



EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
MICROBIOLOGY

G



ISSN
2090-0872

WWW.EAJBS.EG.NET

Vol. 16 No. 2 (2024)



Knowledge, Attitudes, and Practices (KAP) of Workers and Milk Producers towards Brucellosis in Hantoob Administration Unit - Gezira State, Sudan, 2021

Salman Y. E. Ahmed¹, Ibrahim E. Elmahdi², Azhari A. Mohammed Nour³, Mohamed AE.M. Ibrahim^{2*}, Omer Y. M. Ali², Khalid A. Gadein⁴, and Syed I. Hassan³

¹Faculty of Health and Environmental Sciences, University of Gazira, Sudan.

²Department of Public Health, Faculty of Applied Medical Sciences, Al-Baha University Al-Baha City, Saudi Arabia.

³Department of Basic Medical Sciences, Faculty of Applied Medical Sciences, Al-Baha University, Al-Baha, Saudi Arabia.

⁴Department of Agricultural Analysis Laboratory, Ministry of Agriculture, Livestock and Irrigation, Omdurman. Sudan.

*E. mail: mibrahim@bu.edu.sa

ARTICLE INFO

Article History

Received:19/10/2024

Accepted:23/11//2024

Available:27/11/2024

Keywords:

Brucella, Brucellosis, milk producers, public health, workers, and Zoonotic disease.

ABSTRACT

This study aimed to assess the level of knowledge, attitudes, and practices among workers and milk producers towards bovine brucellosis in the Hantoob administration unit-Gezira State, Sudan in 2021. A Cross-sectional with a randomized sampling technique was used, 85 workers and milk producers from 22 villages in the Hantoob administration unit were involved in the study. A structured questionnaire was used to assess knowledge, Attitudes, and Practices among workers and milk producers. The data were collected from the workers and milk producers through the questionnaire methods. Results found that the knowledge of the workers and milk producers was poor about Brucellosis that (59%) did not know about brucellosis. The majority of those who knew about brucellosis (80%) knew about it from their friends, and (96%) didn't know about the causative agent of brucellosis. Most workers and milk producers (80%) did not know the mode of brucellosis transmission and did not realize that brucellosis is transmitted from animals to humans. Most workers and milk producers (84%) showed ignorance about the symptoms of brucellosis in animals, while (92%) did not know the symptoms in humans, and 87% of the workers and milk producers didn't know the prevention methods of brucellosis. Most of the workers and milk producers (64%) didn't isolate the aborted animals and left them with other animals. The majority of the workers and milk producers (91%) drank raw milk, and (82%) of them were non-cooked meat, this Study also shows that there was no periodic checkup or Immunization for brucellosis in animals in our area study (96%). No immunization for brucellosis in animals in our area study (96%) and Based on this study.

INTRODUCTION

Brucellosis is a bacterial disease that affects populations of livestock and humans, as well as their respective economies, throughout the world (World Health Organization, 2020).

The bacteria are shed in urine, milk, and other fluids, posing a risk to humans through contact with infected animals or products. A highly contagious zoonotic disease known as brucellosis is caused by the highly contagious bacteria *Brucella* spp., a Gram-negative bacterium that can be transmitted to both humans and animals and poses a significant risk to public health (Alkahtani *et al.*, 2020). There is a consensus that cattle are primarily affected by *Brucella abortus* (*B. abortus*) and less frequently by *Brucella suis* (*B. suis*) and *Brucella melitensis* (*B. melitensis*), whereas sheep and goats are most commonly affected by *B. melitensis* (Negash and Dubie, 2021). Brucellosis, also known as “undulant fever”, “Mediterranean fever” or “Malta fever”. (World Health Organization, 2006) Recently, additional *Brucella* species such as *B. ovis* or *B. neotomae* (same strain as *B. canis*), *B. microti* from the common vole, *B. penibedalis* and *B. cetacia* from marine mammals, *B. inopinata* from the female breast, *B. papioni* from baboons, and *B. vulpeus* from red foxes have been reported (Banai *et al.*, 2018; Mahmoud, 2019). Several *Brucella* species have been identified in central Saudi Arabia as a result of human investigations conducted in the desert climate such as *B. melitensis* (Jokhdar, 2009; Nemenqani *et al.*, 2009; Kamal *et al.*, 2013 Alshaalan *et al.*, 2014 and Alnemri., *et al.*, 2017] and *B. abortus* first officially diagnosed as an infection in British soldiers, brucellosis now is touted as a potential biological warfare agent. However, its relatively long and variable incubation period (1-8 wk), as well as the fact that many infections are asymptomatic, has made it a less desirable agent for weaponization (Celebi *et al.*, 2007). It is known that *Brucella* is not host-specific, but it does exhibit a host preference, and spillover can occur when many host species are maintained together or when high-quality grazing areas and water supplies are shared (Ducrottoy *et al.*, 2017). Brucellosis

is associated with abortion, infertility, and decreased production of milk and meat, resulting in considerable economic impact on the animal husbandry industry worldwide (Rossetti, 2017). From a public health perspective, brucellosis is usually considered an occupational health hazard mainly affecting livestock handlers such as butchers, farmers, laboratory staff, slaughter workers, and veterinarians (Zamakshshari *et al.*, 2021). The diagnosis of brucellosis is generally achieved either directly or indirectly via *Brucella* isolation or the detection of specific antibodies (Zurovac *et al.*, 2022). PCR analysis can increase the sensitivity and specificity of detecting the infection and differentiation between *Brucella* species (Batinou *et al.*, 2022).

