

## THE IMPACT OF BRUCELLOSIS ON THE ECONOMY AND PUBLIC HEALTH IN AFRICA

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**Summary:** *Brucellosis of both animals and humans has been known in Africa for a very long time. Humans have often revealed an insidiously evolving infection in animals. In Africa, the predominantly non-sedentary systems of livestock production (unrestricted grazing, transhumance and nomadism) make it difficult to identify the disease and to evaluate its economic and health impact.*

*The aim of summarising member countries' answers to the questionnaire is to gain a better understanding of local livestock production and animal health management practices, as well as to gather information on infections caused by *Brucella abortus*, *B. melitensis* et *B. suis* and on diagnostic capabilities in the various countries, as well as to form a clear idea of the economic and health importance of the disease.*

*In 28 of the 29 countries that had answered the questionnaire by 3 February 2009, livestock production is important both economically and socially. The countries have a combined cattle population of 133 932 000 head, together with 277 665 050 sheep and goats. For the other species, the numbers are: 10 633 000 camelids, 6 968 000 equids, 9 047 000 pigs and 801 580 000 poultry. The size of national livestock populations varies from country to country. However, Sudan, Algeria, Mali, Niger, Morocco, Kenya, Burkina Faso and Tanzania stand out as the leading livestock-producing countries. The share of livestock production in gross domestic product (GDP) varies widely, from 0.2% in Gabon to 53% in Chad and 63% in Eritrea. The livestock share of export earnings ranges from 0.03% in Benin to 24% in Burkina Faso. As meat and milk production is still insufficient to cover the needs of all these countries in spite of increased productivity, they resort to imports. Imports come mainly from bordering countries with surpluses (Sahel countries and southern Africa) and secondly from other continents.*

*From a health standpoint, even though cattle, sheep, goats and pigs are under official veterinary control in 25 of the 29 countries that participated in the survey, there is no epidemiological surveillance of brucellosis in more than half of the respondent countries. Nevertheless, bovine brucellosis attracts much more attention than brucellosis of other animal species. Prevalence in cattle ranges from 0.034% in Botswana to 30% in Niger. In small ruminants, it ranges from 0.1% to 12.5%. The prevalence of the infection in humans is reported by only a few countries and is negligible, except in one case.*

*Although national laboratories have the capacity to diagnose brucellosis, in many cases lack of funding prevents them from conducting systematic screening and implementing effective control measures. While most countries have legislation recognising brucellosis as a contagious disease of cattle, sheep, goats and pigs, very few notify cases to the OIE or apply certification measures.*

*For this reason, it is recommended to: strengthen capacity building of Veterinary Services in Africa for better detection of brucellosis, raise awareness of the need to notify cases of brucellosis to the OIE; to set up national joint committees for zoonosis control comprising both public health and animal health officials and to conduct an exhaustive study of the real economic and health importance of animal brucellosis in Africa.*

**Key words:** brucellosis – Africa – economy – public health

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## Introduction

Brucellosis is an infectious, contagious disease of numerous animal species as well as humans. It is caused by bacteria of the *Brucella* genus. Six species (*B. abortus*, *B. melitensis*, *B. suis*, *B. ovis*, *B. canis*, *B. neotomae*) containing several biotypes are responsible for the natural infection of a number of animal species, including cattle, small ruminants, pigs, rodents and carnivores, as well as humans and other mammals. Although brucellosis is a disease of worldwide distribution, recognition of its health and economic importance differs from country to country.

Although the public health importance of brucellosis is acknowledged throughout the world, the economic importance of animal brucellosis is felt most keenly by countries practising intensive livestock farming, as the disease not only causes production losses (from abortion, stillbirth, sterility, a longer calving interval and lower milk yields), it also constitutes a barrier to trade.

In Africa, large livestock is reared under a non-sedentary system (transhumance, nomadism), which makes it impossible to estimate the true importance of brucellosis. Previous studies on brucellosis in Africa have tended to focus mainly on the epidemiological, clinical and microbiological aspects of the disease [1, 2, 6]. The economic and health aspects did not attract much attention from researchers until recent years [9, 10, 11].

To gain a clearer picture of the economic and health importance of brucellosis, the World Organisation for Animal Health (OIE) therefore initiated this study of African countries by sending a questionnaire to each country. Of the 51 OIE Members in Africa, only 29 completed the questionnaire (as of 3 February 2009).

