Original article

Assessment of the breeding and maintenance problems of laboratory animals in Ethiopia

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Abstract: Laboratory animal breeding and maintenance problems existing in Ethiopia were assessed and identified. From which part of the breeding or maintenance activities and the problems emerged were identified. Some Laboratory animal breeding and maintenance facilities were visited. A comprehensive questionnaire was distributed to various institutions in Ethiopia. The visits were limited to institutions in and around Addis Ababa where many of the laboratory animal facilities are concentrated. The questionnaire was distributed to all institutions that were believed to breed/ maintain laboratory animals. Therefore, most of the institutions which were outside Addis Ababa were reached only through the questionnaire. Collection and microscopic examination of faecal samples were carried out on a representative population of animals to assess the health status of the animals. Some positive results have been obtained. Samples from diets of some animals were also taken from the visited institutions. To evaluate the quality of the diet, each sample was analyzed for its nutrient contents. This study demonstrated that there are problems in housing, feeding, staffing, provision of veterinary care, breeding system and the like. The annual production and utilization of laboratory animals in the country was also found to be very minimal. [*Ethiop. J. Health Dev.* 1999;13(1):49-54]

Introduction

Laboratory animals are essential tools in biomedical research and training. They are equally essential in tests and evaluations of different therapeutic drugs. They also play important roles in the production of vaccines, sera and other biological substances of public health and veterinary importance. There are also some diseases which require laboratory animals for their diagnoses. In order to obtain the optimum benefit from them, laboratory animals must be of an appropriate quality (1-4).

When talking about problems of laboratory animals, it refers to those factors that can affect the quality of the animals.

Generally there are three factors that can influence the quality of laboratory animals. These are their environment, their genetic constitution, and the interaction between the two (3,5-7). Therefore, in well maintained laboratory animal breeding practices, the animals are comfortably housed, are provided with balanced diets, get the necessary veterinary care, and have a carefully selected genetic background. Unless optimal standard of laboratory animal breeding practices are employed, offsprings are reproduced insufficiently, lack uniformity, and can be susceptible to diseases. Animals which are reproduced under such poor conditions yield unreliable results when used for research purpose (1,3,4).

Literatures reveal that laboratory animal breeding problems exist in most developing countries (1,8). Such problems occur as a result of poor facilities for controlling the different factors influencing the quality of the animals.

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As revealed by literatures and personal observations, standard laboratory animal breeding and maintenance set-up should, at least, fulfill the following facilities (3,4,9): The house should be built from appropriate materials such as like stone blocks or bricks. Two rooms are at least needed for

each species for breeding and holding. There should also be other rooms for quarantine, store, office, laboratory and shower. Extra equipment such as autoclave, refrigerators, cages, cage racks, drinking bottles, feeding troughs, euthanasia chamber should be available. The feed should be neat and contain all the required nutrients. Diagnostic laboratory for animals, veterinary professionals and similar other health facilities should be available. Competent and capable staff should also be available. The animal attendants should be literate. The foundation stock of the breeding colony must be from a known source. A careful breeding record should be maintained.

There is only little information available regarding laboratory animal situations in Ethiopia. It is also doubtful that the required standard is met. However, systematic assessment of the problems and evaluating its magnitude are essential steps to improve the situation. Thus, this study attempts to assess problems of breeding (production) and maintenance of laboratory animals in Ethiopia. The study was carried out at the Ethiopian Health and Nutrition Research Institute (EHNRI) in 1996.

Methods

This study analysed the availability of various facilities required in a laboratory animal breeding/maintenance unit of modest standard. The quality of the facilities was evaluated. All problems with the production and maintenance practices were analysed.

Three types of institutions were considered eligible to participate in this study:

1. Those known to breed, use, and maintain laboratory animals.
2. Those which do not breed but use animals obtained from other breeders, and
3. Those which are not known whether they use animals or not yet the nature of their activities require use of laboratory animals. Such institutions include agricultural and biomedical research and training institutions.

The laboratory animal breeding/maintenance facilities in some of the studied institutions were observed. In the visited institutions, faecal samples from representative numbers of animals were collected for parasitic tests in order to assess their health status. To evaluate the quality of the diet, samples from the diet of some laboratory animals were also collected. Each sample of diet was analyzed for its nutrient content.

Additionally, a comprehensive questionnaire was sent to all participating institutions. Questions related to housing, feeding, staffing, health care facilities provided for laboratory animals were included in the questionnaire.

Assessment was done using an arbitrary scoring system. The scoring variables include: materials used to build animal houses, number of rooms in the breeding setup, number of ingredients in the diet, number of staff and their educational status, availability of health professionals and equipped diagnostic laboratory facilities. For instance stone block was taken as first class material and then came brick, concrete block, wood and mud, and corrugated iron sheet each of which was given a score of 5,4,3,2, and 1, respectively. Similarly, the possible number of rooms that should be available in a breeding set-up of modest standard were listed in the questionnaire. Score was given in accordance with the number of rooms marked to be available in a particular institution.

The questionnaire used for data collection was distributed to all relevant institutions in the country.

