Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (35-51), Month: May - August 2016, Available at: www.noveltyjournals.com

Farmers' Awareness Regarding Brucellosis as a Neglected Emerging Infectious Diseases in Rural Areas

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Abstract: **Brucellosis is a neglected bacterial zoonotic disease in many countries affecting both humans and animals. Brucellosis is an occupational hazard of livestock farmers, dairy workers, veterinarians, slaughterhouse workers, and laboratory personnel, all of whom are considered to belong to the high-risk occupational group. The aim of this study was to determine the Farmers' Awareness "Knowledge, Attitude and Practice" regarding Brucellosis as a Neglected Emerging Infectious Diseases in Rural Areas.Design: a descriptive analytical design was used. Setting: This study was conducted into two villages affiliated to one district in Menoufia Governorate. Sample: A systematic random sample of 164 farmers "Males and females" was selected. The subjects were selected from the agriculture committee in the two villages. Instruments: Structured interviewed questionnaire was used for data collection including the: Questions related to socio-demographic data, and Brucellosis KAP questionnaire: Results:- shows that, nearest sixty percent of male compared to sixty five percent of female have ever heard about brucellosis. Regarding to their knowledge about methods of transmission of brucellosis from an animal to another; about one third of male and female mentioned that direct mixing contact with the diseased animal, while 55.6% of female compared to 38.6 of male mentioned that mating is the method of infection transmission between animals. Regarding the factors that increase the transmission of the disease about two third of the studied sample mentioned that direct contact with animals. Regarding farmers practice when the animals infected, 26.6% of the illiterate farmers sold the animal in the market while 44.4% of the participant who had university education call the vet when the animal infected .74.7% of male farmers compared to 60.5% of females had poor knowledge about brucellosis while the minority had fair knowledge. Whereas moderate risk total practice score represents 44.6% which was higher than 43.4% who had high risk total practice score among male farmers that was reversed among females farmers. Conclusion: The majority of the studied sample had poor total knowledge scores about brucellosis. Nearest half of the famers had poor practice so there is a high risk of exposure of brucellosis through the consumption of infected milk products, as well as through farmer's practices regarding infected animal. The positive total attitude score represents 66.7% among female's farmers that were higher than male farmers that represent 56.6%. Recommendation: Health education for the farmers about brucellosis, at primary health care setting in rural areas and mass media including the following; methods of transmission and prevention in humans and animals.**

Keywords: **Brucellosis, Emerging Infectious Diseases, Farmers' Awareness.**

1. INTRODUCTION

Brucellosis is "one of the major zoonotic infections worldwide; especially in Mediterranean countries and Middle East, it remains significant public health concern, and caused by gram-negative coccobacilli of the genus Brucella and affects cattle, sheep, goats, and other livestock" [1]. "Brucellosis affects the public health and economic performance of endemic as well as non-endemic countries, in developing countries, it is very common and a subset of the neglected tropical diseases". Zoonoses are diseases naturally transmitted from vertebrate animals to humans and vice-versa. Although "brucellosis has

been controlled in most industrialized countries, it remains a major problem in the Mediterranean region, western Asia, Africa, and Latin America". It can cause appreciable economic losses in the livestock industry because of abortions, decreased milk production, sterility, and veterinary care and treatment costs [2].

"The WHO considers brucellosis to be a neglected zoonosis because, despite its widespread distribution and international health systems [3], the term neglected highlights that diseases affect mainly poor and marginalized populations in low-resource settings" [4].The "true global incidence of human brucellosis is difficult to determine, but the incidence of the disease worldwide is estimated at more than 500,000 infections per year" [2]. The report of "human brucellosis in endemic areas varies widely; < 0.01 to > 200 per 100,000 population [5], In sub-saharan Africa, prevalence of 5-55% in humans and 8–46% in animals reported [6] and in Uganda, human brucellosis has been reported to be prevalent in both rural and urban areas [7], In sub-Saharan Africa, brucellosis is often easily misdiagnosed as other febrile syndromes such as malaria and typhoid fever, thereby resulting in underreporting and hence misdirected treatments [8].

Prevalence rates of Brucellosis in Egypt as reported by [9] were as follows "in cattle, buffaloes, sheep, and goats were generally higher in Benisuef than in other governorates, the movement of infected sheep or goats can contaminate pastures and spread brucellosis to other animals (e.g., cattle or buffaloes) in other areas, this movement is a major risk factor for failure of brucellosis eradication programs, elimination or control of infection in sheep and goat flocks can reduce spread of the disease in cattle and buffaloes".

Humans can acquire the infection through "consumption of unpasteurized milk or dairy products from infected animals and through direct contact with contaminated tissues or secretions from infected animals, in particular aborted fetuses, fetal membranes, and vaginal discharges, as a result, individuals who have occupational contact with livestock in endemic areas are at high risk (e.g., livestock owners, abattoir workers, shepherds, and veterinarians)" [10, 11]. The "symptoms of the disease are nonspecific but the majority of patients, in the acute form, complain of fever (over 38.5°C), sweats, malaise, anorexia, headache, arthralgia, and backache. Persistent and recurrent fever are the most common clinical symptoms in subacute cases, complicated cases may go on to develop arthritis, spondylitis, sacroiliitis, osteomyelitis, meningoencephalitis, and endocarditis" [12].

The high frequency of brucellosis and "the nonspecific clinical picture emphasizes the importance of laboratory-based diagnosis, Blood culture is the gold standard for microbial diagnosis, However, it may take 2–6 weeks to isolate the organism". Also, "prior use of antibiotics may interfere with growth of Brucella spp., Blood cultures require containment level 3 facilities to avoid laboratory-acquired infection, which may limit its use in small and remote health care facilities" [13]. A community-based survey was carried out in 2 villages in the Nile Delta, "the sero-prevalence of brucellosis among humans was 1.7% and the diagnostic seropositivity level by STA was 1/320 [14]. The brucellosis in our country necessitates isolation of the organism for confirmation of high positive titres. As for other fastidious pathogens, molecular detection by polymerase chain reaction offers an alternative method of diagnosis of brucellosis [15, 16].

"Brucellosis is responsible for a global burden imposed on human health through disability and on animal productivity, in human's brucellosis causes a range of flu-like symptoms and chronic debilitating illness, in livestock brucellosis causes economic losses as a result of abortion, infertility and decreased milk production". The ultimate "sources of infection with brucellosis are infected animals, mainly the major food-producing animals, thus the control of brucellosis in humans depends on its control in ruminants, for which accurate estimates of the frequency of infection are very useful, especially in areas with no previous frequency estimates [4].

