FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
REGIONAL OFFICE FOR THE NEAR EAST
(RNE)

PRELIMINARY DATA ON VETERINARY VACCINE PRODUCTION / NEEDS IN SOME COUNTRIES OF THE NEAR EAST

2000

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1.INTRODUCTION:

Animal production is an important economic resource for all countries of the Near East Region. The total numbers of food animals raised in the region (Table 1) are about:

100 million cattle,
23 million buffaloes,
13 million camels,
233 million sheep,
132 million goats,
0.5 million pigs,
1039 million chicken and
53 million other poultry species,

in addition to about:

1.5 million horses and
13 million donkeys and mules

Enzootic diseases continue to be the leading cause of economic losses and are the main constraint for improving the productivity of native animals. Many of these diseases are still far from being in terminal decline in several countries of the region. Most of these diseases could be controlled, eliminated and/or eradicated by applying carefully designed immunization programs. Adequate funds are required to provide such campaigns with the appropriate safe and potent vaccines and to cover the relevant costs (salaries, training, transport, storage and cooling equipment, evaluating the efficacy of vaccination by clinical and laboratory methods, etc.). Therefore, in order to design realistic policy for improving the control of enzootic diseases in the Near East, information should be firstly collected on the present status of veterinary vaccine production, importation and the actual vaccine needs by different countries of the region.

The objective of the present study is to collect through the National Veterinary Authorities of all countries in the region information on:

1) The availability of a veterinary vaccine producing laboratories.
2) The types and quantities of the annually produced veterinary vaccines.
3) Future plans to expand and/or improve veterinary vaccine production.
4) The responsible authority applying quality control of the locally produced veterinary vaccines.
5) The types and quantities of veterinary vaccines consumed annually by the country and to identify whether these vaccines are locally produced or imported.
6) The types of veterinary vaccines, which are still needed for the control of prevalent diseases against which no immunoprophylactic control programs are so far applied.

For this purpose, a questionnaire was prepared and officially submitted through the Regional Animal Production and Health Officer to the concerned Veterinary Authorities of each individual country of the region. The questionnaire was designed in a very simple manner in order to facilitate its completion by the national authorities of each country.

This manual will be updated every biennium.

2. COUNTRIES TO WHICH THE QUESTIONNAIRE WAS SUBMITTED:

The questionnaire was submitted by electronic mail, fax or air-mail to UNDP, FAO Representatives or the concerned veterinary authorities of the following countries:

- Algeria
- Bahrain.
- Cyprus.
- Djibouti.
- Iran.
- Iraq.
- Jordan.
- Kuwait.
- Lebanon.
- Libya.
- Mauritania.
- Morocco.
- Oman.
- Pakistan.
- Palestine.
- Qatar.
- Saudi Arabia.
- Somalia.
- Sudan.
- Syria.
- Tunis.
- Turkey.
- UAE.
- Yemen.

In addition, relevant data was directly collected from the concerned Egyptian veterinary authorities.

3. COUNTRIES WHICH RESPONDED TO THE QUESTIONNAIRE:

Despite the submission of several reminders to the concerned authorities to which the questionnaire was submitted, over a period of about 10 months, out of the 24 countries which received the questionnaire, only the following 12 countries responded positively:

- Egypt
- Iraq.
- Jordan.
- Lebanon.
- Morocco.
- Oman
- Pakistan.
- Qatar
- Saudi Arabia.
- Syria.
- Tunis.
- Turkey.
- UAE.

Out of these countries: Iraq, Jordan, Morocco, Pakistan, Saudi Arabia, Syria, Tunis and Turkey have national laboratories for veterinary vaccine production.

After analyzing the data received from the above countries, its comparative demonstration in tables 3 to 11 was presented in the Biological Products of the 21st Century: Future of Serum and Vaccine Industry Congress, which was held in Cairo, 23-26 May 1999. Iran and Sudan submitted their relevant completed questionnaire later. Accordingly, the data received from these two countries were analyzed separately and demonstrated as addendum in this report.

4. INTERPRETATION OF THE OBTAINED DATA:

The data received from some countries, as a response to the questionnaires was not complete. Despite this fact, the obtained data was carefully analyzed, compared with relevant data submitted by other countries of the region and summarized in this part of the report:

4.1. EGYPT:

Upon the approval of the concerned Egyptian authorities for the official FAO request, relevant data was directly collected from the **Veterinary Serum and Vaccine Research Institute** and the **General Organization of Veterinary Services**.

4.1.1. Historical Background of Local Vaccine Production:

Production of veterinary biologics in Egypt started in 1903 for rinderpest control by simultaneous use of virulent virus and antiserum. The producing laboratory was established in Abbassia, Cairo and was belonging to the Ministry of Health. In 1914, it was attached to the Veterinary Medicine Department of the Ministry of Agriculture. Production of veterinary vaccines (e.g. Hemorrhagic septicemia, fowl plague and fowl pox) and allergic diagnostic reagents (e.g mallein) started in 1928. Thereafter, rinderpest African horsesickness vaccines were produced in 1934 and 1944, respectively. This was followed by progressive development of the laboratory and establishment of several new buildings for production of bacterial and more viral vaccines as well as applying more advanced technology for improving vaccine production. Starting in 1962, long-term successive projects launched in cooperation with FAO were initiated to produce in cell cultures rinderpest, FMD, African horsesickness, bluetongue and sheeppox vaccines. In addition, bilateral projects with the United States were also launched in 1978 and continued for about 2 decades to produce Rift Valley vaccine and to modernize the applied methodology in the different units of the Serum and Vaccine Laboratories.

In 1982, the Veterinary Serum and Vaccine Laboratories became independent as one of the Research Institutes belonging to the Agriculture Research Center, Ministry of Agriculture. It is now designated: **The Veterinary Serum and Vaccine Research Institute.** More than 150 post-graduated scientific staff, 160 veterinarians and 550 helping personnel (engineers, assistant engineers, technicians, administrators, permanent and temporary workers, etc) are working in this Institute.

In 1996, the Quality Control Department of the Veterinary Serum and Vaccine Research Institute was upgraded as an independent **Central Laboratory for Evaluation of Veterinary Biologics**, which is also attached to the Agriculture Research Center. For this purpose, a modern well-equipped building was established and additional staff was recruited. About 40 scientific staff and veterinarians as well as about 60 helping personnel are working in this Central Laboratory.

4.1.2. Structural Organization:

The Institute is managed by Prof. Ahmad Dawood, the Director General and three Deputy Directors responsible for: (1) Virological Vaccines, (2) Bacteriological and Parasitic Vaccines and (3) Research, Studies and Projects, respectively.

4.1.2.1. The Virological Vaccines Sector include 8 Research Departments :

- Pox Vaccines Research Department.
- Rinderpest Research Department.
- Rift Valley Fever Research Department.
- Foot-and-Mouth Disease Vaccine Research Department.
- Pet Animal Research Department.
- African Horsesickness Vaccine Research Department.
- Newcastle Research Department.
- Bovine Respiratory Diseases Vaccine Research Department.

4.1.2.2. The Bacteriological and Parasitic Vaccine Sector include 5 Research Departments:

- Anaerobic Vaccines Research Department.
- Aerobic Vaccines Research Department.
- Bacterial Sera and Antigens Research Department.
- Bacterial Diagnostic Products Research Department.
- Parasitic Vaccines Research Department.

4.1.3. Local Production of Vaccines and Biological Products :

Each of the above Research Departments is divided to two units: (1) Research Unit; and (2) Production Unit. In addition, a special farm for production of SPF embryonated chicken eggs is established in an isolated area in Koum Oshim (about 80 km south-west to Cairo) to provide the Institute's requirement of egg embryos needed for vaccine production and research. The average annual amounts of the produced vaccines and biological products include:

I. Viral Vaccines :

For Poultry:

1)	Newcastle (HB1)	46 million
2)	Newcastle (Komorov)	80 million doses
3)	Newcastle (F strain)	52 million doses
4)	Newcastle (LaSota)	23 million doses
5)	Newcastle (Inactivated)	4 million doses
6)	Gumboro	15 million doses
7)	Infectious bronchitis	2 million doses
8)	Fowl pox	3 million doses
9)	Pigeon pox	5 million doses
10)	Pigeon paramyxo	
11)	Reo	0.4 million doses
12)	Duck plague	0.4 million doses

For Livestock:

1)	FMD	12 million doses (serotype 0)
2)	Rift Valley Fever (live)	3.5 million doses
3)	Rift Valley Fever (inactivated)	4.5 million doses

	For Cattle:	
1)	Rinderpest	Egypt is declared provisionally free from rinderpest; therefore production is limited to keep a strategic stock only.
2)	Lumpy Skin Disease	Experimental batches
3)	Bovine Respiratory Disease Complex (inactivated: IBR, BVD and PI-3)	6,000 doses
	For Sheep and Goats:	
1)	Sheep and Goat Pox	6 million doses
2)	PPR (using a homologous local strain as a seed virus)	Experimental batches
	For Accompanying Pet Animals:	
1)	Rabies (live)	5 thousand doses
2)	Rabies (inactivated)	5 thousand doses
3)	Distemper.	500 doses
4)	Canine parvovirus	
	For Equines:	
1)	African Horsesickness (9 serotypes or monovalent)	Strategic stock
II.	**Bacterial Vaccines:**	
	For Poultry:	
1)	Fowl cholera (4 strains)	13 million doses
2)	Avian coryza	6 million doses
3)	Rabbit hemorrhagic septicemia	300 thousand doses
4)	Spirochetosis	500 thousand doses
	For Cattle:	
1)	Hemorrhagic septicemia (oil adjuvant)	7 million doses
2)	B.C.G.	0.25 million doses
	For Sheep (and Goats):	
1)	Hemorrhagic septicemia (oil adjuvant)	20 thousand doses
2)	Lamb dysentery and pulpy kidney	500 thousand doses
3)	Black disease	10 thousand doses
4)	Black leg and gas gangrene	800 thousand doses
III.	**Antisera :**	
1)	Antitetatanic	8 Liters

IV. Diagnostic Reagents :

1) Rift Valley Fever cellular antigen
2) Brucella Rose Bengal antigen
3) Brucella balanced acidic antigen.
4) Brucella stained milk ring antigen
5) Brucella Rivanol antigen.
6) Paratyphoid antigen.
7) Polyvalent stained pullorum antigen.
8) Avian tuberculin.
9) Bovine tuberculin.
10) Different relevant diluents.