Below we present the results from analysing the questionnaire answers on the following aspects:

1. Livestock production data
2. Animal health management
3. Animal health legislation
4. Economic impact of brucellosis
5. Public health impact of brucellosis.

## 1. Livestock production data

### 1.1. Total number and growth rate of livestock populations

Over the past decade, livestock production has attracted renewed interest in a number of African countries, as evidenced in studies by Sidibé [8] and Renard [7] and data collected by the World Bank [3] and the Food and Agriculture Organization of the United Nations [5].

Table 1 (see appendix) shows the number and the growth rate of the various livestock populations by country.

#### Comments

The total number of cattle in the 28 countries of the 29 that replied to the questionnaire is 133 932 000. The size of each country's animal population varies widely, from 50 000 head in Gabon and Comoros, to 41 138 000 in Sudan. The growth rate is just as variable, ranging from 0.05% to 5.48%.

The total number of sheep and goats is 277 665 050 head, varying from 9 000 head in Comoros to more than 50 million head in Sudan. The countries with the largest number of small ruminants (more than 15 million head) are: Sudan, Algeria, Mali, Morocco, Kenya, Burkina Faso and Tanzania.

The total numbers of other species in the 28 countries are: 10 633 000 camelids, 6 968 000 equids, 9 047 500 pigs and 801 580 000 poultry. Sudan, Niger, Chad and Mauritania have fairly large camelid populations. Burkina Faso, Malawi and Tanzania are the only countries to have more than 1 million pigs.

Of all these species, only cattle, sheep, goats and pigs are susceptible to brucellosis.

## 1.2. Economic importance

The indicators that were taken into account and which figure in [Table 2](#) (see appendix) are the share of livestock production in: gross domestic product (GDP), export earnings, per capita income of the rural population and the national budget. The expression of the indicators is not uniform: comparisons are impossible in some cases because some countries gave them as percentages while others gave them as monetary values.

An analysis of the data shows that the share of livestock production in GDP varies widely, from 0.2% in Gabon to 63% in Eritrea and 53% in Chad. In 13 of the 29 countries, the livestock share of GDP is at least 10%. This testifies to the importance of livestock production in these countries' economies.

The share of livestock production in export earnings ranges from 0.03% in Benin to 24% in Burkina Faso. Countries such as Botswana, Morocco and Tanzania (all potential exporters) have expressed their livestock export earnings as monetary values, which prevents us from comparing them with those of other countries.

In most of the countries that replied to the questionnaire, a relatively small share of the national budget is devoted to livestock production and sanitary controls, except in Sudan and Eritrea, where the share is more than 20%.

## 1.3. Livestock development policy

As [Table 3](#) (see appendix) shows, in answer to the question of whether there is a national policy to support livestock production, 24 countries said yes, three said no and two did not answer.

Setting aside three series of contradictory answers in three countries, there are a total of 176 livestock development projects in 27 countries, half of which receive foreign support.

## 1.4. Livestock production and foreign trade

### 1.4.1. Exports

Of the 29 countries that replied to the questionnaire, 6 (Comoros, Gabon, Gambia, Guinea-Bissau, Sierra Leone and Togo) export neither live animals nor animal products, except for Gambia, which stated that it exports animal products. Exports from the remaining countries go mainly to neighbouring African countries. For instance, the Sahelian countries of West Africa (including Mauritania, Mali, Niger and Burkina Faso) export to coastal countries in the same zone, whereas Chad, Sudan, Botswana, Tanzania and South Africa export to central and eastern African countries.

A number of countries derive significant earnings from such exports, including Benin (25.9%), Burkina Faso (37.5%), Mauritania (30%) and Namibia (64%).

### 1.4.2. Imports

All the countries, with the exception of Guinea-Bissau, Mauritania, Niger and Chad, import live animals. Apart from African origins, livestock are also imported from the Americas (Brazil, Uruguay, USA), Europe (including France, Germany and the Netherlands) and Asia (India).

The values of annual imports in millions of euros are relatively high in the case of Morocco (25 million), Rwanda (8.5 million), Botswana (8.33 million) and Swaziland (5.55 million).

## 1.5. Livestock production system

The most commonly practised systems are sedentary, unrestricted grazing and transhumant livestock production and very few are of the nomadic type. Livestock is farmed mainly for meat production (27 countries) or mixed dairy/meat production (21 countries). Only Rwanda focuses chiefly on dairy production.