"Brucellosis was first reported in Egypt in 1939 and is now endemic, the predominate species of Brucella in cattle and buffalo in Egypt is B. melitensis, it was reported in a scientific report from Egypt for the first time, since then, the disease has been detected at high levels among ruminants, particularly in large intensive breeding farms" [17]. In Egypt, the close contact between farmers and their animals due to the predominance of small scale farms, occupational exposure of farmers, veterinarians and butchers to infected animals and consumption of unpasteurized milk and dairy products are considered to be the major risk factors for human infection with Brucella spp [14 ,18, 19].

"Raw milk and direct contact with infected animals and animal materials and fluids are the major risks for transmission of brucellosis to the human population; pasteurization of milk and use of protective clothing when dealing with infected animals (e.g. when assisting with lambing or handling abortion materials) are highly recommended but may be very difficult to implement under field situations because of a lack of proper supplies or because of traditional beliefs and practices". In general, measures to improve hygiene and sanitation are not popular. Measures to improve milk pasteurization and farm

sanitation are particularly valuable in protecting the human population in areas of high prevalence or where vaccination or other veterinary measures is cumbersome. The presence of an informal milk distribution circuit may increase the problem [20].

Educating farmers and consumers about the disease can be beneficial, and the development of small milk pasteurization plants at selected central locations should be considered. This suggests that measures aimed at reducing the occurrence of brucellosis in animals are the most effective means of reducing human infection [20].

The Nile Delta region has "one of the highest human and ruminant densities in the world; with more than 125 person per km2 and more than 196 ruminant/km2 [21]. Most households in the region raise small numbers of cattle, buffaloes, sheep or goats which are kept in close contact with household members, these animals are a source of meat and dairy products that are consumed within the same household or sold in local markets or to middlemen, the milk is mostly sold unpasteurized, either directly by the producers or indirectly by milk collectors or food shops, cream and butter made by the farmers or by local dairy processing plants are also often sold without heat treatment [19]. The potential for human exposure to zoonotic pathogens such as Brucella spp. is amplified by these demographics, husbandry practices and dairy production and marketing systems, which closely tie the incidence of brucellosis in the livestock and human populations [22].

Consequently, "a control program including voluntary vaccination of ruminants was established in the early 1980s [23], indirect techniques regularly used in diagnosis of Brucella are field tests such as the milk ring test, serological tests such as the standard agglutination test and buffered agglutination test, which are confirmed by the complement fixation test and enzyme-linked immune-sorbant assay [24], however, these tests cannot differentiate antibodies originating from vaccine or wild-type strains". The tests are also prone to false-negative and false-positive reactions, [25].

Control programs for brucellosis in Egypt have used 2 methods: "vaccination of all animals and slaughter of infected animals with positive serologic results, the difficulty of accurately detecting all infected animals, especially carriers, is a major limitation of these programs, to enhance efficiency of brucellosis-specific prophylaxis; early detection of brucellosis by highly sensitive and specific methods is needed" [17]. Control and prevention of brucellosis and "the importance of surveillance Mass vaccination is the mainstay of brucellosis control in livestock, but should be combined with other measures that limit the spread of the pathogen, allow identification of animals and herds, and increase community participation, the efficacy of brucellosis control programs depends on a range of factors; Before a control program can be developed a situation analysis and needs assessment should be performed, a situation analysis is essential, as most endemic countries have little information on the prevalence of brucellosis, its geographical distribution [26].

The major risk factors involved in transmission, is "the knowledge, attitudes and practices (KAP) of farmers and livestock owners, the situation analysis should involve Policy makers and provide information on livestock numbers, legislation, resources and the capacity of veterinary and laboratory services; this is reflected in guidelines issued by international organizations such as the Food and Agriculture Organization and the World Organization for Animal Health [27]". Based on the results of the situation analysis, "a needs assessment and a risk analysis can be performed and used to design a vaccination program, identify complementary measures, and determine human and financial resources that will be required" [27] .

Also, three important risk factors for human brucellosis as reported by [28] "as living in rural settings, consumption of traditionally prepared milk products and being single, Individuals who lived in the rural areas were three times more likely to be Brucella seropositive compared to their counter parts who lived in urban areas, public awareness campaigns especially in rural communities to disseminate knowledge about brucellosis and associated risk factors should be prioritized. Consumption of unpasteurized milk products should particularly be discouraged".

The management needs "an integrated approaches and application of veterinary science, which are part of the Neglected Tropical Disease, strategic approach to transmission control solutions can then be developed to minimize the effects of major risks of transmission, such as a lack of human resources, the absence of a cold chain for vaccine storage or intense cross border migration of unvaccinated animals, increasing awareness of farmers on the disease, transmission control" [4]. Also there is a need to initiate screening, treat infected humans early, and educate the public about risk factors and appropriate preventive measures of brucellosis [28].

Obtaining disease information and educating the public will help to increase awareness of the disease, increase community participation, and promote acceptance of control measures in livestock. Control and preventive measures may not be

understood or accepted by traditional livestock communities because they may interfere with their lifestyle, food habits and farming practices. A high degree of public participation is an important factor for successfully controlling disease [29].

Previous KAP studies regarding brucellosis among people in different endemic settings have revealed that; a study in Kenya has shown poor awareness and knowledge of the transmission routes of brucellosis from animals to humans [30]. Similarly, "poor knowledge and frequent high-risk behaviors regarding brucellosis were observed in a survey of small-scale dairy farms in Tajikistan [31]. In contrast, "a high level of knowledge of the disease was found in a KAP study conducted in a village in the Nile Delta region of Egypt, where despite the high level of awareness and detailed knowledge of disease transmission, high-risk behavior was generalized" [31].

2. AIM OF THE STUDY

The aim of this study was to determine the Farmers' Awareness "Knowledge, Attitude and Practice" regarding Brucellosis as a Neglected Emerging Infectious Diseases in Rural Areas.

Research Questions:

1. What is the knowledge level of farmers about brucellosis in rural area?
2. What is the attitude of Farmers towards brucellosis?
3. What is the practice level of farmers towards brucellosis?
4. What is the accessibility of veterinary services among farmers in rural area?

Operational Definition:

Awareness was operationally defined as common knowledge or understanding about a scientific, or social. It forms a basic concept of the theory having knowledge of, feel of, or sense of, and practice. This information is incredibly useful as intended to behave toward this information and critical transformed into performance/practice [32, 33].

3. SUBJECTS AND METHOD

Design: none experimental descriptive research design was used to fulfill the aim of the present study.

Setting: Multi stage random sample was used to select one district from Menoufia Governorate. Then select the two villages from the selected district.