MATERIALS AND METHODS

Study Area:

The study was conducted in the Hantoub administration unit in Wad Madani, Gezira state in March 2021. Hantoub area is in the north and east of Wad Madani, approximately 25 km away. The population of Hantoub was 77,003 people living in 13,286 families across 22 villages. The community had a semi-nomadic lifestyle, with residents working as farmers, sponsors, and merchants. In terms of healthcare, there were two hospitals and ten health centers in the area.

Study Population:

The study included all workers and milk producers in the Hantoub administrative unit of Gezira state during the study period.

Study Design:

In March 2021, a cross-sectional study was conducted in the Hantoub administrative unit to evaluate the knowledge, attitudes, and behaviors of workers and milk producers regarding Brucellosis.

Sample Size:

A Simple random sample technique was used to select 85 workers

and milk producers in the Hantoub administrative unit during the study period.

Data Collection:

A structured questionnaire was used. The questionnaire contained the following sections. The socio-demographic characteristics of the workers and milk producers, Knowledge of the milk producers toward Brucellosis, and Attitude of the milk producers and Workers sponsors toward Brucellosis.

The data was collected through a questionnaire that included the following sections:

1. Socio-demographic characteristics of the workers and milk producers
2. Knowledge of the milk producers about Brucellosis
3. Attitude of the milk producers towards Brucellosis
4. Workers' and milk producers' views on Brucellosis

Data Processing and Analysis:

Data processing and analysis were conducted using the Statistical Package for

Social Science (SPSS) v. 22 on a computer.

RESULTS

The data were collected from 85 workers and milk producers in the Hantoub administrative unit through questionnaires and analyzed using SPSS version 22.

As shown in Table 1. The study revealed that the respondents were distributed across different age groups: 8% were aged 10-20 years, 14% were aged 21-30 years, 23% were aged 31- 40 years and 55% were over 41 years old. In terms of education, 53.4% were illiterate, 43.1% had a primary education, and 3.5% had an intermediate education level. None of the respondents had a secondary or university education. Regarding income, none of the respondents earned less than 100 SDG, 3.5% earned between 100-150 SDG, 25% earned between 150-200 SDG, and 71.5% earned more than 200 SDG. In terms of work experience, 4.7% had less than one year of experience, 3.5% had 1-3 years, 16.5% had 3-5 years, and 75.5% had more than 5 years of experience.

Table 1. Demographic information.

Variable	Freq.	Percent	
Age	10-20 years	7	8%
	21-30 years	12	14%
	31-40 years	20	23%
	> 41 years	46	55%
	Total	85	100%
Education level	Illiterate	45	53.4%
	Primary	37	43.1%
	Intermediate	3	3.5%
	Secondary	0	0.0%
	University	0	0.0%
	Total	85	100%
Monthly income SDG*	50-100	0	0.0%
	100-150	3	3.5%
	150-200	21	25%
	More than 200	61	71.5%
	Total	85	100%
Work duration	Less than 1 year	4	4.7%
	1-3 years	3	3.5%
	3-5 years	14	16.5%
	More than 5 years	64	75.3%
	Total	85	100%

*SDG: Sudanese Pound

The study revealed that 41% of respondents were aware of brucellosis, while 59% did not know about the disease (Table 2). Only 4% of respondents knew the causative agent of brucellosis, while 96% were unaware of it. Regarding the mode of transmission, only 20% of respondents knew how brucellosis is transmitted, while 80% were unaware. Additionally, 20% of respondents knew that brucellosis is zoonotic, while 80% did not. When it comes to recognizing the clinical signs of brucellosis in animals, only 16% of respondents were knowledgeable, while 84% were not. Similarly, only 8% of respondents knew the symptoms of brucellosis in humans, while 92% did not. Awareness of Brucellosis Prevention: Only 13% of respondents knew how to prevent brucellosis, with 87% lacking knowledge

on disease prevention. Prevalence of Brucellosis Infection: 1% of respondents tested positive for brucellosis, while 99% tested negative. Attitudes towards Raw Milk Consumption: 91% of respondents reported consuming raw milk, while 9% did not. Attitudes towards Cooked Meat Consumption: 82% of respondents consumed cooked meat, while 18% did not. Practices Related to Brucellosis Diagnosis in Animals: Only 4% of respondents mentioned regular screening for brucellosis in animals, with 96% stating no such screening was conducted. Practices Related to Vaccination against Brucellosis in Animals: 4% of respondents were aware of immunization programs for brucellosis in animals, while 96% were unaware of such vaccination efforts.

Table 2. Respondent's Knowledge attitudes and practice toward brucellosis.

