Buffered plate antigen test (BPAT) using Buffered acidified plate test antigen (killed *Brucella abortus* strain 99 antigen, at concentration of 11% in lactate buffer, pH 3.7±0.03), Rose Bengal test (RBT) using Rose Bengal test antigen (Rose Bengal stained, 8% cells killed *Brucella abortus* strain 99 antigen in lactate buffer, pH 3.65±0.05) and Complement fixation test, warm micro technique (CFT), using complement fixation test antigen (*Brucella abortus* biovar 1 strain 1119-3 cells in phenol saline, at a concentration of 4.5%, pH 6.8) were conducted (Alton *et al*., 1988; OIE, 2016)

Veterinary outreach message

The message was designed according to the new P-Process, steps in strategic communication (Health Communication Partnership, 2003). The message was directed toward basic knowledge, good attitude and good practices to control brucellosis and veterinary outreach campaigns were continued for six months to targeted groups.

Statistical analysis

Data were analysed was carried out using two way ANOVA test and differences between means and LSD at $P<0.05$ were considered according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Table (1) shows results of impact of veterinary outreach and immediate fair compensation on brucellosis seroprevalence in different groups with different screening and confirmatory serological tests in the four groups. G1 (53 buffaloes and 138 cattle), G2 (74 buffaloes and 121 cattle), G3 (102 buffaloes and 79 cattle), and G4 (109 buffaloes and 96 cattle). Total number of animals is 772 (338 buffaloes and 434 cattle).

Table (2) shows Impact of veterinary outreach and immediate fair compensation on knowledge, attitude and practices (KAPs) of animal householders towards brucellosis in Group 1 and Group 2.

Table (3) shows Impact of veterinary outreach and immediate fair compensation on knowledge, attitude and practices (KAPs) of animal householders towards brucellosis in Group 3 and Group 4

The present study was designed to assess the impact of veterinary outreach and rapid fair compensation donated by nongovernmental organizations (Dar-Alorman Charity Society) on animal brucellosis seroprevalence and large ruminant householders' Knowledge, Attitude and practices (KAPs) in an endemic village in Beni-Suef Governorate of Upper Egypt. Beni-Suef Governorate has the highest seroprevalence at Upper Egypt according to Samaha et al., (2008) and Refai (2002). The present study tried to clarify the role of NGOs in brucellosis control in Egypt and to estimate the impact of the two factors (immediate, fair and sufficient compensation provided by NGOs and veterinary outreach about brucellosis) on the animal householders KAPs and the reflex on their large ruminant's seroprevalence. Also, find the lost fragment of puzzle which may help in completing the picture which elucidates ineffectiveness implementation of brucellosis control programs in Egypt, as brucellosis is still endemic among ruminants and recent studies illustrated that the incidence of infection may be increasing according to Jennings et al., (2007).

The overall seroprevalence of examined buffaloes was 2.1% (9 of 434). These 9 positive cases were distributed in the four groups as the following; group (1) had (4 of 138) with prevalence 2.9%. Group (2) had (4 of 121) with prevalence 3.3%. Group (3) had (0 of 79) with prevalence 0% and group (4) had (1 of 96) with seroprevalence 1%.

In the current study, in Table (1), the overall seroprevalence of examined cows by BAPAT was 2.8% (12 of 434). These 12 positive cases were distributed in the four groups as the following; group (1) had (6 of 138) with the highest prevalence equal 4.3%. Group (2) had (4 of 121) with prevalence 3.3%. Group (3) had (1 of 79) with prevalence 1.3% and group (4) had (1 of 96) with the lowest prevalence equal 1%. The overall seroprevalence of examined cows by RBPT was 2.3% (10 of 434), these 10 positive cases were distributed in the four groups as the following; group (1) was the highest (5 of 138) with prevalence 3.6%. Group (2) had (4 of 121) with prevalence 3.3%. Group (3) had (0 of 79) with prevalence 0% and group (4) had (1 of 96) with prevalence 1%. The same examined cows showed the following results by Complement Fixation Test (CFT); G1 had (4 of 138) with seroprevalence 2.9% and the other results were similar to that of RBPT.