Sample: A systematic random sample of 164 farmers "Males and females" was selected. The subjects were selected from the agriculture committee in the two villages which the farmers were enrolled.

Sample size and power of the study:

In order to calculate the sample size required to illustrate the frequency of knowledge, in a community of N=3200 individuals, we used Epi website [34]. Our assumptions were:

Population size N=3200, Frequency of knowledge in the population = 13%+/-5%, A power (1- β) or (% chance of detecting) of 80%, Confidence limits = 5%, Results were presented as shown in the following figure .We used 95% confidence level with sample size of 165 participants as our sample size.

Instruments for data collection:

Structured questionnaire was used for data collection including the following:

Part 1: Questions related to socio-demographic data, age, sex, level of education, and occupation besides farming.

Part 2: Brucellosis KAP questionnaire:

A) It assessed Farmers' knowledge about brucellosis; exposure to brucellosis either in human or in animals was assessed through questionnaire. It was developed by the researchers based on the current related literatures. This tool measures Farmers knowledge consisted of 10 close ended questions. The Farmers were asked to choose the answer.

B) It assessed nurses' attitude towards brucellosis: It included two items related to Farmers' attitude. The farmers are asked to rate the extent to which they perceive each statement. 1= negative 2 = positive.

C) It assessed the farmer's practice to avoid or prevent brucellosis;

It includes questions about their practice toward brucellosis, it included 10 items. These items were on a 2 point scale ranging. The Farmers were asked to answer the extent to which they perceive each statement by either yes or no.

Scoring system for knowledge: Each question was given a score 1 for correct answer and zero to the incorrect answer. Each part of the questionnaire was collected separately to give a total percentage score that was classified into two categories for knowledge as follows: Score of 50 and > means the Fair score. The Low score less than 50 means poor score.

Scoring system for practice: Each question was given score one for correct answer and zero to the incorrect answer. The total percentage of total practice score was classified into three categories as follows: The high risk practice score 0 to <40, the moderate risk scores from 40 to <60 and the low risk score 60 and more means good practice.

Scoring for attitude: the positive attitude was given score one and negative attitude given score zero.

Procedure for data collection:

- Study period: This study was conducted during the period starting from April 2015 to the end of December 2015.
- An official letter from the Faculty of Nursing was delivered to the administrative authorities in the agriculture committee at the two villages in Menoufia Governorate- Egypt, where the data were collected to conduct the study after an explanation of the purpose of the study. The researchers introduced themselves to every participant, explain the purpose of the study and assured them that confidentiality would be maintained throughout the study. Then a verbal consent was obtained from each participant.
- Ethical consideration: Human rights and ethical considerations were followed during the study, with total confidentiality of any obtained data. An oral consent was obtained from administrative authorities in the heath as well as from all participants, after explaining the aim of the study.
- Validity; Instruments were reviewed and tested for validity by 5 experts in community health nursing, modification were done accordingly to ascertain relevance and completeness.
- Reliability: The internal consistency of the questionnaires was calculated using Cronbach's alpha coefficients. Test-retest was used. The Cronbach's alpha of the questionnaire was 0.88 indicate good reliability.
- Pilot study, a pilot study was conducted on 10 farmers to evaluate the clarity of developed tool before starting the actual data collection. The pilot sample was not included in the total sample of the research work to ensure stability of the answers. Based on the results of the pilot study, modifications, and rearrangement of some questions were done. It also helped to estimate the time needed to fill in the questionnaire.
- The time taken for filling questionnaire was about 15-20 minutes for each farmer.
- Farmers were asked about brucellosis. Farmers who agreed to participate in the study were requested to complete the required tool. The researchers introduced themselves to the respondents, and explained the aim and objectives of the study to the Farmers in the study settings.
- Then, the designed questionnaire was filled by the researcher from the farmers included in the study through home visiting .This was repeated in each place of the study setting. The researchers were present all the time to clarify any ambiguity.

Statistical analysis:

Up on completion of data collection, the data collected were coded, data entry, tabulated and statistically analyzed by personal computer and statistical package SPSS version 16. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables. Chi square test was done for qualitative variable analysis and p-value < 0.05 was considered significant.

4. RESULTS

Table (1) showed that 51.9% of female studied sample were in the age group 20 to less than 40 years, while 61.4% of the studied male were in the age group 40 and above years. Regarding education, about one third of the studied samples of male and female were illiterate while the least percent of them had university education 19.9% and 4.9% respectively.

Table (2) showed that only sixteen percent of the total sample mentioned that; bacteria are the cause of brucellosis infection which was a correct answer. While nearest the half percent of farmers answered it is cause by virus incorrectly. Regarding the types of animals affected, the least percent of studied sample (18.3, 8.0%) respectively mentioned that sheep and goats are the affected types of animals. Regarding most affected six more than half of the studied sample (53%) mentioned the disease affects both males and females.

Table (3) shows that, nearest sixty percent of male compared to sixty five percent of female have ever heard about brucellosis. The difference was not statistically significant p= 0.25. Regarding Methods of transmission from an animal to another, about one third of male and female mentioned that direct mixing contact with the diseased animal while 55.6% of female compared to 38.6 of male mentioned that mating is the method of infection transmission between animals. Regarding method of transmission to human, 28.4% of female know that none boiled milk is the source of infection to human compared to 19.3% of male. The difference was statistically significant p = 0.001.

Figure (1) shows that more than fifty percent of female farmers didn't know symptoms of an infected animal. While 27.7% of male mentioned that sudden death of animal is the symptoms of disease compared to only 6.2% of female mentioned that. The least percent of the studied sample males and females mentioned that weight loss, lack of milk production, diarrhea and skin infection were the symptoms of an infected animal, the difference was statistically significant (p= 0.00).

Figure (2) showed that, about one third of the studied sample mentioned that, high temperature is the signs of brucellosis in humans. While more than half of the studied sample didn't know signs and Symptoms of brucellosis in human. The difference was not statistically significant between males and females. P= 0.349

Table (4) showed that more than one third of the farmers who had basic education mentioned that boiling milk is the method to prevent brucellosis in humans. However about one third of university educated mentioned that follow good health habits is the method of prevention. While the lowest percent 9.5 of farmers who had no education they don't know the methods of prevention of brucellosis in human.

Figure (3) Methods of prevention of Brucellosis in humans

Figure (4) showed that 44.4% percent of the female participant mentioned that source of knowledge was friends and neighbor compared to 32.25% of male said that they know about brucellosis from family members and people in the village. While only 9.9%of females. There was a statistically significant difference (P = < 0.03).