4.1.4. Imported Vaccines:

The average annual types and amounts of imported veterinary vaccines are:

For Poultry:

1)	Newcastle: Hitschner B1	672 million doses
	LaSota	787 million doses
	Other types	794 million doses
2)	Gumboro	786 million doses
3)	Infectious bronchitis	85 million doses
4)	Marek	66 million doses
5)	Fowl pox	40 million doses
6)	Infectious laryngotracheitis	22 million doses
7)	Avian encephalomyeilitis	8 million doses
8)	Reo	8 million doses
9)	Duck plague	0.75 million doses
10)	Mycoplasma	2.7 million doses
11)	Avian coryza	16 million doses
12)	Fowl cholera	3 million doses
13)	Coccidiosis	2.3 million doses

For comparison, the types and quantities of both locally produced and imported poultry vaccines are listed in Table 2. Egypt is importing about 93 % of its needs of poultry vaccines.

For Livestock:

1)	Covaccine (Anaerobic)	526 thousand doses
2)	Quadrivalent BRD vaccine	101 thousand doses
3)	Rota and Corona	500 thousand doses
4)	Brucella	8 thousand doses

For Dogs and Cats

1)	Rabies	11 thousand doses
2)	Polyvalent canine	2.5 thousand doses
3)	Trivalent feline	20 doses

4.1.5. Quality Control of Locally Produced and Imported Vaccines and Biological Products:

A **Central Laboratory for Evaluation of Veterinary Biologics (CLEVEB)** was recently established and became responsible for the quality control of both locally produced and imported veterinary vaccines and biological products. This Central Laboratory is administratively and technically separated from the Veterinary Serum and Vaccine Institute. It includes 9 Research Departments:

- Quality Control Research Department for Poultry Viral Vaccines.
- Quality Control Research Department for Poultry Bacterial Vaccines.
- Quality Control Research Department for Large Animal Viral Vaccines.
- Quality Control Research Department for Large Animal Bacterial Vaccines.
- Clinical Pathology Research Department.
- Quality Control Research Department for Anti-parasitic Vaccines.
- Department for Monitoring Specific Pathogens.
- Sterility Research Department.
- Molecular Biology Research Department.

In addition, the Laboratory has a **National Reference Bank for Bacterial and Viral Strians as well as Cell Lines.**

4.1.6. Future Plans:

At present, the Veterinary Serum and Vaccine Institute has many ambitious plans to upgrade the quality of the produced vaccines by applying all the requirements of Good Manufacturing Practice (GMP). For this purpose, several modern buildings are established and the old buildings are remodeled. Most of the scientific staff members of the Institute are send abroad to internationally recognized relevant Institutes for training on advanced technology. Investigations are going on to produce vaccines which were not previously produced in the Institute: (e.g. homologous PPR, Lumpy Skin Disease, Camelpox, Brucella, etc). In addition, plans for production of more types of poultry, anaerobic, equine, canine and feline vaccines are in the pipeline. Furthermore, quantitative increase of the presently produced vaccines are also considered.

The recent establishment of the Central Laboratory for the Evaluation of Veterinary Biologics will also help in assuring the safety and potency of both locally produced and imported vaccines.

4.2. IRAQ:

According to the data provided by Dr. Fadhel Abbas Jassim, Chief of Veterinary Services, the questionnaire was completed by Dr. Majid Hassan Mahmood, Head of the National Project for Control of Brucellosis and Tuberculosis, Abu Gharib, Baghdad. In this project (which started in 1995), 3 scientific staff members and 7 helping personnel are working. Accordingly, under part I of the questionnaire (which is dealing with local veterinary vaccine production), only production of pilot batches of Brucella vaccines were listed. However, under part II of the questionnaire (which is dealing with routinely applied immunoprophylactic programs), it was indicated that many of the used vaccines are locally produced. Most probably, these vaccines are produced in the well-known governmental Veterinary Vaccine Institute, Abu Gharib, Baghdad.

Therefore, it was concluded that **the locally produced vaccines** (as shown from part II of the questionnaire) might include:

III.	**Viral vaccines:**		
1)	Newcastle	22,693,993	doses used annually
2)	Gumboro	11,032,891	doses used annually
3)	Fowlpox	3,102,424	doses used annually
4)	Infectious bronchitis	226,315	doses used annually
5)	Rinderpest	1,336,727	doses used annually
6)	Sheeppox	6,061,871	doses used annually

IV.	**Bacterial vaccines:**		
1)	Hemorrhagic septicemia (for cattle)	379,579	doses used annually
2)	Blackquarter (for cattle)	322,285	doses used annually
3)	Anthrax (for sheep)	230,062	doses used annually
4)	Enterotoxemia (for sheep)	2,649,958	doses used annually
			(partially imported)
5)	Brucella (strain 19) - pilot batch	10,000	doses
6)	Brucella (rev-1) - pilot batch	20,000	doses

It was indicated that the quality control of the pilot batches of the two brucella vaccines is carried out by the vaccine producers themselves.

On the other hand, **the imported vaccines** include:

1)	FMD	98,181 doses used annually
2)	Enterotoxemia	partially imported without indicating the quantity
3)	Rabies	1,121 doses used annually

Although it was not mentioned in the questionnaire that Iraq is planning to produce more vaccines within the next 5 years, it was indicated that the country is in bad need for the following vaccines:

1)	Egg drop syndrome	2 million doses annually
2)	Marek's disease	2 million doses annually
3)	IBR	30 thousand doses annually
4)	Contagious pustular dermatitis	500 thousand doses annually
5)	E. coli + rotavirus + coronavirus	40 thousand doses annually

6)	Salmonellosis (?)	1 million doses annually
7)	Avian collibacillosis	1 million doses annually
8)	Mastitis (?)	30 thousand doses annually

COMMENTS

- The numbers of personnel producing vaccines other than Brucella vaccines in Abu Gharib laboratory are not given.
- It seems that the quantities of used vaccines are very low in relation to the numbers of animals in Iraq.
- Some animal species are not included in the national vaccination campaigns (e.g. sheep are not vaccinated against FMD).
- The serotypes of FMD virus incorporated in the imported vaccine are not given.
- The specificity of some required vaccines are not described (e.g. vaccines against mastitis and salmonellosis).
- The country is still vaccinating against rinderpest.

After preparing this report, it was indicated that the governmental Veterinary Vaccine Institute, Abu Gharib, Baghdad is now semi-privatized as: “Kindy Veterinary Vaccine Company”. A small part of this Institute is still under complete governmental management, in which Brucella vaccines are produced.

4.3. JORDAN:

The data was provided by Dr. Assad R. Abu Al-Ragheb, Chief of Veterinary Services. In 1988, the "Jordan Bio-Industries Center" was established in Amman. Nine years later, (in 1997) it was privatized and its name changed to the commercial "Jordanian Vaccine Company (JOVAC)" No data was given on the numbers of working personnel. The working staff includes 14 scientific personnel and 33 helping personnel.

4.3.1. This Center is annually producing the following vaccines:

I.	**Viral vaccines:**	
	For Poultry:	
1)	Newcastle (B1)	100 million doses
2)	Newcastle (Lasota)	100 million doses
3)	Newcastle (clone)	100 million doses
4)	Gumboro -D78 (cell culture)	100 million doses
5)	Fowlpox	50 million doses
6)	Infectious bronchitis – 120	100 million doses
7)	Infectious bronchitis -52	50 million doses
	For Cattle:	
	Rinderpest	2 million doses
	For Sheep and Goats:	
	1) Sheep pox (cell culture)	4 million doses
	2) Goat pox (cell culture)	1 million doses
	3) Sheep and goat pox (cell culture)	1 million doses
	4) Peste des petits ruminants (cell culture)	2 million doses
II.	**Bacterial Vaccines:**	
1)	Brucella: rev-1 (reduced doses)	5 million doses
2)	Brucella: rev-1 (full doses)	1 million doses
3)	Brucella: strain 19	100 thousand doses
4)	Anthrax	500 thousand doses
III.	**Diagnostic antisera against** :	
1)	Newcastle virus.	
2)	Brucella strains.	
3)	Sheeppox virus.	
4)	Goat pox virus.	
5)	PPR virus.	

Within the next 5 years, it is planned to produce the following vaccines :

- Inactivated poultry vaccines.
- Combined live poultry vaccines.
- Enterotoxemia vaccine.
- FMD vaccine.

The quality control of the locally produced vaccines are carried out by scientific staff other than the producers who are working in another Institute.
The data of the Quality Control Institute is not given.