Variable	Yes	No
Respondent's knowledge of brucellosis	(35) 41%	(50) 59%
Respondent's awareness of the causative agent of brucellosis	(3) 4%	(81) 96%
Respondents' understanding of the mode of transmission of brucellosis	(17) 20%	(68) 80%
Respondent's awareness of the zoonotic nature of brucellosis	(17) 20%	(68) 80%
Respondent's knowledge of the clinical signs of brucellosis in animals	(14) 16%	(71) 84%
Respondent's knowledge of the symptoms of brucellosis in humans	(7) 8%	(78) 92%
Respondent's awareness of prevention methods for brucellosis	(11) 13%	(74) 87%
Percentage of respondents infected with brucellosis	(1) 1%	(84) 99%
Attitudes of respondents toward consuming raw milk	(77) 91%	(77) 91%
Attitudes of respondents toward consuming cooked meat	(70) 82%	(15) 18%
Respondents' practices in diagnosing brucellosis in animals	(3) 4%	(81) 96%
Respondents' practices in vaccinating animals against brucellosis	(3) 4%	(81) 96%

The study revealed that 11.8% of respondents learned about brucellosis from the radio, 5.8% from TV, and the majority (80%) from friends. Only 2.4% learned about brucellosis from other sources such as pharmacies (Fig. 1).

The study revealed that all respondents were aware of the causative agent of brucellosis and correctly identified bacteria as the causative agent (Fig. 2).

Figure 3 revealed that only 6% of respondents were aware of the mode of transmission of brucellosis, with 41%

attributing it to insects, 29% to raw milk, and 24% to uncooked meat.

Respondents' ability to identify clinical signs of brucellosis in animals varied (Fig. 4). Only 14.3% correctly identified infertility and weakness as symptoms, while another 14.3% associated it with weakness. The majority (71.4%) recognized abortion as a symptom.

As shown in Figure 5 the study found that only one respondent recognized abdominal pain as a symptom of brucellosis in humans, while another mentioned fever,

and two mentioned headaches. Most of the respondents (95%) identified all these symptoms.

The awareness of respondents about methods to control *Brucella* infection is depicted in Figure 6 among those who were aware of prevention methods, 36.4% mentioned boiling milk, 27.3% cited cooking meat, 18.2% stated treating sick animals, and another 18.2% identified immunizing animals as preventive measures.

The study revealed that 15% of respondents did not take any action when they encountered aborted animals, while 13% isolated the animals. The majority (64%) did not isolate the animals, and only

8% sought veterinary assistance (Fig. 7).

The study found that 21.2% of respondents only dried their hands after touching aborted animals (Fig. 8), 54.2% washed their hands with water only, and 24.7% washed their hands with water and soap. None of them used a sterilizer.

According to Figure 9, the study showed that 2% of respondents spent 1-4 hours daily with animals, 12% spent 4-8 hours, and 35% spent 8-12 hours. The majority of respondents (51%) spent the entire day with animals.

10.6% of respondents treated themselves when infected with brucellosis, 78.8% visited a doctor, and 10.6% sought advice from friends (Fig. 10).

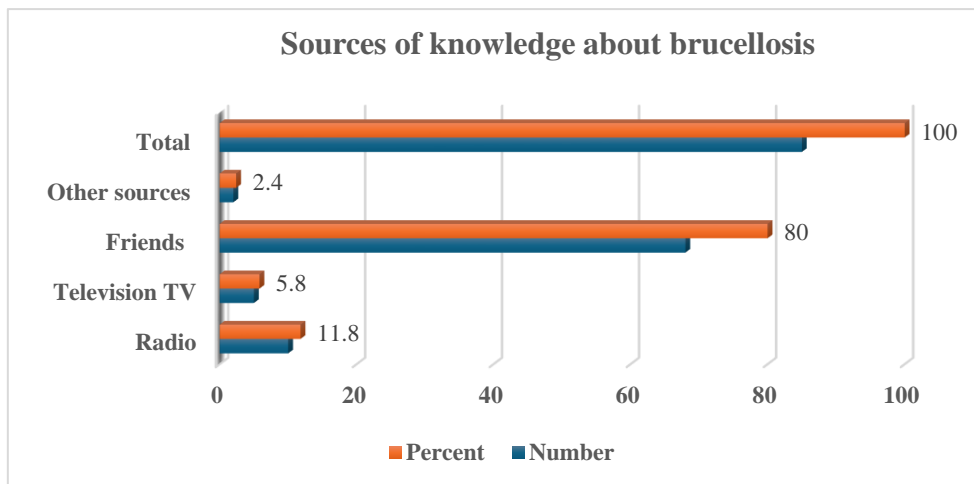


Fig. 1: Sources of respondents' knowledge about brucellosis.