It was not possible to visit all the relevant institutions in the country. Hence, such visits were restricted to institutions in and around Addis Ababa.

Results

A total of twelve institutions participated in the study. Problems related to laboratory animals' breeding/maintenance identified from these institutions were the following:

1. Lack of proper animal house,
2. Lack of appropriate diet for most types of animals,

Table 1: **Laboratory animal breeding/maintenance scores of different institutions in Ethiopia**

Names of institutions	Breeding and Maintenance Facilities of Laboratory Animals

	Health Facilities	Housing facilities	Staffing Situation	Feeding facilities	Breeding practices	Average score
Ethiopian Health and Nutrition Research Institute	82.86	63.33	44.68	100.0	62.50	70.67
National Vet. Institute (N.I.)	94.29	58.33	70.21	83.33	65.00	74.23
Gondar College of Med. Sciences	71.43	33.33	10.64	16.64	27.50	31.91
Institute of Pathobiology AAU	37.14	26.67	19.15	100.00	10.00	36.59
Baherdar Regional Vet. Lab.	91.43	40.00	23.40	50.00	2.50	41.47
Jimma Institute of Health Sciences	Nil	3.45	Nil	16.67	No breeding	5.03
Dept. of pharmacology, AAU	Nil	30.00	12.75	33.33	"	28.73
Eth. Pharmaceutical Manufacturing Enterprise (EPHARM)	40.00	22.45	19.15	33.33	"	63.83
International Livestock Research Institute, ILRI	82.86	71.43	51.06	50.00	"	63.83
Dept. of Chemistry, AAU All African Leprosy Eradication	Nil	14.89	29.79	16.67	"	15.35
Rehabilitation and Training Centre (ALERT) Institute of Agricultural Research	68.57	75.00	53.19	100.00	"	79.35

3. Shortage of trained manpower and in some absence of permanently assigned animal attendants.
4. Shortage of equipment in animals houses such as:
   - 4.1. Cages and cage racks,
   - 4.2. Restraining devices,
   - 4.3. Room heaters and ventilators.
   - 4.4. Water boilers,
   - 4.5. Appropriate drinking bottles or watering device,
   - 4.6. Hose or similar devices for washing cages and other utensils, etc.,
5. Problems of understanding by concerned individuals,
6. Absence of coordinating office or centre,
7. No training course on the care and management of laboratory animals in the country,
8. Absence of national or individual members of International Council for Laboratory Animals Science (ICLAS) which stands to promote the field, and
9. Little demand for laboratory animals with optimal quality.

According to the scoring, 63.6% of the laboratory animal breeding and maintenance facilities in the studied institutions were below average (Table 1).

The parasitic tests on the faecal samples showed that about 27% of laboratory animals are infested with one or more types of internal parasites, (Table 2).

Analysis of the mouse diet indicated that its nutrient content especially the protein is significantly ($P<0.001$) lower compared with that of a widely accepted mouse diet.

Diets of other animals could not be analyzed since they were not given composite diets. They were only given bran, cabbages or similar vegetables which always show variations if analyzed. This is also an indication of poor feeding practice as part of the many problems of laboratory animal breeding and maintenance in the country.

None of the participating institutions reported breeding and using rats and hamsters for experiments.

This study found that the average annual production and consumption of the country were 11,401 and 9,651 laboratory animals respectively. Production and consumption of laboratory animals were also found to be decreasing as compared with that of the previous years (Fig. 1).

It is also worth mentioning that this study has ascertained that the major local source of laboratory animals to most institutions in the country is the Ethiopian Health and Nutrition Research Institute (EHNRI).

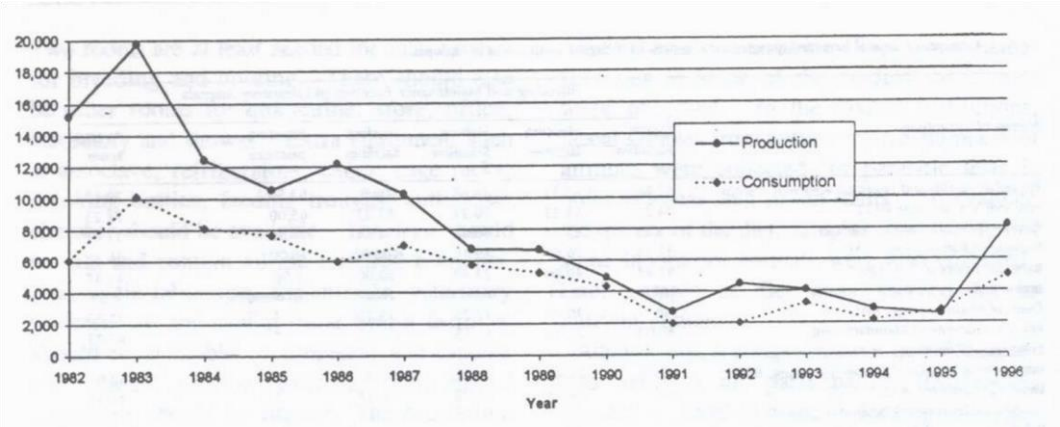

Figure 1: **Institute Fifteen years production and consumption of laboratory animals in Ethiopian Health and Nutrition Research**

Discussion

The responses of the participating institutions except that of one which maintains only six laboratory rabbits, show that all of them had problems of laboratory animal production and maintenance. Most of the problems identified found to exist in Ethiopia are similar with those of other developing countries (1).