4.3.2. The annual amounts of imported vaccines include:

A. Poultry vaccines:

1)	Newcastle	1,105,769,500 doses
2)	Infectious bronchitis	60,360,000 doses
3)	Newcastle + Bronchitis	58,311,000 doses
4)	Gumboro	8,823,000 doses
5)	Fowlpox	3,520,000 doses
6)	Marek	2,500,000 doses
7)	Laryngotracheitis	1,370,000 doses
8)	Encephalomyelitis	3,263,000 doses
9)	Bronchitis + Gumboro + Newcastle	1,994,500 doses
10)	Viral arthritis (reovirus)	1,481,500 doses
11)	Newcastle + Bronchitis + Egg drop syndrome	1,131,000 doses
12)	Newcastle + Gumboro + Reovirus	156,000 doses
13)	Newcastle + Egg drop syndrome	83,250 doses
14)	Bronchitis + Gumboro + Newcastle + Tenosynovitis	44,000 doses
15)	Egg drop syndrome	20,000 doses
16)	Mycoplasma + Newcastle + Gumboro	156,000 doses
17)	Salmonella	2,637,000 doses
18)	Coryza	104,500 doses
19)	Coccidia	1,216,750 doses

B. Cattle vaccines:

1)	FMD : serotype O (strain Manisa) and serotype A22	50,000 doses
2)	Clostridia	7,314 doses

C. Sheep and Goat vaccines :

1)	FMD (monovalent strain O1 Manisa O only)	250,000 doses
2)	Clostridia	3,328,000 doses
3)	Pasteurella	4225 doses

D. Equine vaccines:

1)	Equine Influenza	1,000 doses

E. Vaccines for dogs:

1)	Rabies	1,750 doses
2)	Distemper + Hepatitis + Parvovirus + Parainfluenza	700 doses

F. Feline vaccines:

1)	Panleukopenia	700 doses

COMMENTS

- The reasons for production of separate sheeppox and goatpox vaccines on one hand and sheep & goat pox vaccine on the other hand are not indicated. Also the used vaccine strain(s) are not described.
- The source(s) of vaccine importation are not indicated.
- The country is importing different varieties of combined poultry vaccines.
- The reason for using bivalent FMD vaccine for cattle (incorporating serotypes O and A) and a monovalent vaccine for sheep and goats (serotype O only) is not indicated.
- It seems that the country is still vaccinating against rinderpest.

4.4. LEBANON:

The data was provided by Dr. Mansour Kassab, Chief of Veterinary Services, Ministry of Agriculture. It was indicated that Lebanon was producing poultry and livestock vaccines in Fanar Laboratory of the Agriculture Research Institute, Beirut which was established in 1965 and in which 25 scientific staff members were working, but the vaccine production stopped since 1995.

Accordingly, **Lebanon is annually importing the following amounts of vaccines**:

I. Poultry vaccines:

1)	Newcastle	322,445,000 doses
2)	Gumboro	72,390,000 doses
3)	Infectious bronchitis	16,617,000 doses
4)	Marek's	3,720,000 doses
5)	Viral arthritis	1,364,000 doses
6)	Fowlpox	1,350,000 doses
7)	Laryngotracheitis	1,020,000 doses
8)	Coccidiosis	1,640,000 doses
9)	Arthritis (?)	95,000 doses

II. For cattle :

1)	FMD	19,958 doses
2)	IBR	79,000 doses
3)	BVD/IBR	2,600 doses
4)	Collibacillosis (for newborn calves)	9,822 doses

III. For sheep and goats :

1)	FMD	30,637 doses
2)	Sheep and goat pox	35,335 doses
3)	Enterotoxemia	263,451 doses
4)	Anthrax (for sheep)	3,950 doses

IV. For dogs :

1)	Inactivated distemper, adenovirus, parainfluenza & parvovirus vaccine	9,000 doses
2)	Rabies	6,000 doses

In addition, it was indicated that the vaccination programs are not applied yearly or on regular bases.

Furthermore, future campaigns are planned to control brucellosis. For this purpose 80,000 doses of strain 19 vaccine and 700,000 doses of rev-1 vaccine will be required.

COMMENTS

- The reason of stopping vaccine production in Fanar Laboratory is not indicated. Also, it is not mentioned if this laboratory will start again to produce veterinary vaccines.
- The source(s) of vaccine importation are not given.
- The serotypes of FMD virus incorporated in the used vaccine are not given.
- It seems that the country is not vaccinating against rinderpest; is Lebanon declared provisionally free from rinderpest ?.

4.5. MOROCCO:

The data was provided by Dr. T. Abdelhaq, Chief of Veterinary Services, Ministry of Agriculture, Rabat.

4.5.1. Locally produced vaccines:

Morocco has, in Rabat, a semi- governmental Veterinary Vaccine Producing Laboratory designated: **BIOPHARMA**, which was established in 1984. In this laboratory, 10 scientific staff members and 57 helping personnel are working.

Biopharma is annually producing the following vaccines:

A.Viral vaccines:

(1) Newcastle HB1	120 million doses	
(2) Newcastle-Lasota	50 million doses	
(3) Sheep and goat pox	25 million doses	(cell culture vaccine)
(4) Rabies	250 thousand doses	(cell culture - inactivated)
(5) Camelpox	30 thousand doses	(cell culture - inactivated)

II. Bacterial vaccines:

(1) Enterotoxemia	15 million doses
(2) Blackleg	2 million doses
(3) Anthrax	100 thousand doses
(4) Blackleg & Anthrax	500 thousand doses

In addition, Biopharma is planning to produce the following vaccines within the next 5 years:
(1) Infectious bronchitis.
(2) Inactivated Newcastle.
(3) Foot and mouth disease.
(4) Improve the produced bacterial vaccines by applying ultra- and micro-filtration.

The quality control of the locally produced vaccines is carried out by the producing staff.

4.5.2.Imported Vaccines:

A list of the currently imported vaccines was attached to the completed questionnaire without indicating the annual quantities of imported doses for each individual vaccine. The list included the following vaccines:

1)	Newcastle	imported from:	Spain, Germany, Holland, USA and France.
2)	Infectious bronchitis		Spain, Germany, Holland, USA and France.
3)	Gumboro		Spain, Germany, Holland, USA and France.
4)	Marek		Germany, USA and France.
5)	Fowlpox		Germany, USA and France.
6)	Avian encephalomyelitis		Germany, Holland, USA and France.
7)	Avian arthritis		Germany
8)	Egg drop syndrome		France
9)	Infectious coryza		Spain, Germany, Holland and France.
10)	Coccidiosis		Great Britain

11) Pasteurollosis France.
12) Haemophilus France
13) Rabies (250 thousand doses) France
14) Feline panleukopenia France
15) FMD (1.8 million doses) France

COMMENT

- Some of the locally produced vaccines (e.g. Newcastle and rabies) are less than the needs of the country and additional quantities are imported.
- The serotype(s) of FMD virus incorporated in the imported vaccine are not indicated.

4.6. OMAN:

The completed questionnaire was prepared by Dr. Rashid M. S. Al-Suleimany, Chief of Veterinary Services and submitted to Dr. Talib Ali during his visit to Oman in February 1999.

Oman is not producing veterinary vaccines. The country is importing the following vaccines:

I. For Poultry:

1)	Newcastle	)
2)	Fowl pox	)
3)	Gumboro	) Imported amounts are not given
4)	Marek's	)
5)	Infectious bronchitis	)

II. For cattle:

1)	Foot-and-mouth disease	2,000 doses (from Rhone Merieux)
2)	Rinderpest	100,000 doses
3)	Botulism	200,000 doses
4)	Rabies	25,000 doses

III. For sheep and goats:

1)	Peste des petits ruminants	900,000 doses
2)	Sheep and goat pox	300,000 doses
3)	Enterotoxemia	600,000 doses

IV. For camels:

1)	Rabies	1,500 doses

V. For equines:

1)	Influenza	1,500 doses
2)	Tetanus	1,500 doses

VI. For dogs:

1)	Distemper	2,000 doses
2)	Rabies	2,000 doses
3)	Parvovirus	600 doses

VIII. For cats:

1)	Feline rhinotracheitis	720 doses
2)	Rabies	2,000 doses
3)	Feline panleukopenia	720 doses

In addition, it was indicated that the following vaccines are also required to control the relevant prevalent diseases:

- Contagious caprine pleuropneumonia.
- Camlpox.
- Foot-and-mouth disease (without indicating the target animal species).

COMMENTS

- Considerable amounts of rabies vaccine are used for several animal species; which may indicate the wide spread of this disease in the country.
- Vaccination against rinderpest is still applicable.

4.7. PAKISTAN:

The data was provided by Dr. M. Zafarullah, Chief of Veterinary Services, Ministry of Agriculture and Livestock (Livestock Wing) Islamabad.

Pakistan has 5 institutes in which veterinary vaccines are produced:

(1) The Veterinary Research Institute in Beshawer (North West Frontier Province):
Established in 1949 and the working personnel include 5 scientific staff members and 15 helping personnel.

(2) The Veterinary Research Institute in Lahore:
Established in 1962 and has 100 scientific staff members and 349 helping personnel.

(3) The Sindh Poultry Vaccine Center in Karachi:
Established in 1974 and has 8 scientific staff members and 60 helping personnel.

(4) The Vaccine Production Laboratories in Balukhistan:
Established in 1982 and has 10 scientific staff members and 15 helping personnel.

(5) The Poultry Research Institute in Rawalpindi:
Established in 1983 and its working personnel include 6 scientific staff members and 10 helping personnel.

The given data is accumulating the production of the 5 institutes together.