Figure (5) showed that the majority of the studied sample 95.1% had a negative attitude to buy an infected animal while more than half of them 59% of males and 56.8% of females sold the infected animal.

Table (5) showed that regarding farmers practice when the animals infected, 26.6% of the illiterate farmers sold the animal in the market while 44.4% of the participant who had university education call the vet when the animal infected. There was a statistically significant difference (P = < 0.01).

Table (6) showed that the majority of participant (85.5%) boiled milk before drinking while the majority of them didn't boil milk before making cheese, cream and butter ((78.3%, 97.6, 75.9 respectively) the difference was not statistically significant between males and females.

Table (7) showed that about one fifth of the participants who helping in animal' birth using gloves, while any one didn't wear mask as protective devices. The difference was statistically not significant p =0.06

Figure (6) showed the Farmers' Practice of vaccination for animals against brucellosis.

Table (8) shows that the majority (95.2%) of studied male farmers vaccinated their animals compared to, 48.1% of females but about two thirds of females do that when the animals diseased. Also it showed that there is a one veterinary unit services the two villages.

Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (35-51), Month: May - August 2016, Available at: www.noveltyjournals.com

Figure (7) shows that 74.7% of male farmers compared to 60.5% of females had poor knowledge about brucellosis while the minority had fair knowledge. Whereas moderate risk total practice score represents 44.6% which was higher than 43.4% who had high risk total practice score among male farmers that was reversed among females farmers whereas, low risk total score was the least for both male and females.

It also revealed that positive total attitude score represents 66.7% among female's farmers that were higher than 56.6% of male farmers. Which indicate that female farmers didn't buy or sell infected animal were more than male.

Table (1) Socio-demographic characteristics of studied sample by gender

Socio-demographic characteristics		Gender			
		Male N=83		Female N=81	
		No	%	No	%
Age	**20-**	32	38.6	42	51.9
	40+	51	61.4	39	48.1
	Total	83	100.0	81	100.0
Education	**Illiterate**	32	38.6	31	38.3
	Basic education	18	21.7	19	23.5
	Secondary	19	22.9	27	33.3
	University	14	16.9	4	4.9
	Total	83	100.0	81	100.0
Occupation beside Farming	**Housewife**	0	0.0	72	88.9
	Farmer	48	57.8	0	0.0
	worker	17	20.5	2	2.5
	Employee	13	15.7	5	6.2
	Teacher	5	6.0	2	2.5
	Total	83	100.0	81	100.0

Answering research questions number one:-

What was the knowledge level of farmers about brucellosis in rural area?

Table (2) Farmer' Knowledge about brucellosis by gender

Causes of Brucellosis	Gender				Total		X^2	p.value
	Male N=83		Female N=81					
	No	%	No	%	No.	%		
Bacteria	**13**	**15.7**	**14**	**17.3**	**27**	**16.5**	**4.748**	**.191**
Virus	**31**	**37.3**	**42**	**51.9**	**73**	**44.5**		
fungi	**15**	**18.0**	**10**	**12.3**	**25**	**15.2**		
do not know	**24**	**28.9**	**15**	**18.5**	**39**	**23.8**		
Types of animals affected								
Buffalo	**23**	**27.7**	**23**	**28.4**	**46**	**28**	**1.328**	**.857**
cow	**39**	**47.0**	**36**	**44.5**	**75**	**45.7**		
sheep	**14**	**16.8**	**16**	**19.8**	**30**	**18.3**		
goats	**7**	**8.5**	**6**	**7.3**	**13**	**8.0**		
Most affected (sex)								
Men	**21**	**25.2**	**16**	**19.8**	**37**	**22.6**	**.763**	**.683**
Women	**19**	**23.0**	**21**	**25.9**	**40**	**24.4**		
Both of them	**43**	**51.8**	**44**	**54.3**	**87**	**53.0**		
Factors for the increase								
Direct contact with animals	**50**	**60.2**	**50**	**61.7**	**100**	**61.0**	**1.128**	**.770**

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ISSN 2394-7330

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lack of awareness of the disease	19	23.0	16	19.8	35	21.3		
I do not know	14	16.8	15	18.5	29	17.7		
total	83	100.0	81	100.0	164	100.0		

Table (3) Farmer' Awareness "Knowledge" about Mode of Transmission of Brucellosis

Farmer' Awareness Knowledge"		Gender				X^2	P value
		Male		Female			
		No	%	No	%		
Methods of transmission from an animal to another	Mating	32	38.6	45	55.6	19.76	0.001
	Breathing	9	10.8	2	2.5		
	Direct mixing animal	26	31.3	26	32.1		
	Waste (manure)	12	14.5	8	9.9		
	Don't no	4	4.8	0	0.0		
Methods of transmission to humans	Non-boiled milk	16	19.3	23	28.4	19.8	0.001
	Uncooked Meat	3	3.6	15	18.5		
	Placenta of infected animal	11	13.3	7	8.6		
	Dealing directly with the infected animal's	9	10.8	15	18.5		
	Do not know	44	53.0	21	25.9		
Total		83	100.0	81	100.0		

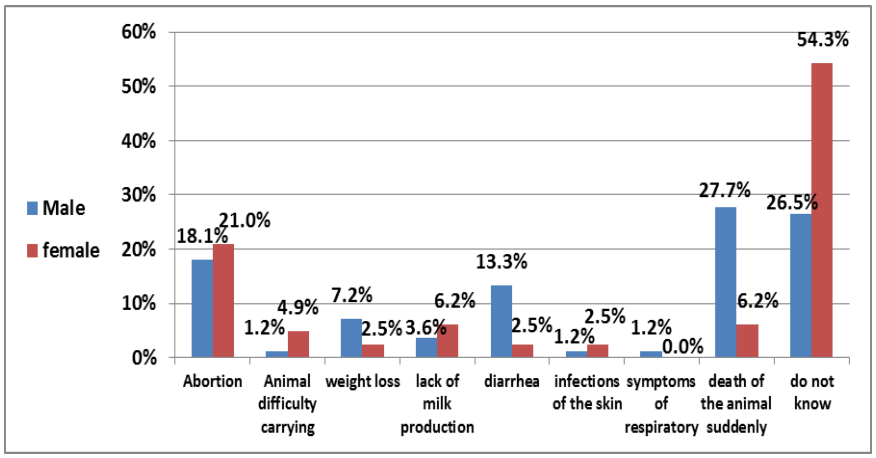

Fig (1) Farmer' Knowledge of Brucellosis symptoms of an infected animal by males and female