The nutritional assessment proved that the diet provided to laboratory mice is very deficient in protein which is a decisive nutrient in animal breeding. Cabbage and bran that are given to the other animals are also not adequate in providing the necessary nutrients. Hence, these animals do not receive any balanced diet. Providing a non-composite diet by itself is also a poor feeding practice. As it can be observed from the arbitrary score (Table 1), the majority of the institutions scored below 50%. This shows that most of the breeding and maintenance facilities are poor. In addition to the low production rate, animals bred under such poor facilities cannot provide reliable results when used for tests or experiments (1,3).

The faecal test has shown an appreciable number of positive cases for GIT parasites (Table 2). This is a good indication for the poor health conditions of the animals. This test was made only in institutions in and around Addis Ababa. Scoring or evaluation of production facilities, however, included all the studied institutions on the basis of their questionnaire responses. Because of this fact, no statistically meaningful relationship was observed between the score of a particular institution and the level of parasitic infestation.

In a conventional breeding colony, internal parasites may not be uncommon (3,7). However, it does not mean that high infestation does not indicate poor health facilities or poor production practices. A high demand for an optimal quality and sufficient quantity of laboratory animals indicate the presence and conduct of many biomedical research work in the country. This can be a good opportunity to improve laboratory animal situations. Unfortunately, the demand for such animals is low in Ethiopia. It is useful to compare the annual consumption of Ethiopia with that of some developed countries where it is believed that there are a lot of research activities. The following list shows the number of rodents used over a period of one year in six developed countries (8,10). Ethiopia which consumes only less than ten thousand rodents is put in the list for the purpose of comparison.

Japan ..... 11,463,661 France 5,000,000

U.K. ..... 4,100,000 Switzerland
..... 3,000,000 Italy .....
2,600,000 Netherlands 1,200,000
Ethiopia 9,651
(includes different species)

Table 2: **Animals examined for gastro-intestinal tract (GIT) parasites and the types of parasites found**

Name of Institution	Species of Animals Examined	Total Number Examined	Types of Parasites Found	Number found Positive
EHNRI	Mouse	156	Hymenolepis nana	
	Guinea Pig		other Parasites	None
	Rabbit		Coccidia	
			Nematodes	
ALERT	Mouse		Trychostron gylus	
Science Faculty, Dept. of Biology (AAU)	Mouse		Hymenolepis nana	
			Nematode	
			Giardia	
Institute of Pathobiology	Mouse		Trychostron gylus	
National Veterinary Institute (N.I.)	Mouse		Balantidium	
	Guinea Pig		Balantidium	
	Rabbit		Balantidium & Coccidia	
Ethiopian Pharmaceutical Manufacturing	Rabbit		Coccidia	

Ethiopia's annual consumption is 0.8% of that of the smallest consumer in the above list.

The level of laboratory animal production and consumption of Ethiopia instead of rising, it is decreasing (1). If there is a decline of production or consumption of laboratory animals in developed countries, it can be attributed to the introduction of modern techniques that can substitute animal experimentation. Decline of production or consumption in developing countries like Ethiopia can hardly mean the introduction of other techniques. It can rather be attributed to the different problems existing in production and use or to the decline of biomedical research activities or can be attributed to both factors.

Recommendations

Finally, it is appropriate to suggest some general steps that should be taken to improve the laboratory animal situations in Ethiopia. The following general recommendations are believed to be basic to solve problems of laboratory animals in the country.

Strong biomedical research activities in a country demand high quality of laboratory animals. Such a demand shall initiate the attention of the concerned to upgrade the laboratory animal breeding facilities. Thus, strengthening biomedical activities can be a prerequisite for the improvement of laboratory animal situations in the country.

The result of this assessment and different literatures indicate that concerned individuals or bodies in developing countries are reluctant to appreciate the essential roles of laboratory animals in science

(1). This is a serious obstacle to improve the situation. To remove such an obstacle, the few available laboratory animal professionals should be encouraged to popularize the activities of laboratory animal production, their essential roles in science, the misleading effect of poor animals in research results, and other similar issues in any scientific media.

Another essential step that should be taken is the formation of a national laboratory animal centre. The objectives of such a centre should be, to create links with relevant international organization for receiving and disseminating useful information. The centre can coordinate different activities like organizing training courses on the breeding, care and use of laboratory animals. If need be, the centre can

advise a relevant government body on matters pertaining to laboratory animals and can represent the country in relevant international forums.

There are international organizations such as the International Council for Laboratory Animals Science (ICLAS) which assists in the global promotion of laboratory animal science. Without having such a national centre, it is very difficult for a country to obtain the necessary assistance from such organizations. Hence, its an essential step to establish such a centre in Ethiopia, too.

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