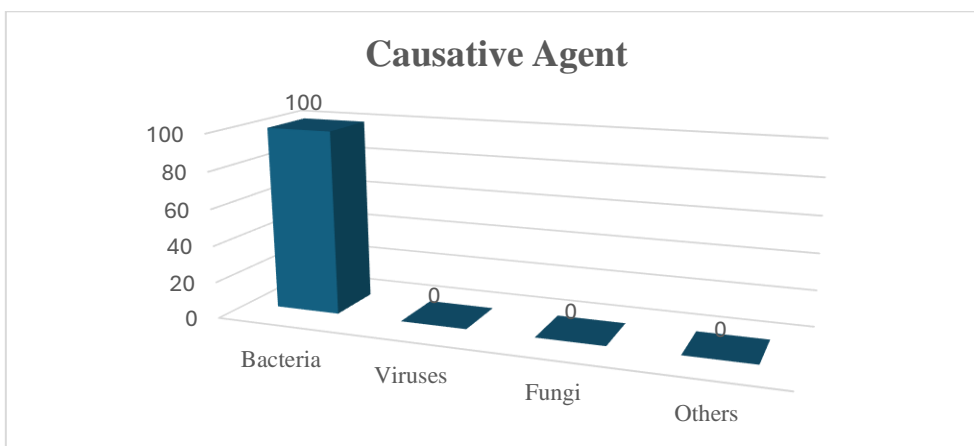


Fig. 2: Awareness of Respondents Regarding the Causative Agent of Brucellosis.

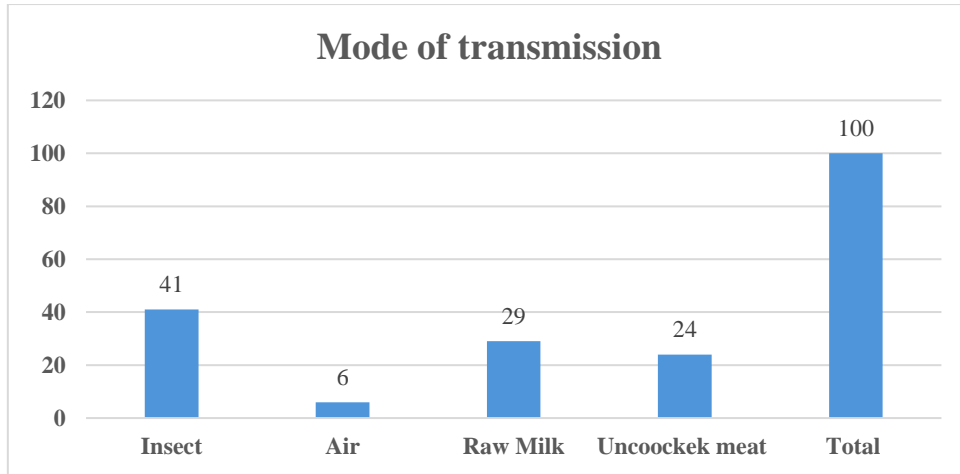


Fig. 3: Knowledge of respondents about the way by which brucellosis is transmitted.

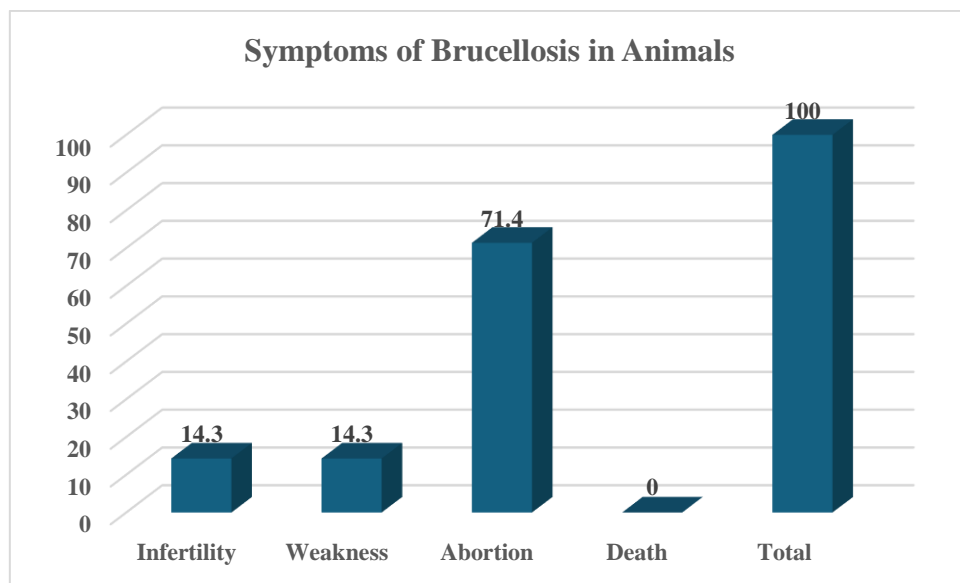


Fig. 4: Respondents' ability to identify clinical signs of brucellosis in animals.