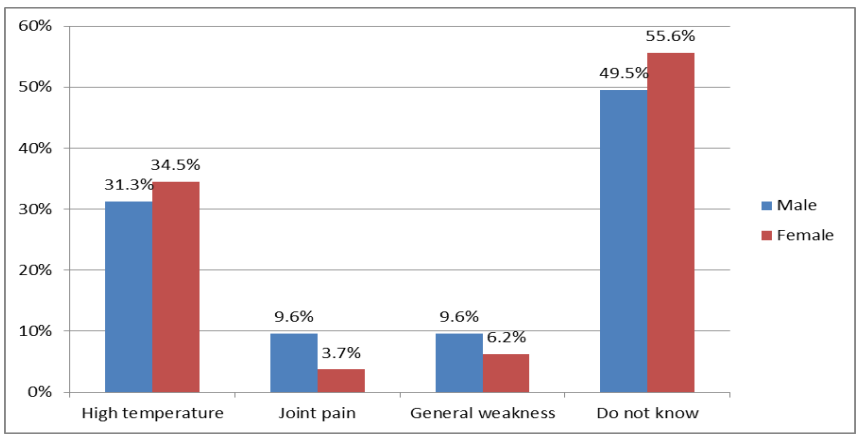

Figure (2) Farmer' Knowledge of Brucellosis Signs and Symptoms in human

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ISSN 2394-7330

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Table (4) Farmer' Knowledge about Methods of Prevention in humans & Animals by Education

Methods of disease prevention in humans	Education								X^2	P. value
	Illiterate		Basic education		Secondary		University			
Boiled milk	16	25.4	14	37.8	9	19.6	4	22.2	**53.7**	**0.000**
Good cooking meat	8	12.7	3	8.1	2	4.3	0	0.0		
Wear gloves during the animal's birth	3	4.8	1	2.7	9	19.6	1	5.6		
Wear special work clothes	9	14.3	8	21.6	3	6.5	1	5.6		
Test for the animal before slaughter	10	15.9	5	13.5	1	2.2	4	22.2		
Follow good health habits	11	17.5	1	2.7	3	6.5	6	33.3		
Don't know	6	9.5	5	13.5	19	41.3	2	11.1		
Disease prevention in animals									**33.9**	**0.001**
Isolate the infected animal	29	46.0	17	45.9	12	26.1	0	0.0		
Animal treatment	3	4.8	4	10.8	8	17.4	0	0.0		
Test for the animal before pregnancy	2	3.2	1	3.7	2	4.3	0	0.0		
Vaccinated healthy and infected animal	22	34.9	12	32.4	15	32.6	9	50.0		
Don't know	7	11.1	3	8.1	9	19.6	9	50.0		
Total	63	100	37	100	46	100	18	100.0		

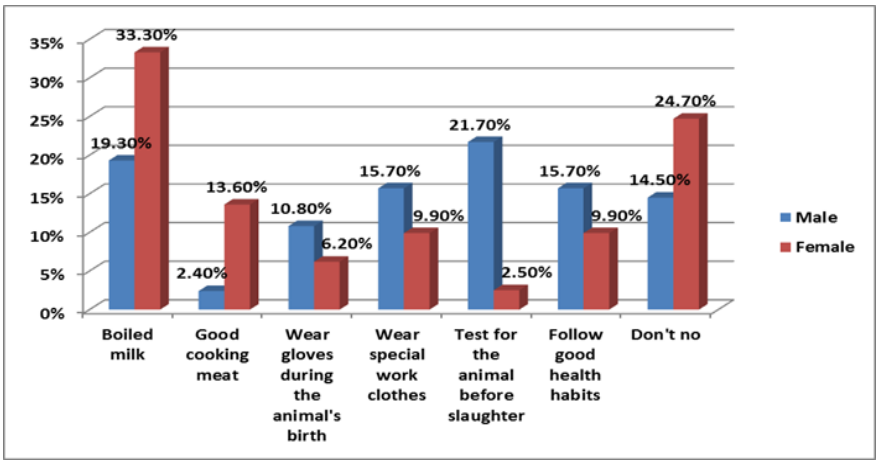

Figure (3) Methods of prevention of Brucellosis in humans as reported by farmers

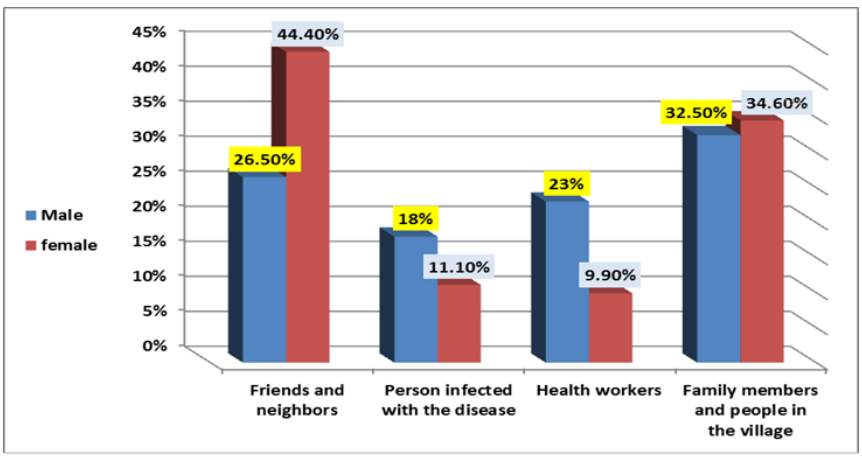

Figure (4) Sources of Farmers information about the Brucellosis

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ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 3, Issue 2, pp: (35-51), Month: May - August 2016, Available at: www.noveltyjournals.com

Answering research questions number two:-

What was the attitude of Farmers towards brucellosis?

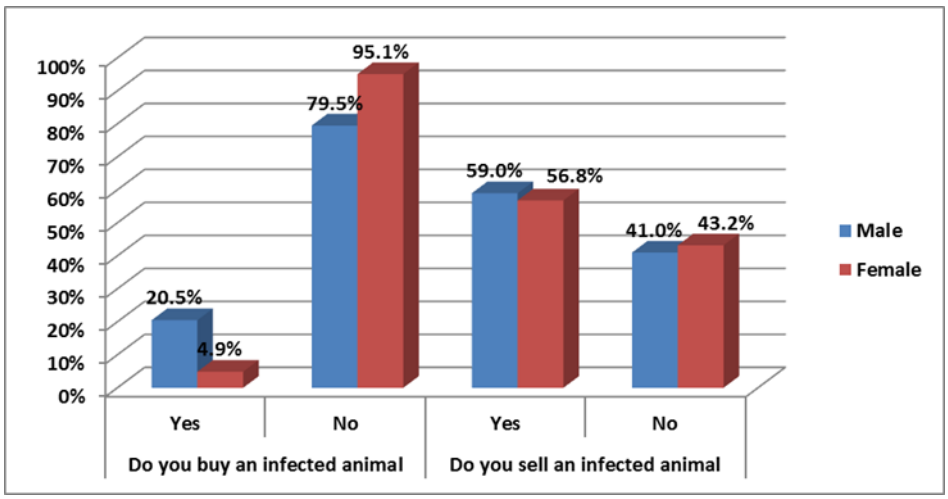

Figure (5) Farmers' Attitude Towards buying or selling infected Animals

Answering research questions number three:-

What was the practice level of farmers towards brucellosis?