4.7.1. The annual amounts of the locally produced veterinary vaccines:

I.	**Viral vaccines:**		
	a. For Poultry:		
1)	Newcastle	239.2	million doses
2)	Newcastle (oil emulsion)	0.37	million doses
3)	Gumboro	24	million doses
4)	Hydropericardium syndrome	19.05	million doses
5)	Fowlpox	2.43	million doses
	b. For cattle:		
1)	FMD	0.4	million doses
2)	Rinderpest	2	million doses
	c. For sheep and goats:		
1)	Sheeppox (in cell cultures and chicken embryos)	0.5	million doses
2)	Goatpox (in cell cultures)	0.065	million doses

d. Rabies vaccines:

1)	Prepared by animal inoculation	0.008	million doses
2)	Prepared in chicken embryos (LEP & HEP)	0.0007	million doses

II.	**Bacterial vaccines :**		
1)	Hemorrhagic septicemia	11.58	million doses
2)	Entertoxemia + Lamb dysentry	6.25	million doses
3)	Black quarter	2.24	million doses
4)	Anthrax spore vaccine	4.18	million doses
5)	Listeriosis	0.018	million doses

III.	**Mycoplasmal vaccines :**		
1)	Contagious caprine pleuropneumonia	4.31	million doses

IV.	**Diagnostic antisera against :**
1)	FMD virus

Within the next 5 years, the country is planning to produce the following vaccines:

- Gumboro.
- Infectious bronchitis.
- Marek's disease.
- Bovine viral diarrhea.
- Hydro Pericardium syndrome (oil based)
- Piroplasmosis.

No data is given on the authority applying quality control for the locally produced vaccines.

4.7.2. The imported vaccines:

The country is importing additional amounts of the following vaccines. Some of these vaccines are partially produced locally:

- Newcastle.
- Gumboro
- Hemorrhagic septicemia.
- Black quarter
- Rinderpest
- FMD
- Equine Babesiosis
- Rabies
- Canine distemper
- Canine hepatitis
- Canine parvovirus
- Feline panleukopenia.

The amounts and sources of imported vaccines are not indicated.

In addition, the authorities are indicating that the following amounts of vaccines are urgently required in order to apply annual national campaigns for some prevalent diseases:

A. <u>For Poultry</u>:

1) Marek's disease	190 million doses
2) Infectious bronchitis	140 million doses
3) Mycoplasmosis	165 million doses
4) Coccidiosis	180 million doses

B. <u>For cattle</u>:

1) Rinderpest	23 million doses
2) Bovine viral diarrhea	6 million doses
3) Bovine brucellosis	8 million doses
4) Black quarter	3 million doses

C. <u>For Sheep and Goats</u>:

1) Peste des petits ruminants	20 million doses
2) Contagious pustular dermatitis	16 million doses
3) Contagious caprine pleuropneumonia	15 million doses

COMMENTS

- The thin distribution for production of limited amounts of vaccines in 5 institutes may influence the quality of the produced vaccines.
- The amount of the produced FMD vaccine and the absence of recommendation to request additional amounts may indicate that the country is not applying relevant control program for this disease.
- The country is still using rinderpest vaccine.

4.8. QATAR:

The data was provided by the concerned Department in the Ministry of Municipal Affairs and Agriculture.

Qatar is not producing veterinary vaccines and is annually importing the following vaccines:

I.	**Poultry vaccines:**	
1)	Newcastle (Lasota)	7 million doses
2)	Newcastle (HB1)	4 million doses
3)	Infectious bronchitis	4 million doses
4)	Gumboro	4 million doses
5)	Fowlpox	300 thousand doses
6)	Avian encephalomyelitis	72 thousand doses
7)	Infectious bronchitis + Newcastle + Gumboro	120 thousand doses
8)	Infectious bronchitis + Newcastle + Egg drop	300 thousand doses
II.	**For cattle:**	
1)	FMD	2 thousand doses
2)	Rinderpest	2 thousand doses
III.	**For sheep and goats:**	
1)	Contagious caprine pleuropneumonia	40 thousand doses
2)	Enterotoxemia	40 thousand doses
IV.	**For camels:**	
1)	Johne's disease	500 doses
V.	**For dogs:**	
1)	Rabies	700 doses
2)	Distemper	200 doses
VI.	**For cats:**	
1)	Rabies	300 doses

COMMENTS

- The serotypes of FMD virus incorporated in the imported vaccine are not indicated.
- Sheep and goats are not vaccinated against FMD.
- The sources of vaccine importation are not given.
- The country is still vaccinating against rinderpest.

4.9. SAUDI ARABIA:

The data was provided by Mr. Majed El-Khamis, Head of the Animal Resources Department, Ministry of Agriculture and Water. The Saudi Arabian Veterinary Vaccine Institute (SAVVI) was established in 1980 and is so far only producing viral vaccines. In this laboratory, 8 scientific staff members and 20 helping personnel are working.

4.9.1. The annual production of vaccines in SAVVI include:

I.	**Poultry vaccines:**	
1)	Newcastle (HB1)	250 million doses
2)	Newcastle (Lasota)	120 million doses
3)	Infectious bronchitis (H120)	40 million doses
II.	**Sheep and goat vaccines:**	
1)	Sheeppox	13.5 million doses
2)	PPR	1 million doses
III.	**Cattle vaccines:**	
1)	Rinderpest	1.5 million doses
IV.	**Rabies vaccines:**	
1)	Rabies (HEP)	70 thousand doses
2)	Rabies (LEP)	5 thousand doses

Within the next 5 years, SAVVI is planning to produce the following vaccines:

- Tissue culture rabies vaccine.
- Marek's vaccine.
- Gumboro vaccine.
- Fowlpox vaccine.

No data was given on the authority responsible for testing the quality control of the locally produced vaccines.

4.9.2. Imported vaccines:

Despite the limited types of the locally produced vaccines, the data relevant to veterinary vaccine importation by the Kingdom was not indicated in the completed questionnaire. However, it was indicated that the country needs annually the given amounts of the following vaccines:

a)	FMD	1 million doses
b)	Infectious bovine rhinotracheitis	100 thousand doses
c)	Bovine viral diarrhea	100 thousand doses
d)	Rotavirus & coronavirus combined vaccine	100 thousand doses
e)	E. coli vaccine	100 thousand doses

COMMENTS

- The given data for the currently applied immunoprophylactic programs was related only to the amounts of the locally produced vaccines and not indicating if any additional imported vaccines are needed by the country (other than those listed under paragraph 4.8.2. above).
- The serotypes of FMD virus, which should be included in the required vaccine, are not indicated.
- The country is still vaccinating against rinderpest.

4.10. SYRIA:

The data provided by Dr. Adel Ziadeh, Chief of Veterinary Services had indicated that production of veterinary vaccine in Syria is carried out in **The Veterinary Vaccine Department**, which is belonging to the Central Veterinary Laboratory, Dawer Al-Matar, Damascus. In this laboratory (which was established in 1968), 16 scientific staff members and 58 helping personnel are working.

4.10.1. Locally produced vaccines:

I.	**Viral vaccines:**	
1)	Newcastle (HB1 and Lasota)	200 million doses annually
2)	Infectious bronchitis (H52 & H120	40 million doses annually
3)	Gumboro	40 million doses annually
4)	Fowlpox	10 million doses annually
5)	Avian encephalomyeleitis	10 million doses annually
6)	Rinderpest	1.4 million doses annually
7)	IBR	100 thousand doses annually
8)	Sheep and goat pox	13 million doses annually
II.	**Bacterial vaccines:**	
1)	Enterotoxemia	13 million doses annually
2)	Anthrax	2.4 million doses annually
3)	Blackleg	300 thousand doses annually
4)	Brucella - strain 19	25 thousand doses annually

III.	**Antisera and antigens :**
1)	Anthrax antigen and antisera.
2)	Salmonella antigen and antisera.
3)	Brucella antigen.

Within the next 5 years, it is planned to produce the following vaccines:

1) Brucella vaccine (rev-1)
2) Expand production of Brucella vaccine (strain 19).
3) Pasteurella vaccine.

No data is given on the responsible authorities applying quality control for the locally produced vaccines.

The locally produced vaccines cover the need of the country for vaccination against:

- Rinderpest.
- IBR.
- Blackleg
- Anthrax (for cattle, sheep, camels and equines)
- Enterotoxemia.
- Sheep and goat pox.

4.10.2. Imported vaccines:

1)	FMD.	850 thousand doses annually
2)	Brucella (for cattle)	30 thousand doses annually
3)	Pasteurella (for sheep and goats)	3 million doses annually
4)	Equine influenza	2 thousand doses annually
5)	Rabies (for dogs)	4 thousand doses annually
6)	Distemper (for dogs)	4 thousand doses annually
7)	Leptospirosis (for dogs)	4 thousand doses annually

More stress is given to expand vaccination campaigns against brucellosis using both strain 19 and rev-1 vaccines.

COMMENTS

- No data is given on the serotypes of FMD virus incorporated in the used vaccine.
- No information is given on the actually needed poultry vaccines and on the possibility of importing some of them.
- The sources of vaccine importation are not given.
- The country is still vaccinating against rinderpest.

4.11. TUNIS:

4.11.1. Locally produced vaccines:

According to the data provided by Dr. S. Bahri, Director General of Animal Health Services, Ministry of Agriculture, Tunis has two laboratories producing veterinary vaccines:

4.11.1.1. Institute of Veterinary Research (Tunis):

One scientific staff member and 2 helping personnel are working in this laboratory which was established in 1982.

Only one vaccine is produced in this laboratory:		
1)	Rabies vaccine (by animal inoculation)	225 thousand doses annually.

The Institute is planning to produce the following vaccines within the next 5 years:
(1) Sheeppox.
(2) Enterotoxemia.
(3) Anthrax.

The quality control of the produced vaccine is undertaken in a foreign Institute:
CNEVA, NANCY, FRANCE.

4.11.1.2. The Department of Virology Production (Location is not given):

Two scientific staff members and 7 helping personnel are working in this laboratory.
The date of establishment is not given.

Two vaccines are produced:		
1)	Rabies (by animal inoculation)	250 thousand doses annually
2)	Anthrax	320 thousand doses annually

The following antisera are also produced:	
1)	Antirabies serum.
2)	Antiscorpion sera.
3)	Antivenom sera.