By comparing the results of cattle and buffaloes brucellosis seroprevalence, G1and G2 are significantly higher than G3 and G4, which may be attributed to the positive effect of veterinary outreach and rapid fair compensation donated by nongovernmental organizations on animal brucellosis seroprevalence.

These results in all groups were less that obtained by another study who studied brucellosis seropervalence among buffloes and cattle in some Governorates including, Beni-Suef Governorate. They reported that highest prevalence is 6.93% for buffaloes and 7.77% for cattle, by the BAPAT which confirms that the area of study was endemic in brucellosis (Samaha et al., 2008). In the current study cows appear to be more likely to have higher seropositivity than Buffaloes this agrees with the results obtained by a cross-sectional study investigated for brucelosis seroprevalence in an endemic village of Egypt (Holt et al., 2011). The low occurrence of brucellosis in buffaloes 1.8% by RBPT than cows 2.3%, may be attributed to the few number of buffaloes intensive farms in comparison with cows. The major population of buffaloes in Egypt is still characterized by individuality in the small villages with the small householders. The resistance of such animal to certain extent, which agrees with a study in Trinidad and Tobago in which experimental intraconjunctival inoculation of a strain of *Brucella abortus* in 1969, illustrated that buffaloes are more resistant to *B. abortus* infection and cattle is more susceptible (Adesiyun et al., 2010; Adesiyun et al., 2011).

Table 1: Impact of veterinary outreach and immediate fair compensation on Brucellosis seroprevalence in different groups with different tests.

Test / Group	Buffloes				Cattle			
	Prevalence with BAPAT	Prevalence with RBPT	Prevalence with CFT	Mean of group	Prevalence with BAPAT	Prevalence with RBPT	Prevalence with CFT	Mean of group
Group 1	3.8	3.8	1.9	3.17[a]	4.3	3.6	2.9	3.6[a]
Group 2	2.7	2.7	2.7	2.7[a]	3.3	3.3	3.3	3.3[a]
Group 3	1.0	1	1	1.0[b]	1.3	0	0	1.0[b]
Group 4	1.8	0.9	0	0.9[b]	1.0	1.0	1.0	0.4[b]
Mean of test	2.3[a]	2.1[a]	1.4[a]		2.4[a]	1.9[a]	1.8[a]	
(LSD)	1.03			1.2	0.74			0.86

Means with the same letter are not significantly different. Group (1), (53 buffaloes and138 cattle). Group (2), (74 buffaloes and121 cattle). Group (3), (102 buffaloes and79 cattle). Group (4), (109 buffaloes and 96 cattle). Total number of animals 772 (338 buffaloes and 434 cattle)

Table (2): Impact of veterinary outreach and immediate fair compensation on knowledge, attitude and practices (KAPs) of animal householders towards brucellosis in Group 1 and Group 2.

Group			Group 1 (174 persons)				Group 2 (172 persons)			
Stage			First questionnaire		second questionnaire		Before VO		After VO	
Item			+ve	%	+ve	%	+ve	%	+ve	%
Attitude and practices.	(1)Disposal of placenta (a) In the water canals.		145	83.3	149	85.6	157	91.3	59	34.3
	(b) Burning.		14	8	14	8	9	5.2	107	62.2
	(c) Burial.		15	8.6	11	6.3	6	3.5	6	3.5
	(2) Wearing protective gloves during helping in parturition		7	4	5	2.9	8	4.7	79	45.9
	(3) Isolation of aborted cows and buffaloes from other animals in the house hold.		2	1.1	3	1.7	3	1.7	126	73.3
	(4) Selling fresh milk in relation to stages of study		159	91.4	160	92	142	82.6	151	87.8
	(5) Heat treatment for milk before selling.		0	0	0	0	0	0	2	1.2
	(6) Calling a private veterinarian to take advice before notification		79	45.4	51	29.3	65	37.8	107	62.2
	(7) How to get rid of infected animal	(1)sell it to neighbor	7	4	7	4	9	5.2	6	3.5
		(2) Sell it in the market	139	8	72	41.3	126	73.3	7	4.1
		(3) Sell it to the butcher	26	14.9	95	54.6	36	20.9	154	89.5
		(4) Notify the Veterinary authorities	2	1.1	0	0	1	0.6	5	2.9

Table (3): Impact of veterinary outreach and immediate fair compensation on knowledge, attitude and practices (KAPs) of animal householders towards brucellosis in Group 3 and Group 4.