## **2. Animal health management**

### **2.1. Impact of brucellosis**

Brucellosis is a disease that has been known in Africa for a very long time, in both animals and humans, as evidenced by a study by *Akakpo et al.* [1]. It is a disease of chronic evolution, the importance of which is difficult to assess owing to the dominant livestock production systems of unrestricted grazing, transhumance and nomadism. However, official Veterinary Services are now starting to turn their attention to brucellosis, after controlling most of the major epizootics that formerly decimated livestock (including rinderpest and contagious pleuropneumonia) and in response to the intensification of dairy livestock production in many Sub-Saharan countries.

The data compiled from analysing the questionnaire reveal that cattle, sheep, goats and pigs are under official veterinary control in 25 of the 29 countries that participated in the survey. However, there is no epidemiological surveillance of brucellosis in more than half of the countries that replied to the questionnaire (15/29). Table 6 (see appendix) shows that there is much more brucellosis surveillance among cattle than among other animal species and humans. The average prevalence of bovine brucellosis in 21 countries varies from 0.034% in Botswana to 30% in Niger. There is much less data for sheep, goats, pigs and humans. In Guinea there are significant prevalence rates of 12.5% in small ruminants and 30% in humans. It would be useful to ascertain the type of exploration technique used.

### **2.2. Brucellosis diagnosis and control**

Many of the countries diagnose brucellosis using a combination of clinical observation and laboratory techniques. Table 7 (see appendix) shows that, apart from Rwanda and Gabon, all countries appear to have a laboratory capable of diagnosing brucellosis. Serology is the most commonly used laboratory technique (22/29 countries), although 18 countries use bacteriological and serological techniques. Only Kenya and Botswana use bacteriology, serology and allergology.

### **2.3. Brucellosis control method and certification of free herds**

As Table 7 shows, the control strategy most commonly used in 18 of the 29 countries is the isolation and slaughter of infected animals. Brucellosis vaccination is compulsory in only 8 of the 29 countries. Only five countries (Algeria, Eritrea, Kenya, Malawi and Morocco) apply certification rules.

The weaknesses of the surveillance system include: lack of systematic brucellosis screening and control in some countries; the difficulties faced by livestock producers in brucellosis surveillance; surveillance centred solely on imported animals; insufficient funding to control the disease and failure to assess the health and economic impact of brucellosis in many countries.

The strength of epidemiological surveillance in the countries is their huge potential for action, including: training technical personnel; conducting passive and active surveillance, especially when importing live animals; building the capacity of diagnostic laboratories; providing sanitary education and fostering cooperation between veterinarians and doctors for the purposes of brucellosis control.

Table 9 (see appendix) shows that, brucellosis treatment is authorised in only five countries, and vaccination in 15 countries, mainly in cattle and small ruminants but never in pigs. Most countries use live and inactivated vaccines.

### **2.4. Animal health legislation**

In all the countries that replied to the questionnaire, except for Gambia and Guinea-Bissau, brucellosis is a notifiable disease in cattle, small ruminants and pigs. All the countries also have food safety legislation, except for Gabon, Guinea-Bissau, Rwanda and the Democratic Republic of Congo.

## 2.5. Regional legislation and agreements

Most of the countries have concluded regional agreements on animal health, the movement of animals and environmental conservation. Such agreements exist in subregional organisations such as WAEMU and ECOWAS in West Africa, AMU in North Africa, CEMAC and CEBEVIRHA in Central Africa, and SADC, IGADD and COMESA in Eastern and Southern Africa<sup>2</sup>.

## 3. Economic impact of brucellosis

The various countries fail to recognise the economic importance of brucellosis. As [Table 11](#) (see appendix) shows, the most adverse effect of brucellosis on the livestock population seems to be abortion, followed by stillbirth, infertility and lower milk yields, and lastly a longer calving interval.

### Estimation of economic losses

Very few countries tackled this chapter on estimating economic losses, no doubt owing to lack of data on funding brucellosis control and on assessing direct economic losses and loss of earnings. Algeria, Gabon, Mauritania, Morocco, the Democratic Republic of Congo, Tanzania, Tunisia and Swaziland gave a few indications regarding the annual cost of brucellosis control. The countries receive public or private financing (livestock producers). Public financing amounts to 19 459.13 EUR in Swaziland, 20 890 EUR in Tanzania and 1 897 288 EUR in Algeria. In Swaziland, economic losses arising from abortion total 2 900 023 EUR, while milk losses are assessed at 1 272 210 EUR and export losses at 47 384 EUR. Tunisia and the Democratic Republic of Congo report economic losses from abortion, reduced agricultural manpower and lower milk yields, although they provide no financial evaluation of the losses.