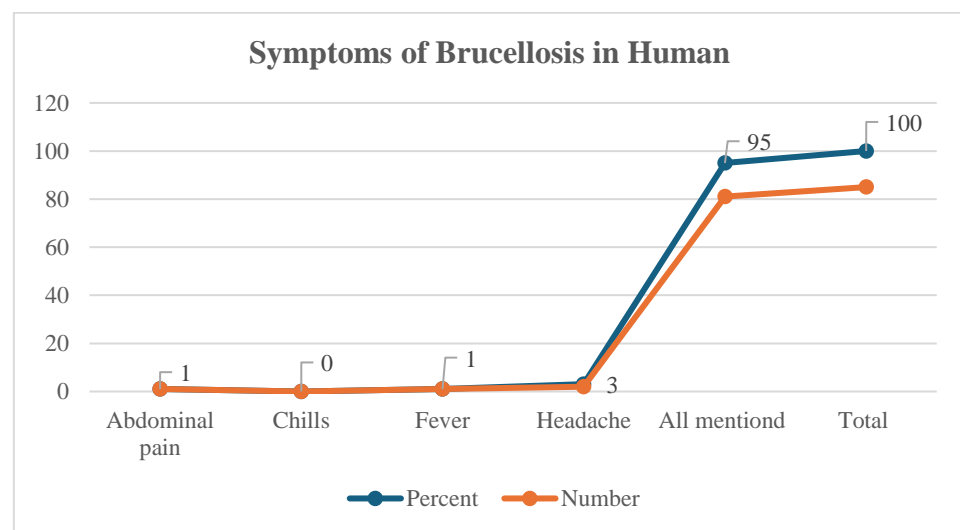


Fig. 5: Respondents' ability to identify brucellosis symptoms in humans.

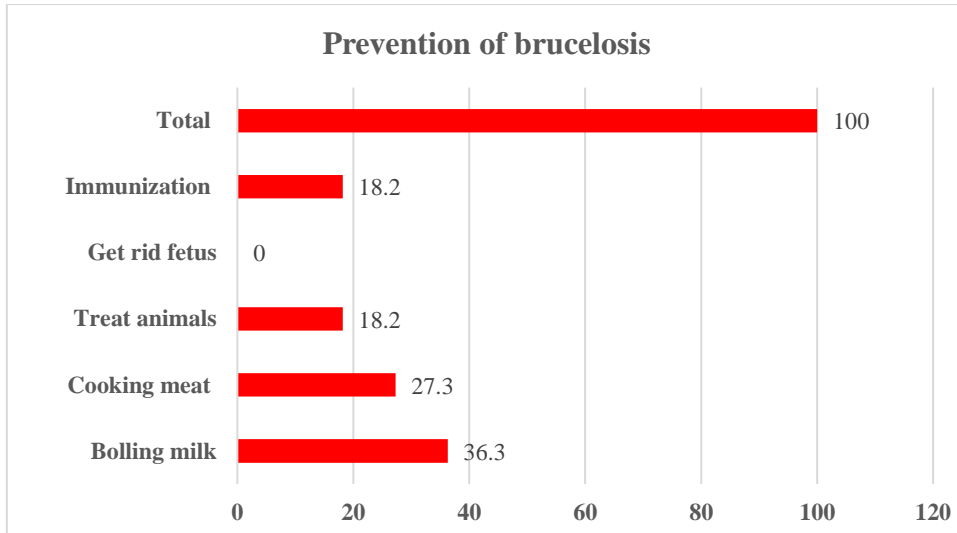


Fig. 6: Respondents' knowledge of brucellosis prevention methods.

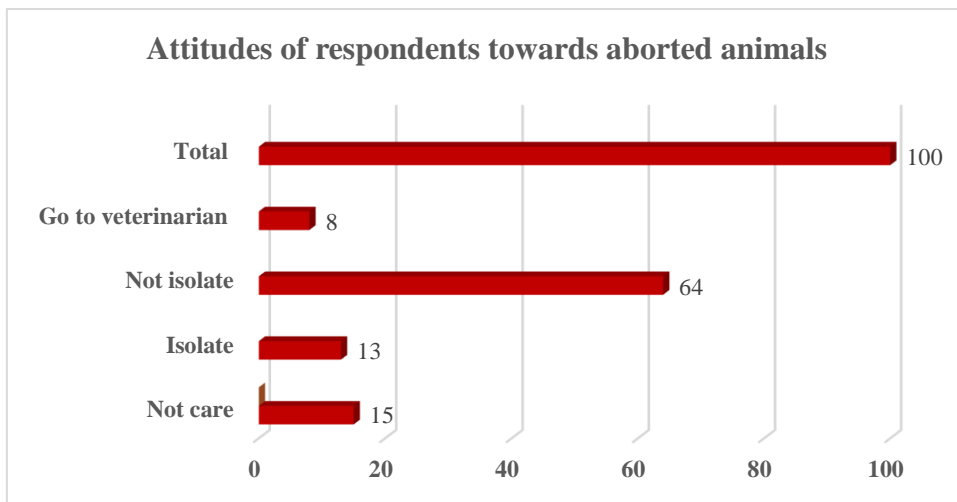


Fig. 7: Attitudes of respondents towards aborted animals.