Group			Group 3 (214 persons)				Group 4 (214 persons)			
Stage			First questionnaire		second questionnaire		Before VO		After VO	
Item			+ve	%	+ve	%	+ve	%	+ve	%
Attitude and practices.	(1)Disposal of placenta (a) In the water canals.		199	93	183	85.5	188	87.9	12	5.6
	(b) Burning.		13	6.1	29	13.6	22	10.3	198	92.5
	(c) Burial.		2	0.9	2	0.9	4	1.9	4	1.9
	(2) Wearing protective glove during helping in parturition		14	6.5	17	7.9	12	5.6	91	42.5
	(3) Isolation of aborted cows and buffaloes from other animals in the house hold.		19	8.9	25	11.7	22	10.3	203	94.9
	(4) Selling fresh milk in relation to stages of study		54	25.2	54	25.2	61	28.5	58	27.1
	(5) Heat treatment for milk before selling.		0	0	0	0	0	0	1	0.5
	(6) Calling a private v to take advice before notification		214	100	214	100	214	100	214	100
	(7) How to get rid of infected animal	(1) sell it to neighbor	0	0	0	0	0	0	0	0
		(2) Sell it in the market	0	0	0	0	0	0	0	0
		(3) Sell it to the butcher	0	0	0	0	0	0	0	0
		(4) Notify the veterinary authorities	214	100	214	100	214	100	214	100

In comparing results of G1 to G2 to identify the impact of Veterinary Outreach (VO) on small householders KAP and brucellosis seroprevalence of their buffaloes and cattle, prevalence in G2 was lower than in G1 in both buffaloes and cattle, and by the two rabid screening tests (BAPAT and RBPT), but it was higher by CFT. The differences were not significant between the seroprevalence of the two groups, which reflects that VO only without other factors like rapid fair compensation nor NGOs support and management had no significant positive effect on animal brucellosis seroprevalence. In Table (2), referring to the knowledge (symptoms, transmission and control) in the two groups, it was obviously raised after VO in G2 which confirms that VO increases the knowledge of animal house holders. Low levels of Knowledge in G1 are matching with results illustrated by another study mentioned that in developing countries, there is insufficient outreach by the public health authorities, rare awareness campaigns with the underreporting of disease and shortage of surveillance (Jennings et al., 2007). On the other hand, (Holt et al., 2011) and **(**Eltholth et al., 2015) recorded higher levels of Knowledge about brucellosis in Egypt, but in a village of the Nile Delta. These results refers to Knowledge about disease is lower in upper Egypt than in Nile delta, which assures upper Egypt needs veterinary outreach campaigns about brucellosis more than Nile Delta.

Attitude and practices of animal householders can be classified into three categories; the first category needs high financial scarifications and leads to high financial losses if there is no rapid fair compensation, like notification. The second doesn't need financial scarifications like, disposal of placenta, wearing protective gloves, calling a private veterinarian to take advice. The third is related to incorrect habits of their customers and any change in these habits will cause commodity recession and economic loses to the producers like milk heat treatment before selling.

The first category like notification of veterinary authorities, in G2 the only 5 persons (2.9%) agreed to notify comparing to only one person (0.6%) agreed before VO to notify. In G1 in the first questionnaire only 2 persons (1.1%), and no one (0%) in the second questionnaire agreed to notify as lack and delay of compensation for livestock owners in Egypt reduces notification and slaughtering of positive cases as notification leads to economic losses due to low compensation. Low compensation was estimated by (Holt et al., 2011) and (Eltholth et al., 2015) with an average of 3,876 LE which is less than 20% of the real

price of the slaughtered animal. The obtained results were similar also to that obtained by another study that concluded that low and delayed compensation for livestock owners in Egypt leads to slaughtering of only 0.2% of animals which have brucellosis seropositivity (Hegazy et al., 2011). The obtained results confirm increase hazards of disease transmission leading to high animal and zoonotic infection.