Human cases are reported in 11 countries (Algeria, Eritrea, Guinea, Guinea-Bissau, Kenya, Morocco, Mauritania, Niger, Sudan, Tanzania and Tunisia), mainly as a result of consuming raw milk or infected soft cheese, or of contact with infected animals or the placenta or aborted foetus during *Brucella*-induced abortion. The people at risk are primarily livestock producers, as well as butchers and veterinarians. After noticing the infection, patients are often admitted to hospital and treated using antibiotics, or else they consult traditional medical practitioners, as in Guinea-Bissau, or forego all forms of treatment as it is too expensive. For instance, the cost of treating a patient ranges from 9 EUR in Tanzania to 200 euros in Morocco, and as much as 650 euros in Algeria.

## Conclusion

In Africa, livestock production is of unquestionable economic, social and cultural importance. After controlling the major epizootics that formerly decimated herds, attention has increasingly turned more to insidiously evolving livestock diseases, one of which is brucellosis. This disease is caused by several bacterial species of the *Brucella* genus (including *B. abortus*, *B. melitensis*, and *B. suis*). It is a major zoonosis.

Brucellosis is well known to all 29 countries that replied to the questionnaire. It is a disease that must be notified to the OIE. Unfortunately, it is a disease that is not monitored closely in the various countries, owing to:

- The non-sedentary livestock production system in many countries.
- Insufficient resources for thorough surveillance.
- Lack of intensified livestock production in countries with a pastoral tradition.
- Frequent confusion of brucellosis with other febrile diseases, such as malaria in humans.
- Other factors.

To improve surveillance results and gain a better understanding of the importance of brucellosis in Africa, it is recommended to: raise awareness of the existence of animal brucellosis and the obligation for countries to notify it to the OIE; create national zoonosis control committees that include both animal health and public health technicians and to conduct a study to better assess the economic and health importance of animal brucellosis in Africa.

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2 WAEMU: West Africa Economic and Monetary Union; ECOWAS: Economic Community of West African States; AMU: Arab Maghreb Union; CEMAC: Economic and Monetary Community of Central Africa; CEBEVIRHA: Economic Commission on Cattle, Meat and Fish Resources; SADC: Southern African Development Community; IGADD: InterGovernmental Authority on Drought and Development; COMESA: Common Market for Eastern and Southern Africa

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../Appendix

## Appendix I

Table 1.- Total number (thousands) and growth rate of livestock species by country

Country	Cattle		Sheep/Goats		Camelids		Equids		Pigs		Poultry	
	total number (thousands)	growth rate	total number (thousands)	growth rate	total number (thousands)	growth rate	total number (thousands)	growth rate	total number (thousands)	growth rate	total number (thousands)	growth rate
Algeria	1 608	3.6	23 371	13	287	14.8	44	4.76				
Benin	1 857	2.6	2 216	2.2					327	0.44	17 000	3.27
Botswana	2 500	0.1	1 575	0.1	0.3	0.5	500	2	4	1	3 226	0.1
Burkina Faso	7 914	2	18 838	3	16	2	37	1	2 042	2	34 329	3
Chad	7 000	2.5	8 000	2.5	1 334	3	400	2	100	5	24 000	
Comoros	50	4.6	9	7							195	3
Congo (Dem. Rep.)	900.47	25	4 783.45	25					961.09	25	19 828	6.25
Eritrea												
Gabon	50	1	222	2	0		20	1	80	2	3 500	0.5
Gambia	340	3.3	663	5	0	0	45	6	60	12	1 200	10
Ghana	1 417		8 000				3		271		40 311	
Guinea	3 756	5.48	2 564	6.7					75	4.94	15 865	6
Guinea-Bissau	631.47	3	700	3	0		0		43.762	4	583.23	7
Kenya	12 531		21 884.3		895.1		424		415.2		25 757	
Malawi	889	3	3 295	15	0.16	10	1.2	5	1 229	20	44 049	25
Mali	8 141	3	23 354	5	852	2.5	357	2	71.8		30 000	
Mauritania	1 677	1.4	12 765.2	5	1 174	0.7						
Morocco	2 781.1	0.85	22 267.8	0.37	180		1 655.1	0.38			296 100	7.78
Namibia	2 384	2	4 722	2	0		206	1	52	1	924	-4
Niger	8 737		23 832		1 630		1 804		100		12 196	
Rwanda	1 195	2.6	3 238	2.6	0.005				586.62	2.6	2 217.7	2.4
Senegal	3 136.5	0.05	9 259.5	0.09	4.105	0.03	517.61	0.04	317.6	0.09	22 078	0.09
Sierra Leone	400	0.5	450	1.3	0	0	0	0	17	2	3 000	5
Sudan	41 138	0.4	50 651	0.5	4 238	3.9	754	0.9	0	0	40 624	7.6
Swaziland	640	7	500	37	0.01	67	12	0.5	40	33	1 500	-20
Tanzania	18 800		17 100						1 400		53 000	
Togo	307.3	3	3 507.8						316.4		10 836	
Tunisia	694	1.26	8 797	1.23	23		187				28 069	
Zambia	2 457	3.9	1 100	0.8			1.1	0.1	538	30	71 192	57
<b>Total</b>	<b>133 932</b>		<b>277 665.05</b>		<b>10 633</b>		<b>6 968</b>		<b>9 047.5</b>		<b>801 580</b>	