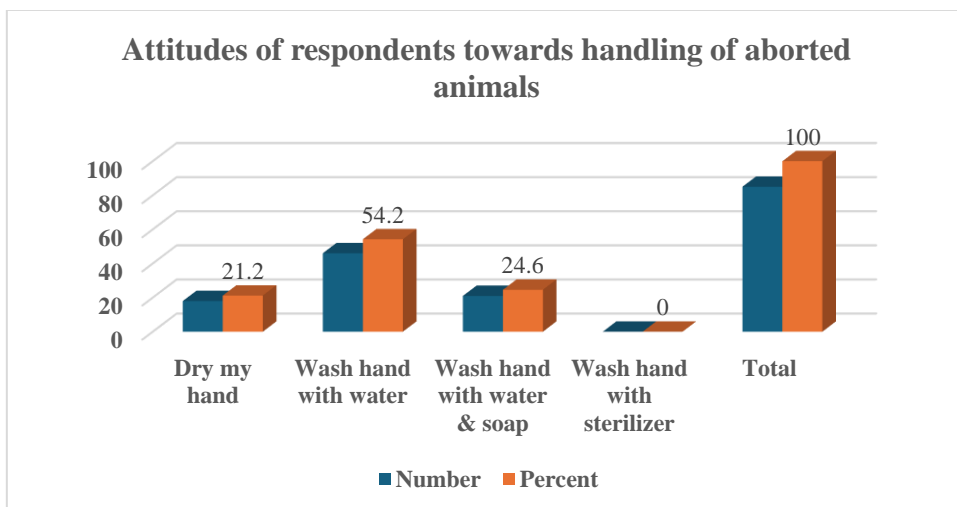


Fig. 8: Attitudes of respondents towards handling of aborted animals.

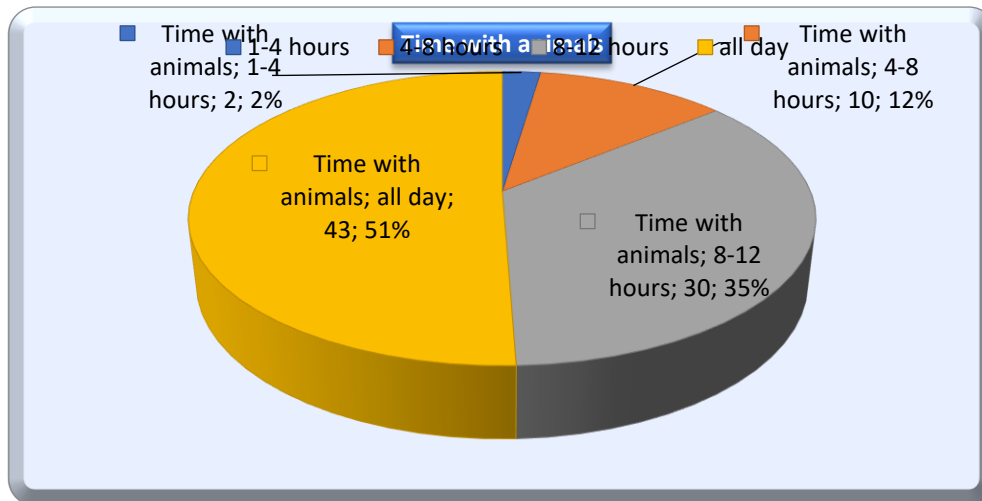


Fig. 9: Time spent by respondents with animals.

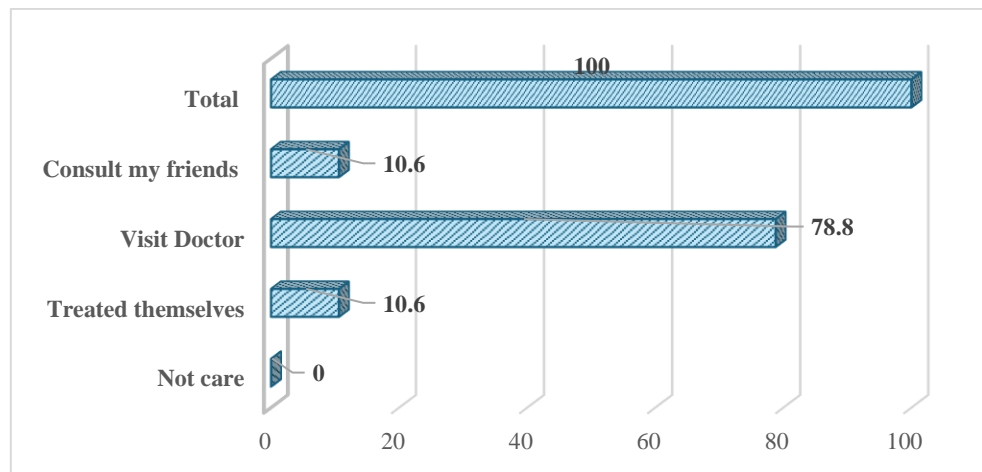


Fig. 10: Attitudes of respondents when getting infected with brucellosis.

DISCUSSIONS

This study aimed to assess the Knowledge, Attitudes, and Practices (KAP) of workers and milk producers regarding Brucellosis in the HantooB administration unit in Gezira State in 2021. The results revealed that 8% of respondents were in the 10-20 age group, indicating that young individuals were involved in animal contact without full awareness of the risks. In contrast, 55% of respondents were over 41 years old, suggesting prolonged exposure to animals and a higher likelihood of Brucellosis infection.