The second category of attitude and practices which doesn't need financial scarifications like, disposal of placenta, wearing protective gloves, calling a private veterinarian to take advice and isolation of aborted animal, all results in this category was markedly improved after VO. isolation of aborted animal also raised markedly from1.7% to 73.3% as the VO focused through the new P-Process in the tailoring the communication message on how to isolate the animal in a simple hygienic manner using available facilities, in a previous study reported that small holders didn't respond to isolate the infected animals due to lack of facilities (Holt et al., 2011). This reflected the important role of veterinary outreach on solving the problems to make positive changes in the attitude and practices of the small householders. Responding to isolation of aborted animal may reduces the risk of infection to in contact animals.

The third is related to incorrect habits of their customers and any change in these habits will cause commodity recession and economic loses to the producers like milk heat treatment before selling. This category needs changing the community behavior of all people not only the householders' behavior. Mass media outreach messages is strongly recommended for this category to change community behavior. These results confirm that rules mentioned in a study about use of mass media campaigns (Wakefield et al., 2010).

Before designing a control program cost-benefit analysis became a must before starting brucellosis control program, cost-benefit analysis was recently applied in India to estimate the endurance and permanence of a brucellosis control program for buffalo and cattle (Singh et al., 2018).

By comparing results of G1 to that of G3 to identify the impact of fair rapid compensation and efforts of NGOs on animal brucellosis seroprevalence and KAP of animal householders, seroprevalence in cattle of G1 were 4.3%, 3.6% and 2.9% versus 1.3%, 0% and 0% in G3 by BAPAT, RBPT and CFT. In buffaloes of G1 was 3.8%, 3.8% and 1.9% versus 1%, 1% and 0% in buffaloes of G3 by BAPAT, RBPT and CFT. These results reflect significant difference between seroprevalence in the two groups which confirms the positive effect of fair rapid compensation and efforts of NGOs which led to minimize animal brucellosis seroprevalence**.** Referring to KAPs of animal householders**'** results of knowledge was very similar as there were no VO campaigns. This similarity excludes occurrence of external VO campaigns or an external effect on the two groups during the year of the study, which was confirmed by feedback from householders and local veterinarians in the village. Similar results obtained in two provinces in Pakistan (Arif et al., 2017). Incorrect perception of the smallholders reflects the need for outreach programs to ensure application of good brucellosis preventive practices. The impact of fair rapid compensation and efforts of NGOs were very clear on calling a private veterinarian to take advice before notification. The percent in G1 was 45% and 29.3% in the first and second questionnaire while all participants (100%) in G3 were calling the private veterinarian to take advise before notification because this service was paid by the NGO and available free of charge to all beneficiaries of the project by the society veterinary consultants. The very high impact of fair rapid compensation was clearly evident from comparing the ratio of notifications in the two groups, as in G1 it was 1.1% and 0% consequently in the two questionnaire versus 100% in G3 which confirms that rapid fair compensation is a very effective tool in brucellosis control. Fair rapid compensation reflected on minimizing brucellosis seroprevalence in G3. All of above reflect the important rule of NGOs in controlling the diseases in developing countries which confirms the recommendations of a workshop held in Nairobi, Kenya which cleared that it became a must to organize the work with governments and non-governmental organizations (NGOs) to coordinate brucellosis studies and to maximize the benefits, as a step on the way forward to control brucellosis in the African countries (USDA, 2013).