Table 2. – Share of livestock production in economic indicators

Country	Share of livestock production		
	in GDP (%)	in export earnings	in per capita revenue of the rural population
Algeria	3.11	1.82	nd
Benin	6	0.03%	nd
Botswana	1.36	77	150
Burkina Faso	12	24%	nd
Chad	53		12
Comoros			30
Congo (Dem. Rep.)			551.5
Eritrea	63	3.8	
Gabon	0.2	0%	10
Gambia	6		10-50%
Ghana	7		
Guinea	3.4		309
Guinea-Bissau	17		
Kenya	12		40%
Malawi	11	1%	45%
Mali	12	20%	217
Mauritania	17.5		
Morocco	25.3	942.64	
Namibia	6.5	6%	28%
Niger	13	20%	10
Rwanda	6		
Senegal	7.5	11	
Sierra Leone	2.7		24%
Sudan	23	20%	
Swaziland	1	18%	1.2%
Tanzania	4.7	18.41	1.7
Togo	3		
Tunisia	36		
Zambia	35	2%	50.3

nd: not determined

Table 3. – Development policy and livestock projects

Country	Existence of a national livestock support policy	Number of development projects	Number of foreign-financed development projects
Algeria	yes	5	0
Benin	yes	2	0
Botswana	yes	3	0
Burkina Faso	yes	7	7
Chad	yes	11	9
Comoros	no	2	2
Congo (Dem. Rep.)	no	30	30
Eritrea	yes	3	2
Gabon	yes	1	1
Gambia	yes	1	1
Ghana	yes	5	1
Guinea	yes	2	2
Guinea-Bissau	no	0	0
Kenya	yes	8	6
Malawi	yes	13	9
Mali	yes	10	7
Mauritania	yes	2	2
Morocco	yes	8	4
Namibia	yes	3	1
Niger		10	9
Rwanda		7	7
Senegal	yes	14	2
Sierra Leone	yes	0	0
Sudan	yes	15	5
Swaziland	yes	3	0
Tanzania	yes	4	4
Togo	yes	2	2
Tunisia	yes	2	2
Zambia	yes	3	3

Table 4.– Exports of live animals and animal products

Country	Exports of live animals	Exports of animal products	Continent of export			
			Africa	Europe	Middle East	Others
Algeria	yes	yes	yes	yes	yes	
Benin	yes	yes	yes	yes		
Botswana	no	yes	yes	yes	yes	yes
Burkina Faso	yes	yes	yes	yes	no	no
Chad	yes	yes	yes	no	no	no
Comoros	no	no				
Congo (Dem. Rep.)	yes	yes	yes			
Eritrea	yes				yes	
Gabon	no	no				
Gambia	no	yes	yes	yes		
Ghana	yes	no	yes	no	no	no
Guinea	yes	yes	yes			
Guinea-Bissau	no	no				
Kenya	yes	yes	yes	no	yes	yes
Malawi	yes	yes	yes	yes		yes
Mali	yes	yes	yes	no	no	no
Mauritania	yes	yes	yes	yes		yes
Morocco	yes	yes	yes	yes	yes	yes
Namibia	yes	yes	yes	yes	no	
Niger	yes	yes	yes	yes		
Rwanda	yes	yes	yes	yes		
Senegal		yes		yes		yes
Sierra Leone	no					
Sudan	yes	yes	yes	yes	yes	yes
Swaziland	yes	yes	yes	yes		yes
Tanzania	yes	yes	yes	no	yes	yes
Togo	no	no				
Tunisia	yes	yes	yes	yes	yes	
Zambia	yes	yes	yes	yes	yes	yes