The study indicated that a large percentage of milk producers had low educational levels, with 62.4% being illiterate and 43.1% having only primary education. None had secondary or

university education, highlighting a lack of knowledge about diseases like brucellosis. Most respondents had worked with animals for over 5 years, increasing their risk of brucellosis infection. Additionally, 59% of respondents were unaware of brucellosis, and 80% of those who were informed learned about it from their friends, potentially leading to misinformation. Alarmingly, 96% of respondents did not know the causative agent of brucellosis, indicating a lack of awareness about prevention measures.

In this study, 80% of respondents were unaware of how brucellosis is transmitted, highlighting a significant risk of infection. Only 17 of the respondents knew the transmission mode, with 5 identifying raw milk and 4 identifying non-

cooked meat. Previous research has identified ingestion, direct contact through skin breaks, airborne transmission, and contact with infected animal tissues as the main modes of transmission.

The study revealed that 80% of respondents were unaware that brucellosis can be transmitted from animals to humans. Previous research has shown that various types of *Brucella*, such as *B. melitensis* in sheep, *B. abortus* in cattle, and *B. suis* in swine, are linked to human illness. Additionally, cases of brucellosis in humans have been reported due to dogs infected with *B. canis*.

This study revealed that a large percentage of respondents were unaware of the symptoms of brucellosis in animals (84%) and humans (92%), indicating potential confusion with other febrile diseases. Additionally, 87% of respondents were unfamiliar with prevention methods for brucellosis, suggesting a lack of knowledge among milk producers. Only 13% of respondents isolated aborted animals, while 64% did not, posing a risk of infection to other animals. Vaccination of animals that are potential carriers of bacteria, especially within livestock populations, is promising for controlling the spread of brucellosis (Schurig *et al.*, 2002). The study found that a significant percentage of respondents in the study area did not practice proper hand hygiene after touching aborted animals, which increases the risk of brucellosis infection. Additionally, a high percentage of respondents consumed raw milk and uncooked meat, which are common modes of brucellosis transmission. Infected animals and their products serve as reservoirs for the disease. Furthermore, the study revealed that there is a lack of periodic checks and immunization for brucellosis in animals in the area. It is important to handle vaccines such as Strain 19 *B. abortus* and *B. melitensis* Rev-1 with caution to prevent accidental exposure.

Conclusions

The study found that workers and milk producers had inadequate knowledge about Brucellosis, with 59% having no awareness of the disease. Among those who were aware, 80% learned about it from friends, and 96% did not know the causative agent. Additionally, 80% were unaware of the transmission mode from animals to humans. The majority (84%) were unfamiliar with the symptoms in animals, and 92% did not know the symptoms in humans. Prevention methods were unknown to 87% of participants. Furthermore, 64% did not isolate aborted animals, and 91% consumed raw milk, while 82% ate uncooked meat. There were no periodic checks or immunization programs for Brucellosis in animals in the study area, with 96% lacking these preventive measures.

Recommendations

Health authorities at the Ministry of Health and local levels should conduct an awareness campaign for workers and milk producers in the study area about brucellosis. This campaign should cover the causative agent, transmission methods, and prevention strategies for brucellosis. Periodic awareness messages should be broadcast through radio and TV. Health authorities should take responsibility for regular brucellosis checks on animals and ensure that owners immunize their animals. Owners should be required to obtain a free brucellosis certificate for their animals. Further studies on brucellosis in the area should be conducted.

Declarations

Ethical Approval: The study was approved by the Research Ethics Committee of the Faculty of Health and Environmental Sciences, Gezira University-Sudan. Written Consent was sought from the respondents to participate in the study and identification numbers were accorded to all participants for confidentiality. Participants' defined privacy was accorded during collection of data. Written consent was sought from the

participants to publish and disseminate the research findings.

Potential Benefits and Hazards: Collecting information on KAP regarding brucellosis and associated risk factors did not harm anyone.

Recruitment Procedures: Participants were recruited voluntarily as they arrived to attend prearranged cattle keeper meetings.

Informed Consent: An information sheet and informed consent document were used by the interviewers to explain the study process and purpose and to obtain consent. The study was voluntary and anonymous.

Conflicts of Interest: The authors have declared that no competing interests exist.

Authors Contributions: The authors contributed equally to the research and writing of this article. All authors have read, reviewed, and approved the content of the last version of this manuscript.

Funding: This work was supported by the research facilities provided by the Faculty of Health and Environmental Sciences, University of Gezira. The authors have no additional funding sources to disclose.

Availability of Data and Materials: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments: We would like to express our deepest gratitude to the Faculty of Health and Environmental Sciences staff.