Table (5) Distribution of Farmer Practice if the animal infected or Suspicion of being infected

Farmer practice when the animal infected or Suspicion of being infected	Education								X^2	P value
	Illiterate		Basic education		Secondary		University			
	No	%	No	%	No	%	No	%		
Selling animal in the market	13	20.6	0.0	0.0	4	8.7	0.0	0.0	34.7	0.01
Give it treatment	10	15.9	8	21.6	9	19.6	0.0	0.0		
call the vet	18	28.6	9	24.3	16	34.8	8	44.4		
go to veterinary unit	6	9.5	5	13.5	8	17.4	6	33.3		
Separate it from the rest of animals	12	19.0	7	18.9	4	8.7	4	22.2		
Animal sell to the butcher	3	4.8	3	8.1	2	4.3	0	0.0		
slaughter of animal in the house	1	1.6	5	13.5	3	6.5	0	0.0		
Total	63	100.	37	100.	46	100.0	18	100.		

Table (6) Distribution of Farmer Practice Regarding Diary of Milk Products

Practice regarding diary of milk products		Gender				X^2	P. value
		Male N=83		Female N=81			
		No	%	No	%		
Sold raw milk	yes	63	38	61	37	.008	.929
	no	20	12.5	20	12.5		
Boiling milk before drinking	yes	71	85.5	63	77.8	1.65	0.14
	no	12	14.5	18	22.2		
Boiling milk. before making cheese	Yes	18	21.7	24	29.6	1.36	0.16
	no	65	78.3	57	70.4		
Boiling milk before making cream	yes	2	2.4	4	4.9	0.74	0.33
	no	81	97.6	77	95.1		
Boiling milk before making butter	yes	20	24.1	28	34.6	2.2	0.096
	no	63	75.9	53	65.4		
	Total	83	100.0	81	100.0		

Novelty Journals

ISSN 2394-7330

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Table (7) Distribution of Personal Protective devices when dealing with animals

Personal Protective devices when dealing with animals		Gender				Total		X^2	P. value
		Male N= 69		Female N= 58					
		No	%	No	%				
Helping in animal birth	Yes	69	83.1	58	71.6	127	100	3.1	0.06
Wearing gloves	yes	14	20.3	12	20.7	26	20.5	0.003	0.6
	no	55	79.7	46	79.3	101	79.5		
Wearing mask	no	69	83.1	58	71.6	127	100	3.1	0.06

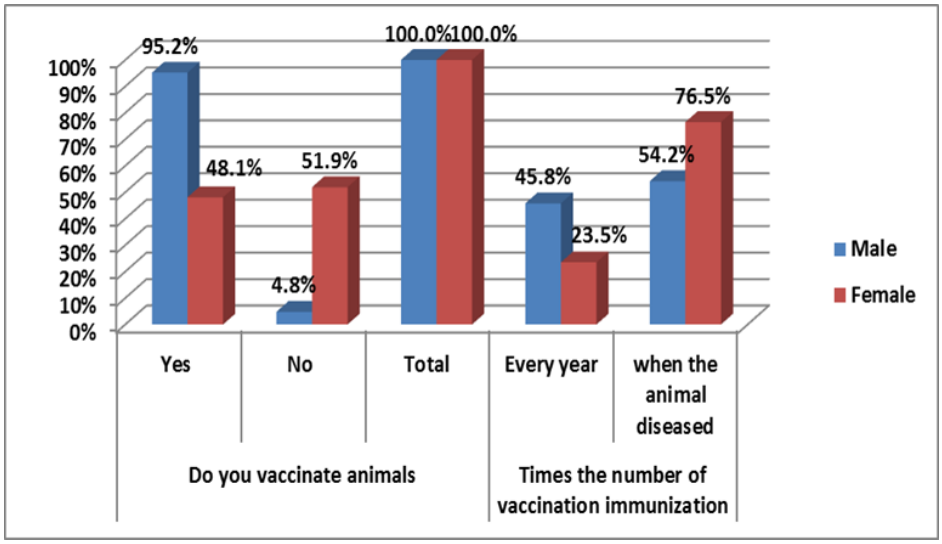

Figure (6) Farmers' Practice of vaccination for animals against brucellosis

Answering research questions number Four:-

What was the accessibility of veterinary services among farmers in rural area?

Table (8) Distribution of Specific protection for animals

Specific protection for animals		Gender				X^2	P. value
		Male		Female			
		No	%	No	%		
vaccinate animals	Yes	79	95.2	39	48.1	44.9	0.00
	No	4	4.8	42	51.9		
Times of vaccination	Every year	38	45.8	19	23.5	9.01	0.002
	for diseased animal	45	54.2	62	76.5		
	Total	83	100.0	81	100.0		
Present of veterinary unit	Yes	83	50.6	81	49.4	1.4	0.16
Vet is constantly present	Yes	36	43	31	38.3	0.33	0.34
	No	47	57	50	61.7		
Vet writes treatment and type of disease	Yes	64	77.1	37	45.7	17.1	0.00
	No	19	22.9	44	54.3		
The animal heals after taking treatment	Yes	67	80.7	37	45.7	41.1	0.00
	No	13	15.7	6	7.4		
	Do not Know	3	3.6	38	46.9		
	Total	83	100.0	81	100.0		