Table 5.– Livestock imports and their annual value

Country	Imports of live animals	Annual value of imports (millions of euros)	Origin of livestock
Algeria	yes	2,3	France, Germany, Austria, Netherlands
Benin	yes	1,52	Niger, Mali, Burkina Faso
Botswana	yes	8,33	South Africa, Namibia
Burkina Faso	yes	7,16	Niger, Nigeria, Brazil
Chad	no		
Comoros	yes	0,4	Tanzania, Madagascar
Congo (Dem. Rep.)	yes		Uganda, Tanzania, Zambia, Zimbabwe, South Africa
Eritrea	yes	0,5	European Union
Gabon	yes	8	Cameroon, Mali
Gambia	yes		Senegal, Mali, Usa, European Union, Brazil, India
Ghana	yes		European Union, Usa, Mali, Burkina Faso, Niger
Guinea	yes		Mali
Guinea-Bissau	no		
Kenya	yes		South Africa, France, Netherlands, Zimbabwe, Usa
Malawi	yes	0,5	South Africa, Tanzania, Zimbabwe
Mali	yes		France, Brazil, Niger, Mauritania, Senegal
Mauritania	no		
Morocco	yes	25	France, Germany, Netherlands
Namibia	yes	0,65	South Africa
Niger	no		
Rwanda	yes	8,5	
Senegal	yes		Mali, Mauritania, France, Brazil
Sierra Leone	yes		Guinea
Sudan	yes		Netherlands, Australia, Cyprus, France, Jordan, Belgium
Swaziland	yes	5,55	South Africa
Tanzania	yes		South Africa, New Zealand, Kenya, Zimbabwe, Germany, Netherlands, Ireland, Denmark
Togo	yes		Sahel Countries
Tunisia	yes		Uruguay, France, Germany, Netherlands, Austria
Zambia	yes		United Kingdom, Netherlands, South Africa

Table 6.– Official veterinary control, surveillance and prevalence of animal brucellosis by country

Country	Official control	Surveillance programme	Prevalence (%)			
			Cattle	Sheep/Goats	Pigs	Humans
Algeria	yes	yes	0.7	6		0.024
Benin	yes	yes	10	2		
Botswana	yes	yes	0.034	0	0.1	0
Burkina Faso	yes	no				
Chad	yes	no	7			4
Comoros	no	no				
Congo (Dem. Rep.)	no	no	5			
Eritrea	yes	yes	10	0		
Gabon	yes	yes	0	0	0	0
Gambia	yes	no	2			
Ghana	yes	no	9			
Guinea	yes	yes	9	12.5		30
Guinea-Bissau	yes	no				
Kenya	yes	no	0.9	1	0.9	
Malawi	yes	no				
Mali	yes	no	22			
Mauritania	yes	yes	1			
Morocco	yes	yes	7	0.1		1.5
Namibia	yes	yes	<0.5	<0.5		
Niger	yes	no	30	2		
Rwanda			1.7			
Senegal	yes	no	20			
Sierra Leone	yes	no				
Sudan	yes	no				
Swaziland	yes	yes	4	0.2	0	
Tanzania	yes	yes	5.8			
Togo	yes	yes				
Tunisia	yes	yes	3.5	7.5		0
Zambia	non	non	2.5	4.7		

Table 8.– Brucellosis control and certification of free herds by country

Country	Control method				Certification
	Compulsory vaccination	Isolation and slaughter of infected animals	Other methods	Details of other methods	
Algeria	yes	yes			yes
Benin		yes			no
Botswana	yes				no
Burkina Faso		yes			no
Chad		yes			no
Comoros			yes		no
Congo (Dem. Rep.)	yes	yes			no
Eritrea	yes	yes			yes
Gabon	yes				no
Gambia					no
Ghana		yes			no
Guinea		yes			no
Guinea-Bissau					no
Kenya	no	yes	yes		yes
Malawi		yes			yes
Mali		yes			no
Mauritania		yes			no
Morocco		yes	yes	vaccination may be authorised	yes
Namibia	yes	yes			no
Niger		yes			no
Rwanda		yes			no
Senegal					no
Sierra Leone	no	no			no
Sudan			yes		no
Swaziland	yes				no
Tanzania		yes	yes	slaughter of infected animals	no
Togo		yes			no
Tunisia	yes				
Zambia			yes		no