REFERENCES

- Alkahtani A.M., Assiry M.M., Chandramoorthy H.C., Al-Hakami A.M., Hamid M.E. 2020. Sero-prevalence and risk factors of brucellosis among suspected febrile patients attending a referral hospital in southern Saudi Arabia (2014–2018). *BMC Infectious Diseases*, 20: 26,1-8. Doi: 10.1186/s12879-020-4763-z.
- Alnemri A.R.M., Hadid A., Hussain S.A., Somily A.M., Sobaih B.H., Alrabiaah A., Alanazi A., Shakoor Z., AlSubaie S., Meriki N. 2017. Neonatal brucellosis: A case report. *The Journal of Infection in Developing Countries* 11:199–202. Doi: 10.3855/jidc.8938.
- Alshaalan M.A., Alalola S.A., Almuneef M.A., Albanyan E.A., Balkhy H.H., AlShahrani D.A., AlJohani S. 2014. Brucellosis in children: Prevention, diagnosis and management guidelines for general pediatricians endorsed by the Saudi Pediatric Infectious Diseases Society (SPIDS). *International Journal of Pediatrics and Adolescent Medicine* 1(1):40–46. Doi: 10.1016/j.ijpam.2014.09.004.
- Banai M., Itin R., Bardenstein S. 2018. Perspectives and outcomes of the activity of a reference laboratory for brucellosis. *Frontiers in veterinary science*. 4:234.
- Batrinou A., Strati I.F., Tsantes A.G., Papapaskevas J., Dimou I., Vourvidis D., Kyrma A., Antonopoulos D., Halvatsiotis P., Houhoula D. 2022. The Importance of Complementary PCR Analysis in Addition to Serological Testing for the Detection of Transmission Sources of *Brucella* spp. in Greek Ruminants. *Veterinary Sciences*. 9(4):193. Doi: 10.3390/vetsci9040193.
- Celebi, G., Kùlah, C., Kiliç, S., & Ustündağ, G. (2007). Asymptomatic *Brucella* bacteraemia and isolation of *Brucella melitensis* biovar 3 from human breast milk. *Scandinavian journal of infectious diseases*, 39(3), 205–208. <https://doi.org/10.1080/00365540600978898>.
- Ducrottoy, M., Bertu, W. J., Matope, G., Cadmus, S., Conde-Álvarez, R., Gusi, A. M., Welburn, S., Ocholi, R., Blasco, J. M., & Moriyón, I. 2017. Brucellosis in Sub-Saharan Africa: Current challenges for management, diagnosis and

- control. *Acta tropica*, 165, 179–193. <https://doi.org/10.1016/j.actatropica.2015.10.023>
- Jokhdar H. 2009. Brucellosis in Saudi Arabia: Review of literature and an alarming case report in a hospital in Jeddah. *Medical Journal of Cairo University (MJCU)*, 77(3):47–55.
- Kamal I.H., Al Gashgari B., Moselhy S.S., Kumosani T.A., Abulnaja K.O. 2013. Two-stage PCR assay for detection of human brucellosis in endemic areas. *BMC Infectious Diseases* 13:145. Doi: 10.1186/1471-2334-13-145.
- Mahmoud HA A.H. 2019. Evaluation of indirect multispecies ELISA for diagnosis of brucellosis in different farm animals. *Animal Health Research. Journal*. 7:422–431.
- Negash W., Dubie T. 2021. Study on seroprevalence and associated factors of bovine brucellosis in selected districts of Afar National Regional State, Afar, Ethiopia. *Veterinary Medicine International*, 2021(1), 8829860. Doi: 10.1155/2021/8829860.
- Nemenqani D., Yaqoob N., and Khoja H. 2009. Breast Brucellosis in Taif, Saudi Arabia: Cluster of six cases with emphasis on FNA evaluation. *The Journal of Infection in Developing Countries*, 3(04), 255-259. Doi: 10.3855/jidc.121.
- Rossetti C.A., Arenas-Gamboa A.M., Maurizio E. 2017. Caprine brucellosis: A historically neglected disease with a significant impact on public health. *PLoS Neglected Tropical Diseases*, 11(8), e0005692. Doi: 10.1371/journal.pntd.0005692.
- Schurig GG, Sriranganathan N, Corbel MJ. 2002; Brucellosis vaccines: past, present and future, *Veterinary microbiology*, 90(1-4), 479-496. Doi: 10.1016/S0378-1135(02)00255-9.
- World Health Organization. 2020. Brucellosis. In: Fact sheets. [Cited 2023 Jul 24]. <https://www.who.int/news-room/fact-sheets/detail/brucellosis>
- World Health Organization. 2006. Brucellosis in humans and animals. Produced by the World Health Organization in collaboration with the Food and Agriculture Organization of the United Nations and the World Organization for Animal Health. <https://www.who.int/publications/i/item/9789241547130>.
- Zamakshshari N., Ahmed I.A., Nasharuddin M.N., Hashim N.M., Mustafa M.R., Othman R., Noordin M.I. 2021. Effect of extraction procedure on the yield and biological activities of hydroxychavicol from Piper betle L. leaves. *Journal of Applied Research on Medicinal and Aromatic Plants*, 24:100320. Doi: 10.1016/j.jarmap.2021.100320.
- Zurovac Sapundzic Z., Zutic J., Stevic N., Milicevic V., Radojicic M., Stanojevic S., Radojicic S. 2022. First Report of Brucella Seroprevalence in Wild Boar Population in Serbia. *Veterinary Sciences*, 9(10), 575. Doi: 10.3390/vetsci9100575.