In comparing results of G1 to G4 to identify the impact of fair rapid compensation, VO and efforts of NGOs on animal brucellosis seroprevalence and KAPs of animal householders, in Table (1) seroprevalence in cattle of G1 was 4.3%, 3.6% and 2.9% versus 1% in G4 by BAPAT, RBPT and CFT. In buffaloes of G1 was 3.8%, 3.8% and 1.9% versus 1.8%, 1%

and 0% in G4 by BAPAT, RBPT and CFT. Results reflect significant difference between seroprevalence in the two groups which confirms the positive effect of fair rapid compensation**,** VO and efforts of NGOs which led to minimize animal brucellosis seroprevalence. Referring to KAPs of animal householders' results in Tables (2-3) of knowledge was very significantly positively increased in G4 after VO except that related to selling fresh milk without heat treatment which may increase the risk of zoonotic infections. Numerous KAPs surveys for owners of animals referred different results in different countries. In Tajikistan a study recorded low knowledge and awareness of brucellosis in a survey of small-scale dairy farms (Lindahl et al., 2015). Also poor knowledge and awareness were recorded in a study in Kenya (Kang'ethe et al., 2007). High knowledge but risky attitudes and practices in Egypt were obtained by Holt et al., (2011) and Eltholth et al., (2015). The impact were very clear on some attitudes and practices in Tables (2-3) as disposal of placenta in water canals decreased significantly from 87.9% to only 5.6% after VO. *Brucella melitensis* was isolated from Nile catfish concluding that getting rid of animal wastes in water canals is a high risk attitude leads to increase hazards of infection (El-Tras et al., 2010). Burning of placenta increased to 92.5%. About calling a private veterinarian to take advice before notification; the percent in G1 was 45% and 29.3% in the first and second questionnaire while all participants (100%) in G4 were calling the private veterinarian to take advice before notification because this service was paid by the NGO as mentioned before. Isolation of aborted animals was clearly raised after VO in group 4 to reach 94.9%, in a previous study reported that small holders didn't respond to isolate the infected animals due to lack of facilities (Holt et al., 2011). But by good managing of facilities and through VO house holders learned how to isolate animals in a simple effective manner. The very high impact of fair rapid compensation was clearly evident from comparing the ratio of notifications in the two groups. It was 1.1% and 0% consequently in the two questionnaires in G1 versus 100% in G4 which confirms that rapid fair compensation is a very effective tool for brucellosis control in Egypt, which reflected on minimizing brucellosis seroprevalence in G4.

CONCLUSION

Due to the problems of small-scale family farming, land fragmentation, depending on integration between crop and livestock production, suffering from decline in community spirit and teamwork, the majority of livestock is owned by small house holders, animals kept with the owner in the same small house holding, Low and delayed compensation for livestock owners, lack of community based animal health outreach programs about brucellosis, the shortage of data about brucellosis, negative communities perceptions and attitudes towards the visibility of control programs, this study strongly recommends cooperation between governmental veterinary authorities and NGOs in Egypt. The NGOs role is important in, providing services, assisting needs, policy implementation, establishing a link between the community and the government, and sharing their expertise**.** Continuous community based animal health programs, Veterinary outreach, continuous brucellosis surveillance campaigns, providing adequate funding and financial studies are effective tools in control of brucellosis in Egypt. Risk based strategic planning strongly recommended to control brucellosis in Egypt.

CONFLICT OF INTEREST

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

ACKNOWLEGEMENT

The authors would like to acknowledge Dar-Alormam Charity Society management and workers for their support and cooperation. Authors would also like to acknowledge the animal householders agreed to share in this study.

AUTHOR CONTRIBUTIONS

All authors contributed equally in all parts of this study. The views expressed in this research are those of the authors and don't necessarily reflect the official policy or position of the Government of the Arab Republic of Egypt. The authors declare that they have no competing interests.

Copyrights: © 2019 @ author (s).

This is an open access article distributed under the terms of the **Creative Commons Attribution License (CC BY 4.0)**, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply

with these terms.

REFERENCES

Adesiyun, A. A.; Fosgate, G. T.; Seebaransingh, R.; Brown, G.; Stoute, S. and Stewart-Johnson, A. (2011). Virulence of *Brucella abortus* isolated from cattle and water buffalo. *Trop. Anim. Health Prod.*, 43(1):13-16.