Table 7.- Brucellosis diagnostic method and techniques and laboratory diagnostic capacity by country

Country	Brucellosis diagnosis			Laboratory diagnostic capacity	Laboratory technique				
	Clinical signs	Laboratory analysis	Clinical signs and laboratory analysis		Bacteriology	Serology	Allergology	Bacteriology and serology	Other techniques
Algeria		yes		yes				yes	
Benin	yes	yes	yes	yes	yes			yes	
Botswana		yes	yes	yes				yes	yes
Burkina Faso	yes	yes	yes	yes				yes	
Chad	yes	yes	yes	yes			yes		
Comoros	yes			yes			yes		
Congo (Dem. Rep.)	yes	yes	yes	yes	yes			yes	
Eritrea			yes	yes	yes			yes	
Gabon			yes	yes	no				
Gambia	yes		yes	yes	yes			yes	
Ghana	yes	yes	yes	yes	yes			yes	
Guinea			yes	yes	yes			yes	
Guinea-Bissau	yes		yes	yes	yes			yes	
Kenya	no	yes	yes	yes	yes		no	yes	yes
Malawi			yes	yes	yes			yes	
Mali		yes	yes	yes	yes			yes	
Mauritania			yes	yes	yes			yes	
Morocco		yes	yes	yes	yes			yes	
Namibia	yes	yes	yes	yes	yes			yes	
Niger	yes	yes	yes	yes	yes			yes	
Rwanda	yes	yes	yes	yes	yes			yes	
Senegal	yes	yes	yes	yes	yes			yes	
Sierra Leone			yes	yes	yes			yes	
Sudan			yes	yes	yes			yes	
Swaziland		yes		yes	yes			yes	
Tanzania		yes	yes	yes	yes			yes	
Togo				yes	yes			yes	
Tunisia	yes	yes		yes	yes			yes	
Zambia			yes	yes	yes			yes	

Table 9. – Authorised brucellosis treatments and vaccines, by animal species and country

Country	Treatment		Vaccinations		Animal species vaccinated				Vaccine type	
	Authorised	Frequently practised	Authorised	Frequently practised	Cattle	Sheep/Goats	Pigs	Live	Inactivated	
Algeria	no	no	yes			yes		yes		
Benin										
Botswana	no	no	yes	yes	yes			yes		
Burkina Faso	no	no	no	no	no	no	no	no	no	
Chad	yes	yes	no	no	no	no	no	no	no	
Comoros	yes	no	no	no				no	no	
Congo (Dem. Rep.)	yes	yes	yes	yes	yes			no	no	
Eritrea	no	no	yes	yes	yes	yes		yes	yes	
Gabon	no	no	yes	yes	yes			yes	yes	
Gambia	no	no	no	no						
Ghana	no	yes	no	no	yes			yes		
Guinea	no		no							
Guinea-Bissau		no		no	no	no	no	no	no	
Kenya	yes	no	yes	yes	yes	no	no	yes	no	
Malawi	no	no	no	no						
Mali	no	no	no	no				no	no	
Mauritania	no	no	yes	no						
Morocco	no	no	yes	no	yes	yes		yes		
Namibia	no	no	yes	yes	yes	yes			yes	
Niger	no	no								
Rwanda	no	yes								
Senegal										
Sierra Leone	yes	no	yes	no						
Sudan	no	no	yes	yes	yes			yes		
Swaziland	no	no	yes	yes	yes			yes		
Tanzania	no	no	yes	yes	yes			yes	yes	
Togo	no		no							
Tunisia	no		yes		yes	yes		yes		
Zambia	no	yes	yes	yes	yes			yes	yes	

Table 10.– Brucellosis legislation and implementation in certain countries

Country	Notifiable disease	Notifiable species					Legislation on food safety
		Cattle	Sheep/goats	Pigs	Humans	Other	
Algeria	yes	yes	yes		yes	yes	yes
Benin	yes	yes	yes	yes			yes
Botswana	yes	yes	yes	yes			yes
Burkina Faso	yes	yes	yes	yes	yes	yes	yes
Chad	yes	yes	yes				yes
Comoros	yes	yes	yes				yes
Congo (Dem. Rep.)	yes	yes	yes	yes	yes		no
Eritrea	yes	yes	yes	yes	yes		yes
Gabon	yes	yes	yes	yes	yes		no
Gambia	no						yes
Ghana	yes	yes					yes
Guinea	yes	yes	yes				yes
Guinea-Bissau	no						no
Kenya	yes	yes	yes	yes	no		yes
Malawi	yes	yes	yes	yes			yes
Mali	yes	yes	yes	yes			yes
Mauritania	yes	yes	yes				yes
Morocco	yes	yes	yes				yes
Namibia	yes	yes	yes	yes			yes
Niger	yes	yes	yes	yes	yes		yes
Rwanda	yes	yes	no	no	no		
Senegal	yes	yes	yes	yes			yes
Sierra Leone	yes	yes	yes				yes
Sudan	yes	yes	yes	no	yes		yes
Swaziland	yes	yes	yes	yes	yes		yes
Tanzania	yes	yes	yes	yes			yes
Togo	yes	yes	yes	yes	yes	yes	yes
Tunisia	yes	yes	yes		yes		yes
Zambia	yes	yes					yes