Within the next 5 years, the Department is planning to:
1) Use cell cultures for production of rabies vaccine.
2) Produce colostridial vaccines for sheep.

The quality control of vaccines produced in this laboratory is carried out in another institute : Pasteur Institute, Tunis.

4.11.2. Imported Vaccines:

Tunis is annually importing the following vaccines (No data was provided on the source(s) of importation):

I. Poultry vaccines:

1)	Infectious bronchitis (H120)	22 million doses
2)	Infectious bronchitis (H52)	5 million doses
3)	Avian encephalomyelitis	800 thousand doses
4)	Gumboro	123 million doses
5)	Marek	6.5 million doses
6)	Newcastle HB1	38 million doses
7)	Newcastle – Lasota	97 million doses
8)	Fowlpox	6 million doses
9)	Big head syndrome	9 million doses
10)	Hemorrhagic eneteritis of turkey	3 million doses
11)	Newcastle, IB & Gumboro	500 thousand doses
12)	Newcastle, IB & Big head syndrome	2 million doses

II. Cattle vaccines:

1)	FMD (Incorporating serotypes O,A&C)	280 thousand doses
2)	Brucellosis (strain 19)	104 thousand doses

III. Sheep and goat vaccines:

1)	FMD (serotype O)	3.08 million doses
2)	Sheeppox	1.75 million doses
3)	Brucellosis (rev-1)	1.50 million doses

IV. Camel vaccines:

(1) FMD 8 thousand doses

In addition, Tunis is planning to annually use 150 thousand doses of a vaccine against theilerliosis.

COMMENTS

- It was observed that FMD vaccine for cattle is incorporating serotypes O, A and C, while that of sheep is monovalent (serotype O).
- It is reported that camels are vaccinated against FMD; is the disease clinically occurring among camels in Tunis? And which type of vaccine is used for camels: the tri- or monovalent ?

4.12. TURKEY:

According to the data received from Dr. Gelal Ozcan, General Director of Protection and Control, Veterinary Services, Ankara, 7 institutes are producing veterinary vaccines in Turkey:

4.12.1. Veterinary Control and Research Institute, Pendik, Istanbul:

This Institute was established in 1914. At present, 25 scientific staff members and 87 helping personnel are working in this laboratory which is now producing:

- Viral vaccines.
- Bacterial vaccines.
- Protozoal vaccine.
- Antisera

A. Production of viral vaccines:

1)	Sheep and goat pox in cell culture	20 million doses annually
2)	Contagious echthyma in cell culture	5 million doses annually.

B. Production of bacterial and mycoplasmal vaccines:

1)	Brucellosis strain 19 (cattle)	500 thousand doses annually
2)	Bacillary haemoglobinuria (cattle)	50 thousand doses annually
3)	Botulism (cattle)	50 thousand doses annually
4)	Hemorrhagic septicemia (cattle)	no indication on the produced quantity
5)	Colibacillosis (calves)	100 thousand doses annually
6)	Brucellosis Rev-1 (sheep/goats)	7 million doses annually
7)	Enterotoxemia (sheep/goats)	4 million doses annually
8)	Live contagious agalactia (sheep/goats)	5 million doses annually
9)	Killed contagious agalactia (sheep/goats)	500 thousand doses annually
10)	Infectious necrotic hepatitis (sheep)	1 million dose annually
11)	Salmonella abortus (sheep)	2 million doses annually
12)	Contagious caprine pleuropneumonia	3 million doses annually

C. Production of a protozoal vaccine:

1)	Theileria annualata in cell culture	150 thousand doses annually

D. Production of diagnostic antisera:

1)	Against E. coli
2)	Clostridial antisera.

Within the next 5 years, the institute is planning to produce another protozoal vaccine: Babesia bovis.

Quality control of biologics produced in this institute is carried out in Bornova Veterinary Control and Research Institute, Izmir, Turkey.

4.12.2. Veterinary Control and Research Institute, Etlik, Ankara:

This Institute was established in 1921. The number of the working personnel is not indicated. It is producing now the following vaccines:

A. Viral vaccines:		
1)	Rinderpest	15 million doses annually
2)	Bluetongue (serotypes not indicated)	1 million doses annually
3)	Rabies (in chicken embryos)	200 thousand doses annually
4)	Rabies (by animal inoculation)	5 thousand doses annually
5)	Equine abortion	10 thousand doses annually
B. Bacterial vaccines:		
1)	Anthrax	2 million doses annually
2)	Ovine vibrionic abortion	70 thousand doses annually
3)	Johne's disease	5 thousand doses annually

Within the next 5 years, the institute is planning to produce one million doses of Leptospira vaccine annually.

Quality control is carried out in BornovaVeterinary Control and Research Institute, Izmir.

4.12.3. Veterinary Control and Research Institute, Samsun:

The institute was established in 1948. Seven scientific staff members and 34 helping personnel are working in this institute.

The institute is producing only 800 thousand doses of blackleg vaccine annually without indicating the authority applying quality control.

4.12.4. Foot-and-Mouth Disease Institute, Ankara:

This Institute was established in 1967. The numbers of scientific staff members and helping personnel working in this laboratory are 20 and 66, respectively.

The local annual production of FMD vaccine in Turkey is 33 million monovalent doses.
The used serotype(s) are not given.

In addition to the local production, it is indicated in the questionnaire that Turkey is also importing FMD vaccine(s) to vaccinate cattle, sheep and goats without indicating the serotypes of FMD virus to be incorporate in the imported vaccine(s).

No information was given on the authority responsible for applying quality control.

4.12.5. Veterinary Research and Control Institute, Konya:

This institute was established in 1968. Two scientific staff members and 3 helping personnel are working in the Institute.

The institute is only producing 1.5 million doses of enterotoxemia vaccine annually without indicating the authority applying quality control.

4.12.6 Poultry Disease Research and Vaccine Production Institute, Manisa:

This Institute was established in 1986. Thirteen scientific staff members and 19 helping personnel are working in the institute.

The institute is producing the following poultry viral vaccines:

1)	Newcastle (?)	46 million doses annually
2)	Newcastle (?)	150 thousand doses annually
3)	Gumboro	6 million doses annually
4)	Marek disease	15 million doses annually
5)	Infectious bronchitis	5 million doses annually

Within the next 5 years, the institute is planning to produce the following multivalent live viral vaccines:

1) Bivalent Newcastle and infectious bronchitis vaccine.
2) Trivalent Newcastle, infectious bronchitis and gumboro vaccine.

No data is given on the authority applying quality control.

4.12.7. Veterinary Research and Control Institute, Elazic:

The institute was established in 1987. Five scientific staff members and 5 helping personnel are working in the institute.

This institute is producing two vaccines only:

1)	Enterotoxemia	700 thousand doses annually
2)	Infectious hepatitis necroticans	290 thousand doses annually

No data is given on the authority applying quality control.

COMMENTS

No detailed information is given on the actual need of Turkey for veterinary vaccines.
No adequate data is given on the possible importation of additional veterinary vaccines.

- It seems that Turkey is still vaccinating against rinderpest.

4.13. UNITED ARAB EMIRATES:

The data was provided by Dr. Ali A. Arab, Director of the Animal Health Department, Ministry of Agriculture and Fisheries, Dubai.

The country is not producing veterinary vaccines and is importing the following types of vaccines:

I. For Poultry:

1)	Newcastle (HB1 & Lasota)	(Used quantities are not given
2)	Gumboro	(
3)	Infectious bronchitis (52 and 120)	(Importation is from different
4)	Fowlpox	(countries including :
5)	Marek	(Holland, Germany, UK and
6)	Pigeon pox	(Saudi Arabia

II. For cattle:

1)	Rinderpest	100 thousand doses annually	Imported from France
2)	FMD	100 thousand doses annually	& India

III. For sheep and goats :

1)	Rinderpest (to protect against PPR)	
2)	Sheeppox	Imported from Turkey and Saudi Arabia
3)	Goatpox	Imported from Turkey
4)	Sheep and goat pox	Imported from France and other Countries

IV. For equines:

1)	Equine Influenza	Imported from France and other
2)	Tetanus	European countries.

V. For dogs:

1)	Rabies	Imported from France, USA, UK
2)	Distemper + Hepatitis + Parvovirus	and Holland

VI. For cats:

1)	Tricat (?) possibly including Panleukopenia	Imported from France, USA, UK
2)	Rabies	and Holland

COMMENTS

- In most cases, the annual required amounts of individual vaccines are not indicated.
- The serotypes of FMD virus incorporated in the used vaccine is not given.
- The reasons for using individual sheeppox and goatpox vaccines and sheep & goat vaccine is not clarified.
- The country is still vaccinating against rinderpest.