Novelty Journals

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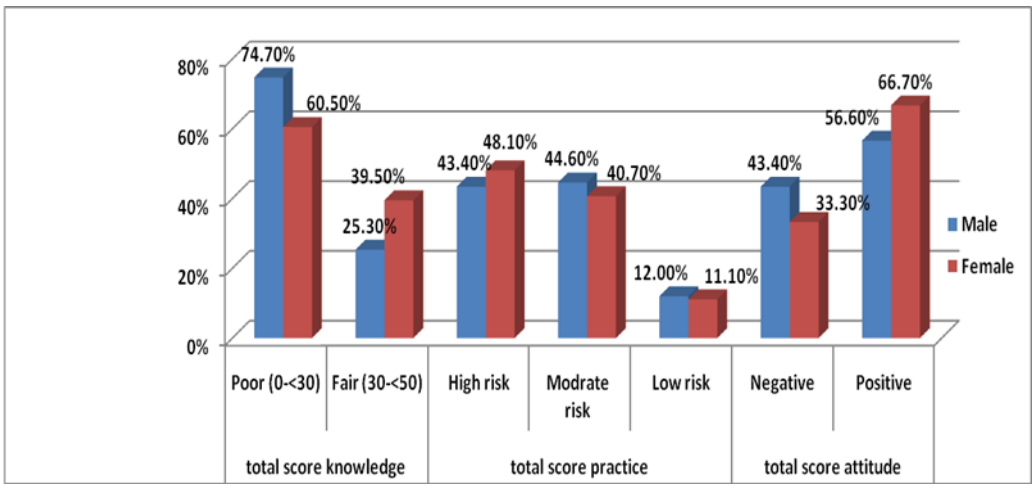

Figure (7) Farmers 'total Scores of Knowledge, practice and attitude about Brucellosis.

5. DISCUSSION

Brucellosis is a highly contagious zoonosis affecting humans and a wide range of terrestrial animals [35]. Despite a high burden of infection in many areas of the world brucellosis is rarely prioritized by health systems and is considered a neglected zoonosis [36]. In Menoufia Governorate most people rely on agriculture with larger proportion depending on animals, people almost entirely depend on livestock for their livelihood [17]. These animals pose a public health threat to humans. The aim of this study was to determine the Farmers' Awareness "knowledge, attitude and practice" regarding brucellosis as a neglected emerging infectious diseases in rural areas.

Regarding age, most of farmers in current study were males and females and above 40 years old. This is perhaps because most women in rural areas are household keepers taking care of children and livestock. The farmers indicated that they had other occupation besides their normal farming activities and animal breeding (Table (1). This result was supported by [37], who found that the most of the respondents in Makuyu, were above 40 years of age and were mainly females.

Regarding the farmers' knowledge about brucellosis the current study revealed that only sixteen percent of the total sample mentioned that bacteria are the cause of brucellosis infection which is the correct answer. Regarding the types of animals affected, the least percent of studied sample male and female (18.3%, 8.0%) mentioned that sheep and goats are the affected types of animals, while the infection is often transmitted from the small ruminants (sheep and goats) to another cattle (buffalo and cows). Regarding the factors that increase the transmission of the disease about two third of the studied sample mentioned that direct contact with animals (Table 2). Additionally more than one third of female farmers mentioned that they heard about brucellosis from friend and neighbors and the least percent from health veterinary workers. This result was contradicted with [38], who studied "Knowledge, Attitudes, and Practices (KAP) and Practices Associated to Brucellosis in Animals of the Livestock Owners of Jordan"? They found that all of the participants said that they had heard about brucellosis: 49.7% of them from media, 38.6% from local veterinarians, and 11.7% from other farmers. Around 90% of the participants were sure that sheep can be infected with brucellosis, 60% were sure that goats can be infected with brucellosis, and about 44% were sure that cattle can be infected with brucellosis. This contradiction may be due to lack of knowledge about the disease in theses villages.

In regard to the most six affected and factors that increase transmission of brucellosis, the current study illustrated that more than half of studied farmers mentioned that both sexes are affected. Also about two third of studied farmers said that direct contact with animals is the factor that contribute to infection transmission. This result was in the same line with [39], who studied "Knowledge and perceptions of brucellosis in the pastoral communities adjacent to Lake Mburo National Park, Uganda". They found that most of the participants (84.7%) believed that the disease segregate between age groups and sex. Two thirds of the participants mentioned that close proximity to wild animals is the major factor that contributes to the increase of brucellosis in the study areas and the majority of the participants (89.8%) believed that brucellosis became a health Problem.

The result of the present study found that farmers had inadequate knowledge about the symptoms of the disease in animal, 19.5% of male and females mentioned abortion as the only symptoms while 27.7 of male mentioned that sudden death of the animal is the symptoms followed by diarrhea, weight loss and animal difficulty carrying (Figure 1). These results were in the same line with [40], who studied "Brucellosis in small ruminants – an investigation of knowledge, attitude and practices in peri-urban farming around the region of Dushanbe, Tajikistan"? They found that majority of the owner's stated that they had somewhat knowledge of the disease. However, their knowledge was rather fallible when it came to the clinical picture: very few mentioned abortion in animals (these very few added other random symptoms such as "fever", "lying down" and "joint aches" as well to their answers). One possible explanation to this might be that in a hyper endemic setting, animals may only show subclinical signs such as reduced fertility and lowered milk production and not dramatic abortion storms [41]. On the other hand the result of the current study was contradicted with [42], who studied "An evaluation of cattle farmers' knowledge of bovine brucellosis in northeast Portugal"? They found that approximately 70% of the farmers considered abortion to be a clinical sign of bovine brucellosis. Although, [41] draw the conclusion from their study in Egypt that the interviewees' high level of awareness of the disease; e.g. the knowledge of clinical signs or transmission pathways, is consistent with an endemic situation. This however, is not consistent with the findings in current study; the results demonstrated lack of farmer's knowledge.

Human brucellosis has a wide clinical spectrum, presenting various diagnostic difficulties because it mimics many other diseases for example malaria, typhoid, rheumatic fever, joint diseases and other conditions causing pyrexia [43]. The "disease manifests with continued, intermittent or irregular fever (hence the name undulant fever), headache, weakness, profuse sweating, chills, arthralgia, depression, weight loss, hepatomegaly, and splenomegaly and generalized aching; Cases of arthritis, spondylitis, osteomyelitis, epididymitis, orchitis, and in severe cases neurobrucellosis, liver abscesses, and endocarditis have also been reported in humans" [44]. The current study revealed that approximately half of the studied farmers didn't know the signs and symptoms of brucellosis in human.