Table 11.– Principal effects of brucellosis on the livestock population by country (classed in decreasing order of importance)

Country	Abortion	Stillbirth	Longer calving interval	Lower milk yields	Infertility	Other effects
Algeria	3	4	2	1	5	slaughter, restocking
Benin	1	2	4		3	
Botswana	1	2	3	4		
Burkina Faso	1	2		4	3	
Chad	1	4		2	3	
Comoros						
Congo (Dem. Rep.)	1	2	3	4		
Eritrea			2	3	1	
Gabon	1	2	4		3	
Gambia	1	2	4	5	3	
Ghana	3	4	1	5	2	
Guinea	1	3	4		2	
Guinea-Bissau	1		4	3	2	
Kenya	1		3	4	2	
Malawi						
Mali	1	2			3	
Mauritania	1	2		3		
Morocco	1	2	3	4	5	
Namibia	3		1	4	2	slaughter
Niger	1	2	4		3	
Rwanda	1	4	2	3	5	
Senegal						
Sierra Leone						
Sudan	3	5	1	4	2	
Swaziland	1	2	4	5	3	
Tanzania	3	5	1	4	2	source of infection, hindered trade
Togo	1	2			3	
Tunisia	1	3		2	4	
Zambia	1			3	2	

Table 12.– Economic evaluation in certain countries

Country	Type of financing	Estimated direct economic losses	Estimated loss of earnings
Algeria	Public: 1 897 288 EUR	0	0
Congo (Dem. Rep.)	Livestock producers	Abortion Lower milk yields	0
Gabon	Livestock producers	Abortion	Zootechnical performance
Mauritania	0	Abortion Lower milk yields	Zootechnical performance
Morocco	Public	0	0
Swaziland	19 459.13 EUR	Abortion: 2 900 023 EUR Milk losses: 1 272 210 EUR Export losses: 47 384 EUR	0
Tanzania	20 890 EUR	0	0
Tunisia	Public	Abortion Reduced agricultural manpower Lower milk yields	Genetic improvement Zootechnical performance

Table 13.– Human brucellosis in the past five years in certain countries

Country	Human cases	Source of contamination	Types of people infected				Measures taken
			Butchers	Producers	Veterinarians	Other humans	
Algeria	yes	raw goats' milk and by-products, fresh cheese		yes	yes		hospital treatment, antibiotics
Benin	no						
Botswana	no						
Burkina Faso							
Chad							
Comoros	no					yes	no measures
Congo (Dem. Rep.)	no	contact with infected animals, raw milk					
Eritrea	yes			yes			
Gabon	no						
Gambia	no						
Ghana		fresh milk, meat					less well-known disease
Guinea	yes	raw milk	yes	yes			traditional treatment, rarely in hospital
Guinea-Bissau	yes	milk		yes			
Kenya	yes					yes	
Malawi	no						
Mali	unknown	contact with infected animals, consumption of raw milk					laboratory confirmation, free treatment, antibiotic treatment with doxycycline
Mauritania	yes		yes	yes	yes	yes	antibiotics
Morocco	yes			yes	yes	yes	
Namibia	no	milk					
Niger	yes			yes			
Rwanda							
Senegal							
Sierra Leone	no						
Sudan	yes	milk, direct contact with placenta/aborted foetus	yes	yes	yes	yes	antibiotic treatment with doxycycline, rifampicine
Swaziland	no						
Tanzania	yes	milk, meat		yes		State farm official	antibiotic treatment with doxycycline, vitamin b
Togo	no						
Tunisia	yes	raw milk and by-products, direct contact	yes	yes	yes	yes	must be notified, investigation of sick patients, confirmation, prevention centred on milk hygiene
Zambia							