Adesiyun, A. A.; Fosgate, G.T.; Persad, A.; Campbell, M.; Seebaransingh, R. and Stewart-Johnson, A. (2010). Comparative study on responses of cattle and water buffalo (*Bubalus bubalis*) to experimental inoculation of *Brucella abortusbiovar* 1 by the intraconjunctival route-a preliminary report. *Trop. Anim. Health Prod.*, 42(8):1685-1694.

Aidaros, H. (2005). Global perspectives-the Middle East: Egypt. *Rev. Sci. Tech.*, 24(2): 589-596.

Al-Dahouk, S.; Tomaso, H.; Nockler, K.; Neubauer, H. and Frangoulidis, D. (2003). Laboratory-based diagnosis of brucellosis - a review of the literature. Part II: serological tests for brucellosis. *Clin. Lab.*, 49 (11-12): 577-589.

Alton, G. G.; Jones, L. M.; Angus, R. D. and Verger, J. M. (1988). Techniques for the Brucellosis laboratory. Paris: Institute National de la Recherche Agronomique.

Arif, S.; Thomson, P. C.; Hernandez-Jover, M.; McGill, D. M.; Warriach, H. M. and Heller, J. (2017). Knowledge, attitudes and practices (KAP) relating to brucellosis in smallholder dairy farmers in two provinces in Pakistan. *PLoS ONE*, 12(3): e0173365.

Cleland, P. C. P.; Baldock, F. C. and Gleeson, L. J (1995). Questionnaire survey of foot and mouth disease (FMD) and of FMD control by vaccination in villages in northern Thailand. Rev. Sci. Tech., 14(3): 567-575.

Dar-Alorman (2018). Dar-Alorman projects available on http://www.dar-alorman.com/Projects/

Eltholth, M. M.; Abd El-Wahab, E. W.; Hegazy, Y. M. and El-Tras, W. F. (2015). Assessing impacts and costs of brucellosis control programme in an endemic area of the Nile Delta, Egypt. *World's Vet. J*., 5(4): 74-81.

El-Tras, W.; Tayel, A. A.; Eltholth, M. M. and Guitian, J. (2010). *Brucella* infection in fresh water fish: evidence for natural infection of Nile catfish, *Clarias gariepinus*, with *Brucella melitensis*. *J. Vet. Microbiol.*, 141(3-4): 321-325.

FAO (2011).A manual for practitioners in community - based animal health outreach **(** www.fao.org/docrep/014/i1799e/i1799e00.pdf)

FAO (2017). Study on small-scale family farming in the Near East and North Africa region; focus country Egypt 2017. (www.fao.org/3/a-i6497e.pdf)

Health Communication Partnership (2003). The new P-Process, steps in strategic communication. Baltimore: Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs/Health Communication Partnership, December 2003.

Hegazy, Y. M.; Molina-Flores, B.; Shafik, H.; Ridler, A. L. and Guitian, F. J. (2011). Ruminant brucellosis in Upper Egypt (2005–2008). *Prev. Vet. Med.*, 101: 173-181.

Holt, H.; Eltholth, M.; Hegazy, Y.; El-Tras, W.; Tayel, A. and Guitian, J. (2011). *Brucella* spp. infection in large ruminants in an endemic area of Egypt: Cross-sectional study investigating seroprevalence, risk factors and livestock owner's knowledge, attitudes and practices (KAPs). *BMC Public Health*, 11: 341-350

Hosein, H. I.; Rouby, S. R.; Menshawy, A.; and AbdAl-Ghany, A. E. (2017). Sensitivity and specificity of the commonly used diagnostic procedures of bovine brucellosis. *Veterinary Sciences: Research and Reviews*, 3(3): 45-52.

Hosein, H. I.; Zaki, H. M.; Safwat, N. M.; Menshawy, A. M. S.; Rouby, S.; Mahrous, A. and Madkour, B. E. (2018). Evaluation of the general organization of veterinary services control program of animal brucellosis in Egypt: An outbreak investigation of brucellosis in buffalo. *Veterinary World*, 11(6): 748–757.