5. GENERAL CONCLUSIONS:

The present study is the first trial to review the production and needs of veterinary vaccines in the Near East Region. However, some countries did not respond to complete the relevant questionnaire and other countries did not provide all the required data. Nevermind, the obtained data may lead to some important conclusions. The following points are examples for such conclusions:

1. With the exception of Biopharma in Morocco, Kindy Veterinary Vaccine Institute in Iraq and JOVAC in Jordan, all the veterinary vaccine producers in the other countries belong to the governmental sector.
2. None of the veterinary vaccine producing countries is self-sufficient for its needs of vaccines and all countries of the region are importing veterinary vaccines, even for diseases against which vaccines are locally produced by some countries (Tables 3 to 9).
3. About 95 % of the quantities of veterinary vaccines produced by 9 Near East countries are against viral diseases, while only 5 % are against bacterial, mycoplasmal and parasitic diseases (Table 10).
4. About 90 % of the quantities of veterinary vaccines produced by the same 9 countries are against poultry diseases, while only about 10 % of the produced vaccines are against cattle, buffalo, sheep, goats, camels and accompanying animals (Table 10).
5. Data provided by 6 countries on the types of imported vaccines had indicated that about 98 % of their veterinary vaccine importation is for poultry (Table 11).
6. Variations are observed between the used vaccines against the commonly prevalent poultry diseases. For examples, some countries are using vaccines against infectious bronchitis, gumboro, infectious laryngotrachieitis, avian encephalomyelitis, egg drop syndrome, reo, coccidiosis and/or mycoplasmosis; while other countries are not using some or many of such vaccines.
7. Most countries of the region are still vaccinating against rinderpest.
8. The few amounts of the used FMD vaccines (as well as other vaccines against many livestock diseases) in several countries of the region as compared to the numbers of target animals may indicate that the currently applied relevant immunoprophylactic control programs are not efficient.
9. Although parasitic infestations constitute serious economic health problems among different animal species in all countries of the region, very limited amounts of protozoal vaccines are produced and/or used by one or two countries only.
10. Despite the prevalence of some diseases which cause serious economic losses in some countries (e.g. Corynebacterium pseudotuberculosis and ephemeral fever), no country is using vaccine(s) to control such diseases.
11. The obtained data on the quality control of the locally produced vaccines are variable from country to country - or even from institute to institute within the same country (Table 10):
    - No relevant data is provided by some producers.
    - The quality control is applied by the producers themselves.
    - The quality control is applied by another scientific staff working in another institute within the country.
    - The quality control is carried out in an internationally recognized foreign institute.

Table 1: NUMBER OF LIVESTOCK IN THOUSANDS IN THE NEAR EAST COUNTRIES (SOURCE: ANIMAL HEALTH YEAR BOOK, 1994)

Country	Cattle	Buffaloes	Camels	Sheep	Goats	Pigs	Horses	Mules & Donkeys	Chicken	Other Poultry	Human
Mauritania	1271		1000	4800	3100		18	155	3900		2
Morocco	3866		36	15594	4431	10	156	1398	90900		26
Algeria	1995		125	17850	2820	6	78	430	78300	123	27
Tunisia	925		231	7100	1420	6	56	311	39000		8
Libya	90		120	3500	600		20	50	1500		5
Egypt	4545	3200	133	3382	3210	27	10	1651	38400	27560	61
Sudan	27192		2856	22870	16449		23	675	35100		27
Djibouti	209		62	470	507			8			(*)
Somalia	4350		6000	13000	12000	9		45	3000		9
Yemen	1379		173	3715	3232		3	500	21500		13
Saudi Arabia	254		415	7257	4150		3	98	81000	6700	17
Oman	189		96	149	739			26	3000		2
UAE	92		136	291	784				7500		1
Qatar	15		43	170	150		1		3200		(*)
Bahrain	24		1	29	17				650		(*)
Kuwait	16		1	150	15				14000		1
Jordan	73		18	2100	555		4	22	77000	14	4
Palestine	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Lebanon	130		1	258	456	41	13	33	24000		2
Syria	1090	1	3	12000	1200	1	38	187	18500	2268	14
Iraq	1385	100	15	6320	1050		21	175	23500		19
Cyprus	87			285	200	370	1	7	3200	1350	(*)
Turkey	18045	316	2	37541	10133	9	450	1013	178260	6200	60
Iran	9640	300	140	45400	23500		255	2033	182000	5000	65
Pakistan	22746	18887	1121	28975	41340		354	3980	98000	3300	136
Total (Percentage to world population)	99608 (6,58%)	22804 (15,58%)	12725 (67,63%)	233206 (21,67%)	132058 (2,55%)	479 (2,60%)	1504 (21,79%)	12797 (8,65%)	1038910 (34,04%)	52515	

(*) No data is available

Table 2: AVERAGE ANNUAL DOSE NUMBERS OF LOCALLY PRODUCED AND IMPORTED POULTRY VACCINES (EGYPT)

Vaccine	Locally Produced		Imported (*)		Total
Newcastle :					
Hitschner B_1	45.737.000	6	671.996.000	94	717.773.000
Komarov	80.000.000	9	794.167.000	85	926.423.000
F strain	52.256.000	6			
Inactivated	4.000.000	100	-	0	4.000.000
LaSota	22.500.000	3	787.141.000	97	809.641.000
Subtotal	**204.493.000**	**8**	**2.253.304.000**	**92**	**2.457.797.00**
Gumboro	14.700.000	2	786.000.000	98	800.700.000
Infectious Bronchitis	1.686.000	2	84.506.000	98	86.192.000
Marek		0	66.152.000	100	66.152.000
Fowl Pox	3.100.000	7	39.912.000	93	43.012.000
Infectious Laryngotracheitis	----	0	22.052.000	100	22.052.000
Avian Encephalomyeilitis	----	0	8.052.000	100	8.052.000
Pigeon Pox	5.042.000	100	----	---	5.042.000
Reo	350.000	4	8.172.000	96	8.522.000
Duck Plague	400.000	35	739.000	65	1.139.000
Avian Mycoplasma	----	0	2.730.000	100	2.730.000
Avian Coryza	6.012.000	27	16.309.000	73	22.321.000
Fowl cholera	13.079.000	81	3.041.000	19	16.120.000
Rabbit Hemorrhagic Septicemia	292.800	100	----	0	292.800
Coccidiosis	----	0	2.344.000	100	2.344.000
Total	**249.154.800**	**7**	**3.293.310.000**	**93**	**3.542.468.000**

(*) Data provided by the General Organisation of Veterinary Services.

Table 3: AVAILABLE DATA ON ANNUAL AMOUNTS (IN MILLIONS) OF POULTRY VACCINES PRODUCED BY SOME NEAR EAST COUNTRIES

Vaccine	Producing Countries								
	Morocco	**Egypt**	**Turkey**	**Iraq**	**Syria**	**Jordan**	**Saudi Arabia**	**Pakistan**	**TOTAL**
Newcastle :									
HB_1	120	46				100	250		**516**
La Sota	50	23				100	120		**293**
Non identified or other type		136	196	23	200	100		340	**995**
Subtotal	**170**	**205**	**196**	**23**	**200**	**300**	**370**	**340**	**1804**
Gumboro		15	6	11	40	100		24	**196**
Infectious Bronchitis		2	5	0.22	40	150	40		**237.22**
Fowl Pox		3.1		3.1	10	50		2.4	**68.6**
Pigeon Pox		5.04							**5.04**
Marek's Diseare			15						**15**
Avian Enceph.					10				**10**
Reo		0.4							**0.4**
Duck Plague		0.4							**0.4**
Rabbit HS		0.3							**0.3**
Avian Coryza		6							**6**
Fowl Cholera		13.1							**13.1**
Spirochaetosis		0.5							**0.5**
TOTAL	**170** **7.2%**	**252.14** **10.7%**	**222** **9.4%**	**37.32** **1.6%**	**300** **12.7%**	**600** **25.4%**	**410** **17.4%**	**366.4** **14.3%**	**2357.86** **100%**

Table 4: AVAILABLE DATA ON ANNUAL AMOUNTS (IN MILLIONS) OF LIVESTOCK AND CATTLE VACCINES PRODUCED BY SOME NEAR EAST COUNTRIES

Vaccine	Producing Countries									
	Morocco	**Tunis**	**Egypt**	**Turkey**	**Iraq**	**Syria**	**Jordan**	**Saudi Arabia**	**Pakistan**	**TOTAL**
LIVESTOCK VACCINES										
FMD			12	33					0.4	**45.4**
Rift Valley Fever : Live Vaccine Inactivated Vaccine			 3.5 4.5							 **3.5** **4.5**
Anthrax	0.1	0.32		2	0.23	2.4	0.5		4.18	**9.73**
Black Leg	2		0.01	0.8	0.32	0.3			2.24	**5.67**
Black Leg And Gas Gangrene			0.8							**0.8**
Black Leg + Anthrax	0.5									**0.5**
John's Disease				0.005						**0.005**
HS			7.02	+	0.38				11.85	**19.25**
TOTAL	**2.6** **2.9%**	**0.32** **0.4%**	**27.83** **31.1%**	**35.805** **40%**	**0.93** **1%**	**2.7** **3%**	**0.5** **0.6%**		**18.67** **20.9%**	**89.355** **100%**
CATTLE VACCINES										
Rinderpest			Emergency stock	15	1.34	1.4	2	1.5	2	**23.24**
IBR + BVD + PI-3			0.006							**0.006**
IBR				0.5		0.1				**0.6**
Brucella (Strain 19)				0.5	0.01	0.025	0.1			**6.35**
Colibacillosis				0.1						**0.1**
B. Haemoglobinurea				0.05						**0.05**
Botulisum				0.05						**0.05**
B.C.G.			0.25							**0.25**
Theileria				0.15						**0.15**
TOTAL	**0**	**0**	**0.256** **1%**	**16.35** **65.2%**	**1.35** **5.4%**	**1.525** **61%**	**2.6** **8.4%**	**1.3** **6%**	**2** **8%**	**25.081** **100%**

Table 5: AVAILABLE DATA ON ANNUAL AMOUNTS (IN MILLIONS) OF SHEEP, GOATS AND CAMEL VACCINES PRODUCED BY SOME NEAR EAST COUNTRIES