Regarding the methods of prevention between animals and from animals to humans, the current study revealed that more than one third of the farmers who had basic education mentioned that boiling milk is the method to prevent brucellosis in humans. However about one third of university educated farmers mentioned that follow good health habits is the method of prevention. While approximately half of the illiterate famers males and females mentioned that isolation of the infected animal is the methods of prevention from animal to another. The lowest percent of illiterate, basic education and secondary educated farmers mentioned that test of animals before pregnancy is the method of prevention between animals (3.2%, 3.7%, 4. 3 %) respectively (Table 4). This result was in contrast with [41], who studied " Brucella spp. infection in large ruminants in an endemic area of Egypt: seroprevalence, risk factors and livestock owner's knowledge, attitudes and practices (KAPs)". They found that, "most of the participants (89.8%) were aware that brucellosis is preventable in both humans and animals, however, only two methods of prevention from animals to humans and within animals were commonly mentioned: pasteurization of dairy products (88.9%) and proper cooking of meat (86.0%) to prevent transmission to humans; and isolation of infected animals (62.0%) from healthy ones as well as testing animals before mating and artificial insemination (52.3%)". It was noted that majority of the participants did not practically isolate the sick animals because of lack of facilities for isolation of suspected and/or infected animals, yet this is one of the major risk factors for disease transmission between animals as susceptible animals can be infected via contact with sick animals or contact with aborted materials or products of parturition. On the other hand this result was in the same line with [45], who studied "Awareness of Personnel in Direct Contact with Animals Regarding Brucellosis" in Qalioubia. They found that the awareness was low about most items of preventive measures in both animals and human of studied sample.

Buying and selling animals is a great hazard as it facilitates transmission between new animals [46]. A similar concern is the mixed pastures. The current study revealed that more than half of studied farmers know that brucellosis is transmitted from animal to human and more than one third of farmers didn't know. This result wasn't in the same line with [38] who found that Out of 537 participants, 495 (92.2%) declared that they were sure brucellosis can be transmitted from animals to humans, 22 (4.1%) were not sure whether brucellosis can be transmitted from animals to humans, whereas the remaining 3.7% were sure that brucellosis cannot be transmitted from animals to humans. This difference may attribute to lack of health camping to these rural areas.

Regarding farmers practice when the animals infected, the present study found that about one fifth of the illiterate farmers sold the animal in the market while more than one third of the farmers who had university education call the vet when the animal infected. This result was in the same line with [41] in Egypt. They found that some farmers would sell the animal at market. This may increase the transmission of brucellosis, not only between households in the same village, but also

between villages and even larger geographical areas. As animals purchased at a market can be moved without restriction to anywhere in Egypt.

The current study found that more than one third of secondary and highly educated farmers called the vet and went to veterinary unit in the village. This result was contradicted with [41] who found that almost all (98%) of farmers would call the local veterinarian. It may be due to about two third of male and female farmers were illiterate and lack of knowledge and they based on their experience for treatment of animal. Significant environmental contamination with Brucella has to be assumed due to local husbandry methods and the lack of effective carcass disposal. Nile catfish have been found to be infected with B. melitensis, especially in small tributaries of Nile canals in the governorates of Kafrelsheikh, Menoufia, Gharbiya, and Dakahlia in the Nile Delta region. It was isolated from 5.8%, 4.2%, 5.8%, and 13.3% of liver, kidney, spleen samples and skin swabs, respectively; it was not isolated from samples of farmed fish [47]. They stated that disposal of animal waste (carcasses, milk, aborted and parturition materials) into the Nile or its canals play an important role in the transmission. The finding of the current study illustrated that the farmers thrown the output of aborted and died animal in the canal.

Brucellosis is an occupational disease; farmers, veterinarians, inseminators are at higher risk of contracting it. There is an even stronger association with poverty; poor people live closer to their animals, are more likely to consume unpasteurized milk products and meat from infected animals, and are less prone to protect themselves when dealing with fetal fluids and vaginal discharges after abortion or full-term parturition. Furthermore, as with other conditions; poor people, especially in rural areas, are less likely to get proper diagnosis and treatment, and since brucellosis is a zoonosis it is a double burden – i.e. it affects both people and their animals - in poor households [1]. In the current study more than 75% of farmers sold raw milk and boiling milk before consumption. This result was in the same line with [38]. They found that more than 75% of the participants interviewed reported that milk from their own animals was regularly consumed in their household and the same proportion regularly sold raw milk to others. The majority of participants (74%) boil milk before it was consumed.

In the current study only one fifth of the participants who helping in animal' birth using gloves, while any one didn't wear mask as protective devices these result was in the same line with [31], who studied “knowledge, attitudes and practices relating to brucellosis among small-scale dairy farmers in an urban and peri-urban area of Tajikistan”. They found that the majority of the respondents did not use any protection when handling cows having an abortion or when dealing with aborted materials

The result of the current study found that More than half of the studied farmers males and females answered that vet is not present all the time. These results were inconsistency with [42]. They studied " An evaluation of cattle farmers’ knowledge of bovine brucellosis in northeast Portugal, who found that the absence of a veterinarian on the farm was mentioned by (60.4%), but approximately three-quarters (69.5%) of the respondents requested a veterinarian only in the case of sick cattle”. The role of a veterinarian in the education/training of cattle producers is essential for improving the understanding not only of the sanitary aspects but also of, veterinary legal fulfillment and veterinary public health [48].

The finding of the current study revealed that about two third of farmers had poor total knowledge score. This result was in the same line with [49]. They studied "Risk associated with bovine brucellosis in selected study herds and market places in 4 countries of West Africa" they found that the knowledge of farmers on the zoonotic character and the ways of transmission of the disease in cattle was generally poor. While it is contradicted with [39], who studied” Knowledge and perceptions of brucellosis in the pastoral communities adjacent to Lake Mburo” in National Park, Uganda. They found that 197 (53.1 %) had moderate overall knowledge on brucellosis symptoms, transmission, treatment, prevention and risk factors among the participant s. A majority of the participants (99.3%) in our study had ever heard about brucellosis (commonly known as ‘brucella’). This discrepancy may be due to low educational level was found to be associated with low awareness of brucellosis.

6. CONCLUSION

The total knowledge scores of the studied sample were poor regarding brucellosis causes, mode of transmission, and methods of prevention in animals and human.

Nearest half of the famers both male and female had poor practice so there is a high risk of exposure of brucellosis through the consumption of infected milk products as well as through farmer’s practices; as close contact with animals is common in rural areas of Egypt.

7. RECOMMENDATION

In order to protect human health, what must be achieved is:

1. Health education for the farmers about brucellosis as a neglected and infectious disease endemic in Egypt, at primary health care setting in rural areas and mass media including the following:

- Methods of transmission in humans and animals
- Methods of prevention for humans and animals
- Importance of vaccination for healthy and diseased animal
- Keep the children away from animals.

2. Provision of training program for the farmers to ensure using of protective measurements, and follow hygienic practice when dealing with the animals to minimize the risk of exposure to Brucellosis.

3. Collaboration between community health nursing and veterinary medical management to increase health awareness of farmers.

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