Jennings, G. J.; Hajjeh, R. A.; Girgis, F. Y.; Fadeel, M. A.; Maksoud, M. A.; Wasfy, M. O.; El-Sayed, N.; Srikantiah, P.; Luby, S. P.; Earhart, K. and Mahoney, F. J. (2007). Brucellosis as a cause of acute febrile illness in Egypt. *Trans. R. Soc. Trop. Med. Hyg.*, 101: 707–713.

Kaltungo, B.; Saidu, S.; Sackey, A. and Kazeem, H. (2014). A review on diagnostic techniques for brucellosis. *Afr. J. Biotechnol*., 13 (1): 1-10.

Kang'Ethe, E. K.; Ekuttan C. E. and Kiragu M. W. (2007). Investigations into the prevalence of

bovine brucellosis and the risk factors that predispose humans to infection among urban dairy and non-dairy farming households in Dagoretti Division, Nairobi, Kenya. *East African medical journal*, 84 (11S): p. S96-S100.

Keen, S. (2006). Non-Government organizations in policy. In: H. K. Colebatch (Eds.) *Beyond the Policy Cycle: The policy process in Australia*. Allen & Unwin, Sydney, Australia: 27–41.

Lindahl, E.; Sattorov, N.; Boqvist, S. and Magnusson, U. (2015). A study of knowledge, attitudes and practices relating to brucellosis among small-scale dairy farmers in an urban and peri-urban area of Tajikistan. *PLoS One*, 2015 Feb 10;10(2):e0117318. doi: 10.1371/journal.pone.0117318. eCollection 2015.

Menshawy, A. M. S.; Perez-Sancho, M.; Garcia-Seco, T.; Hosein, H. I.; García, N.; Martinez, I.; Sayour, A. E.; Goyache, J.; Azzam, R. A. A.; Dominguez, L. and Alvarez, J. (2014). Assessment of genetic diversity of zoonotic *Brucella* spp. recovered from livestock in Egypt using Multiple Locus VNTR Analysis. BioMed Research International, 2014, 353876.

OIE (2016). Brucellosis: Brucella abortus, B. melitensis and B. suis. OIE, World Organisation for Animal Health Paris, France.

Pappas, G. and Papadimitriou, P. (2007). Challenges in *Brucella bacteraemia*. *Int. J. Antimicrob. Agents*, 1: 29-31.

Reddy, A. D.; Singh, D. K.; Mantur, B. G.; Kumar, A.; Kumari, G.; Rajagunalan, S.; Mohan, V. and Pesingi, P. K. (2014). Seroepidemiology of human brucellosis in Karnataka. *Journal of Veterinary Public Health*, 12 (2): 113-115.

Refai, M. (2002). Incidence and control of brucellosis in the Near East region. *Vet Microbiol.*, 90: 81-110.

Samaha, H.; Al-Rowaily, M.; Khoudair, R. M. and Ashour, H. M. (2008). Multicenter study of brucellosis in Egypt. *Emerg. Infect. Dis.*, 14(12):1916-1918**.**

Singh, B. B.; Kostoulas, P.; Gill, J. P. S. and Dhand, N. K. (2018). Cost-benefit analysis of intervention policies for prevention and control of brucellosis in India. PLoS Neglected Tropical Diseases, 12, e0006488.

Snedecor, G. W. and Cochran, W. G. (1989): *Statistical Methods*, Eighth Edition, Iowa State University Press.

USDA (2013). An integrated approach to controlling brucellosis in Africa: Workshop report. Nairobi, Kenya: ILRI. United States Department of Agriculture (USDA), United States Agency for International Development (USAID), and International Livestock Research Institute (ILRI)..

Wakefield, M.; Loken, B. and Hornik, R. (2010). Use of Mass Media Campaigns, *Lancet Journal*, 376: 1261-1271, doi 10.1016/S0140-6736(10)60809-4.

WHO (2006). Brucellosis in human and animals. World Health Organizaion. Geneva, Switzerland.

WHO (2008). Advocacy, Communication and Social Mobilization for TB Control: A Guide to Developing Knowledge, Attitude and Practice Surveys. World Health Organizaion. Geneva, Switzerland.