Vaccine	Producing Countries								
	Morocco	**Egypt**	**Turkey**	**Iraq**	**Syria**	**Jordan**	**Saudi Arabia**	**Pakistan**	**TOTAL**
SHEEP AND GOAT VACCINES									
Sheep And Goat Pox	25	6	20		13	1			**65**
Sheep Pox				6.1		4	13.5	0.5	**24.1**
Goat Pox						1		0.065	**1.065**
PPR						2	1		**3**
ORF			5						**5**
Blue Tongue			1						**1**
Brucella (Rev-1)			7	0.02		6			**13.02**
Enterotoxemia	15		6.2	2.65	13			6.25	**43.10**
Lamb Dysentery And Pulpy Kidney		0.5							**0.5**
Contagious Agalactica			5.5					4.3	**5.5**
CCPP			3.0						**7.3**
Salmonella Abortus			2.0						**2.0**
Infections Necrotic Hepatitis			1.3						**1.3**
Ovine Vibrionic Abortion			0.07						**0.07**
Listeriosis								0.018	**0.018**
CAMEL VACCINES									
Camel Pox	0.03								**0.03**
TOTAL	**40.03 22.6%**	**6.5 3.7%**	**51.07 28.9%**	**8.77 5%**	**26 14.7%**	**14 7.9%**	**14.5 8.2%**	**11.133 6.3%**	**177.003 100%**

Table 6: AVAILABLE DATA ON ANNUAL AMOUNTS (IN MILLIONS) OF POULTRY VACCINES IMPORTED BY SOME NEAR EAST COUNTRIES

Vaccine	Importing Countries										
	Morocco	**Tunis**	**Egypt**	**Iraq**	**Lebanon**	**Jordan**	**Qatar**	**UAE**	**Oman**	**Pakistan**	**TOTAL**
Newcastle	+	135	2253		322	1105	11	+	+	+	**› 3826**
Gumboro	+	123	786		72	9	4	+	+	+	**› 994**
IB	+	27	85		17	60	4	+	+	40 R (*)	**› 333**
Marek's	+	7	66	2	4	2.5		+	+	190 R	**› 271.5**
Fowl Pox	+	6	40		1.4	3.5	0.3	+	+	+	**› 51.2**
ILT			22		1	1.4					**25.4**
Pigeon pox								+			**+**
Avian Enceph	+	0.8	8			3.3	0.07				**› 12.17**
Reo Virus			8.2								**8.2**
Arthritis	+				1.5	1.5					**› 3**
Egg Drop Syndrome	+			2		0.02					**› 2.02**
Coryza	+		16.3			0.105					**› 16.405**
Duck Plague			0.75								**0.75**
Mycoplasma			2.7							165 R	**167.7**
Cholera	+		3								**3**
Coccidiosis	+		2.3		1.6	1.2				180 R	**185.1**
Haemophilis	+										**+**
Big Head Syndrome		9									**9**
Hemorrahagic Enteritis Of Turkeys		3									**3**
Salmonella				2		2.6					**4.6**
IMPORTED COMBINED POULTRY VACCINES 1) Newcastle 2) Gumboro 3) IB 4) Egg drop Syndrome 5) Reo virus 6) Mycoplasm 7) Big head syndrome 8) Tenosynovitis											
1 + 3						58					**58**
1 + 4						0.083					**0.083**
1 + 2 + 3		0.5				2	0.12				**2.62**
1 + 2 + 5						0.016					**0.016**
1 + 3 + 4						1.13	0.3	0.3			**1.43**
1 + 2 + 6						0.2					**0.2**
1 + 3 + 7		2									**2**
1 + 2 + 3 + 8						0.044					**0.044**
TOTAL		313.3	3293.25	6	420.5	1231.598	19.79	+	+	675 R	5979.438

(*) R: Funds are required to import such vaccines.

Table 7: AVAILABLE DATA ON ANNUAL AMOUNTS (IN MILLIONS) OF LIVESTOCK VACCINES IMPORTED BY SOME NEAR EAST COUNTRIES

Vaccine	Importing Countries												
	Morocco	Tunis	Egypt	Iraq	Syria	Lebanon	Jordan	Saudi Arabia	Qatar	UAE	Oman	Pakistan	TOTAL
CATTLE VACCINES													
FMD	1.8	0.28		0.1	0.85	0.02	0.05	1	0.002	0.1	0.002		4.204
Rinderpest									0.002	0.1	0.1	23 R*	23.202
IBR				0.03		0.08		0.1					0.21
BVD								0.1				6 R	6.1
IBR + BVD			0.11			0.003							0.113
Rota + Corona			0.5					0.1					0.6
Rota + Corona + E. Coli				0.04		0.04							0.08
Brucella (Strain 19)		0.104	0.008		0.03							8 R	8.142
E. Coli						0.01		0.1					0.11
Clostridia							0.008					3 R	3.008
Botulism											0.2		0.2
TOTAL	1.8 5.9%	0.384 0.84%	0.618 1.3%	0.17 0.4%	0.88 1.9%	0.135 0.3%	0.058 0.1%	1.4 3%	0.004 0.01%	0.2 0.4%	0.302 0.7%	40 87%	45.969 100%
SHEEP AND GOAT VACCINES													
FMD		3.1				0.03	0.25						3.38
Sheep and Goat Pox		1.75				0.035				+	0.3		2.085
PPR										+	0.9		0.9
Pasteurellosis					3		0.004					20 R	23.004
Brucellosis (Rev-1)		1.5	0.05										1.55
Clostridia			0.5	+		0.26	3.3		0.04		0.6		4.7
CCPP									0.04			15 R	15.004
Anthrax						0.004							0.004
ORF				0.5								16 R	16.5
TOTAL	-- --	6.35 9.5%	0.55 0.8%	0.5 0.7%	3 4.5%	0.329 0.5%	3.554 5.3%	-- --	0.08 0.1%	+ +	1.8 2.7%	51 76%	67.163 100%
CAMEL VACCINES													
FMD		0.008											0.008
John's Disease									0.0005				0.0005

(*) R: Funds are required to import such vaccines.

Table 8: AVAILABLE DATA ON ANNUAL AMOUNTS (IN THOUSANDS) OF LOCALLY PRODUCED AND IMPORTED ACCOMPANYING PET ANIMAL VACCINES BY SOME NEAR EAST COUNTRIES

Vaccine	Countries													
	Morocco	Tunis	Egypt	Turkey	Syria	Lebanon	Iraq	Jordan	Saudi Arabia	Qatar	UAE	Oman	Pakistan	TOTAL
PRODUCTION														
Rabies	250	475	10	205					75				9	1024
Distemper			0.5											0.5
TOTAL	250	475	10.5	205					75				9	1024.5
IMPORTATION														
Rabies	250		11		4	6	1.1	1.75		1	+	32(*)	+	306.85
Distemper					4					0.2	+	2	+	6.2
Parvo												0.6	+	0.6
Leptospirosis					4									4
Quadri-canine (Distemper, Parvo, PI & Adeno)			2.5			9		0.7			+		+	12.2
Tri-cat			0.002								+			0.02
F. Panleukopenia	+							0.7				0.72	+	1.42
F. Rhino-tracheitis												0.72		0.72
TOTAL	250		13.502		12	15	1.1	2.15		1.2	+	36.04	+	330.992

In Oman, considerable amounts of rabies vaccine are used for cattle and camels in addition to dogs and cats.

Table 9: AVAILABLE DATA ON ANNUAL AMOUNTS (IN THOUSANDS) OF LOCALLY PRODUCED AND IMPORTED EQUINE VACCINES BY SOME NEAR EAST COUNTRIES

Vaccine	Countries						
	Egypt	Turkey	Syria	Jordan	UAE	Oman	Pakistan
PRODUCTION							
African Horsesickness (9 serotypes and/or monovalent)	Strategic stock						
Equine abortion		10					
IMPORTATION							
Equine Influenza			+	1	1.5	1.5	
Tetanus					1.5	1.5	
Equine Babesiosis							+

Table 10: AVAILABLE DATA ON THE HISTORY, NUMBER OF WORKING STAFF, AVERAGE ANNUAL AMOUNTS OF PRODUCED VACCINES AND AUTHORITY APPLYING QUALITY CONTROL FOR VETERINARY VACCINES PRODUCING LABORATORIES IN SOME NEAR EAST COUNTRIES

Country	Producing Institute	Year of Establishment	No. of workers		Annual amounts of produced vaccines (im million doses)						Responsible Authority for Quality Control.
			Scientific	Helping	Viral		Bacterial		Total		
					Poultry	Others	Poultry	Others	Poultry	Others	
Morocco	Biopharma	1984	10	57	170 (2)(*)	25.53 (3)	--	17.6 (4)	170	43.15	The Vaccine Producers
Tunis	Inst. Vet. Res.	1982	1	2	--	0.225 (1)	--	--	--	0.225	CNEVA, France
	Dept. Virol. Prod.	?	2	7	--	0.25 (1)	--	0.32 (1)	--	0.57	Pasteur Institute, Tunis
Egypt	VSVRI, Abassia	1903	310	550	230.8(11)	26.0 (12)	19.3 (3)	8.58 (6)	249.3	34.58	Central Laboratory for evaluation of Veterinary Biologics
Turkey	Pendik, Istanbul	1914	25	87	--	25 (2)	--	23.2 (12)	--	48.2	Bornova Vet. Control and Research Inst., Izmir.
	Etlik, Ankara	1921	?	?	--	16.215 (5)	--	2.75 (3)	--	18.965	
	Samsun	1948	7	34	--	--	--	0.8 (1)	--	0.8	No data
	FMD, Ankara	1967	20	66	--	33 (1)	--	--	--	33	
	Konya	1968	2	3	--	--	--	1.5 (1)	--	1.5	
	Poultry, Manisa	1986	13	19	222 (5)	--	--	--	222	--	
	Elazik	1987	5	5	--	--	--	1 (2)	--	1	
Syria	Vet. Vaccine Dept.	1968	16	58	300 (5)	14.5 (3)	--	15.725 (4)	300	30.225	
Iraq	Abu Gharib, Bagddad	?	?	?	37 (4)	7.43 (2)	--	3.61 (6)	37	11.04	The vaccine producers
Jordan	JOVAC, Amman	1988	14	33	600 (7)	12 (5)	--	6.6 (4)	600	18.6	Scientific staff other than producers
Saudi Arabia	SAVVI, Riyadh	1980	8	20	410 (3)	16.075 (5)	--	--	410	16.075	No data
Pakistan	Bashawer	1949	5	15	285.05 (5)	3 (6)	--	28.58 (6)	285.85	31.58	
	Lahore	1962	100	349							
	Poultry, Karachi	1974	8	60							
	Balukhistan	1982	10	15							
	Poultry, Rawalpindi	1983	6	10							
TOTAL					2254.85	160.17	19.3	110.265	2274.15	270.435	
					93.4%	6.6%	14.9%	85.1%	89.4%	10.6%	
					2415.02 94.9%		129.565 5.1%		2544.585		

- **Number of types of produced vaccines.**

Table 11: AVAILABLE DATA ON AVERAGE ANNUAL AMOUNTS (IN MILLIONS) OF VACCINES IMPORTED BY SOME NEAR EAST COUNTRIES TO CONTROL POULTRY, LIVESTOCK. EQUINE AND ACCOMPANYING ANIMAL DISEASES

COUNTRY	ANNUAL NUMBER OF DOSES OF VACCINE FOR:			
	POULTRY	LIVESTOCK	EQUINES	DOGS & CATS
Tunis	313	6.4	--	--
Egypt	3293	1.1	--	0.014
Lebanon	421	0.45	--	0.015
Jordan	257	3.64	--	0.0032
Qatar	20	0.08	0.001	0.0012
Pakistan	675	91	--	0.014
Total	**4979** **98%**	**102.684** **2%**	**0.001** **--**	**0.0474** **--**

6. RECOMMENDATIONS:

Firstly, it is very important to complete the data obtained in the present study through:

- Stimulating the non-responding countries to provide the required data.
- Asking the countries which responded without completing their data to provide additional data.
- Organizing an official mission to visit all countries of the region to collect the required data. In addition, it will be also possible for such mission to collect further data on the technology used for production of each individual vaccine, the currently applied quality control and to evaluate the performance and future plans of the vaccine producing laboratories.

On the other hand, the preliminary data reported in the present study and the conclusions mentioned above should stimulate regional coordination between the countries of the Near East Region in order:

1) To carry out epizootiological and economic studies, to identify the enzootic diseases which needs the application of immunoprophylactic programs in each individual country of the region and to specify the actual types and amounts of the required vaccines for such national programs.
2) To improve and increase the performance of the available governmental and semi-governmental vaccine producing laboratories in some countries by :
   - Stimulating the initiation of an internationally recognized system to inspect the performance of the veterinary vaccine producers, in order to evaluate the following parameters (as applied by WHO for inspection of manufacturers of human biological products (*)):
     i) Personnel.
     ii) Premises.
     iii) Equipment.
     iv) Production and in-process control.
     v) Laboratory control by the relevant quality control laboratories.
     vi) Animals: quality, premises and care.
     vii) Quality assurance.
     viii) Labeling, packing and distribution.
     ix) Containment practices.
     x) Sanitation and cleaning.

     (*) World Health Organization (1997) : Guide for inspection of manufacturers of biological products. Global Programme for Vaccine and Immunization; Vaccine Supply And Quality; Global Training Network, WHO/VCQ/97 03, pp. 50.
   - Application of a parallel systematic method for evaluating the potential viability of veterinary vaccine producers through analyzing the following elements (**) :
     i) Economics/scale given volume and product profolio.
     ii) GMP and consistency of production.
     iii) Historical ability and systems in place to access new technologies.
     iv) Credibility of quality and the power of the National Control Authority.
     v) Management structure.
     vi) Legal status, adequate autonomy.

     By such inspection and evaluation, it could be possible to identify the strengths and weaknesses of each producer and to stimulate for studying the feasibility of correcting

any possible weakness acting as a constraint for expanding the production and/or upgrading its quality.

(**) Milstien J., A. Batson and W. Meaney (1997) : A systematic method for evaluating the potential viability of local vaccine producers. Vaccine (exact volume and page numbers are not available; the relevant data was obtained from the gally proof).

3) To stimulate the governments of the region to encourage the private sector to establish advanced national or regional industry of veterinary vaccines to cover the country's or region's demands of these strategic products. Such national or regional industry can start by a joint venture with a multinational vaccine company.
4) To encourage the scientific cooperation and exchange of personnel and information between the national veterinary diagnostic and research laboratories, as well as the vaccine producing plants of different countries in the region, on one hand with the relevant World Reference Laboratories and the internationally recognized OIE/FAO Collaborating Centers on the other hand.
5) To stimulate for the selection of active veterinary laboratories in some countries of the region which have well developed veterinary services, to act as National Veterinary Reference Laboratories for a certain disease or for a group of diseases. These reference laboratories could act as a nucleus for possible future relevant Regional Veterinary Reference Laboratories for the Near East Region.
6) To establish some regional commissions for the control of some transboundary animal diseases, like the European Commission for the Control of FMD.
7) To establish a Regional Veterinary Vaccine Bank including enough stock of vaccines against selected diseases.
8) To organize regional training courses on:
   i) modern epizootiological investigation including molecular epidemiology,
   ii) new trends in vaccine production, and
   iii) quality control of vaccines and biological products.
9) To encourage the coordination and exchange of information between human and veterinary vaccine producers in countries producing both types of vaccines.

ADDENDUM I (Iran)

After preparing this report, the concerned veterinary authorities in Iran responded in May 1999 to the relevant questionnaire. The data was submitted by Dr. Mohammadi, the Director of Razi Institute - Hesarak, Karaj, Iran. This Institute was established in 1937. No data was given on the number of staff working in the Institute. The obtained data was only concerned to the locally produced vaccines, without indicating if such vaccines cover the national demands, or the country is importing additional types and/or amounts of veterinary vaccines.

The annual amounts of the locally produced vaccines include:

I.Viral Vaccines:

For Poultry:

Newcastle (B1 & Lasota)	1,340,000,000	doses
Infectious bronchitis	260,000,000	doses
Fowl pox	45,000,000	doses
Laryngotracheitis	19,000,000	doses
Total	1,664,000,000	doses

For Livestock:

Foot-and-mouth disease	15,000,000	doses
Rinderpest	11,000,000	doses
Sheeppox	50,000,000	doses
Goatpox	17,000,000	doses
Total	93,000,000	doses

II. Bacterial Vaccines:

For Poultry:

Fowl cholera	4,000,000	doses
Black disease	9,500,000	doses
Total	13,500,000	doses

For Livestock:

Anthrax	50,000,000	doses
Brucella (Rev-1)	16,000,000	doses
Brucella (Strain 19)	850,000	doses
Enterotoxemia	36,000,000	doses
Blackleg	6,000,000	doses
Blackleg and Pasteurollosis	1,350,000	doses
Pasteurollosis	150,000	doses
Agalactia	4,200,000	doses
Anthrax and Tetanus	8,000	doses
Leptospirosis	45,000	doses
Total	114,603,000	doses

II. Parasitic Vaccines :

Bovine theileriosis	170,000 doses
Ovine theileriosis	500,000 doses
Total	670,000 doses

No data was given on the authorities applying quality control for the locally produced vaccines.

COMMENTS

- No data was given on the serotype(s) of FMD virus incorporated in the vaccine.
- It seems that the country is still vaccinating against rinderpest.
- The obtained data indicates that Iran is the biggest producer of veterinary vaccines in the Near East (1,885,773,000 doses annually), however, some essential vaccines (e.g. Gumboro) are not produced.

ADDENDUM II (Sudan)

The questionnaire, received in september 1999, is completed by Dr. A.M. El-Hussein, the Head of the Biological Products Administration, Central Veterinary Research Laboratories, Ministry of Animal Resources, Khartoum. The Laboratory was established in 1913. Thirteen scientific staff members and sixteen helping personnel are working in the laboratory.

The annual amounts of the locally produced vaccines include:

I. Viral Vaccines:		
Rinderpest	5 million	doses
Sheeppox	2 million	doses
Newcastle	3 million	doses
Fowlpox	1 million	doses
African horse sickness	produced on request	
II. Bacterial and Mycoplasmal Vaccines :		
Anthrax	6 million	doses
Blackleg	4 million	doses
Haemorragic septicemia	6 million	doses
CBPP	500 thousand	doses
Brucella (strain 19)	50 thousand	doses

No data is given on the authorities concerned with quality control of the locally produced vaccines.

The country is planning to produce the following vaccines :

1. Viral vaccines :

- Gumboro
- Infectious bronchitis
- Lumpy skin disease
- FMD

2. Bacterial vaccines:

Morel's disease (Staph aureus sub. Sp. Anaerobius)

3. Parasitic vaccines:

Theileria annulata

The imported vaccines:

Without giving data on the quantities and sources, the country is importing the following vaccines:

1. **For Poultry:**

- Newcastle
- Gumboro
- Onfectious bronchitis
- Coryza
- E. Coli
- Avian encephalomyelitis
- Marek's disease

2. **For dogs :**

Rabies 10,000 doses

Additionally required vaccines:

FMD	1 million doses
Lumpy skin disease	1 million doses

COMMENTS

- No data is given on the prevalent serotype(s) of FMD virus , in order to identify the relevant formula of the required vaccine
- The country is still using rinderpest vaccine.
- Till the production of homologous lumpy skin disease vaccine, the heterologous sheeppox vaccine could be used to control the disease among cattle.
- The reported quantities of locally produced and imported vaccines seem to be not enough to control the enzootic diseases of livestock and poultry in Sudan.

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