ANIMAL GENETICS & BREEDING
UNIT-I

Lecture note:
Basics of Biostatistics

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STATISTICS & BIOSTATISTICS ?

Statistics is a very broad subject, with applications in different fields.

STATISTICS?

In simple words, statistics is aggregate of methods for the collecting, classifying, analyzing, interpreting and drawing conclusions from the given information (data).

OR

Statistics may also be defined as the science of extracting information from numerical and/or categorical data.

Statistics & Biostatistics cntd……..

Let's have an example: If we want to know, which car company was number one (1) w.r.t. sale in in a particular city, for year 2022-2023 ?

Step I: **Collect the data** of sale of different cars in that city.

Step II: **Classify all cars according to company name**.

Step III: Then after **analysis** and **interpretation** we can draw **conclusion** that , company 'X' (hypothetical name) is leading company in that city for year 2022-2023 w.r.t. sale.

BIOSTATISTICS ?

Biostatistics: Biostatistics is the application of **statistical principles** (***collection***, ***classification***, ***analysis***, ***interpretation*** and drawing ***conclusions***) to questions and problems in biological data.

Biological data?

The information derived or collected from **living organisms and their products** are known as Biological data. Ex. Data on Human, Data on Animals etc.

Biological data

Let's have an example: If we want to know, which breed of animals at a dairy farm (suppose that more than one breed of animals are present at this dairy farm) are producing more average milk than other breed/s of that herd?

Step I: **Collect the data** of milk production from different lactating animals (***biological data***) of that herd,

Step II: **Classify milk production according to breed wise**.

Step III: Then find average of each breed separately (**analysis**) and by **interpretation , finally** we can **conclude** that, breed 'A' (Hypothetical name) is producing more average milk than other breeds of that herd.

Statistical methods and application

Statistical methods can be used to find answers to some of the questions such as :

1. **What kind and how much data** need to be collected?
2. How should we **present and summarize the given data**?
3. **How we can analyse the data** and **draw conclusions** from it?
4. At last, statistical methods also tells us, how can we assess the **strength of the conclusions** and evaluate their uncertainty?

What statistics provides?

So in a nutshell we can conclude that Statistics provides **methods for**

1. **Design of research** : Planning and carrying out research studies of a given scenario or problem.

2. **Description of data :** Summarizing and exploring data.

3. **Inference from the given data:** Making predictions and generalizing about phenomena represented by the data.

Application of Biostatistics/Statistics

Some of the application are as :

- **Veterinary science**: Is new animal **feed** is more productive? Which antibiotic is more effective for a given clinical condition?
- **Agricultural science**: Is new **variety of seed (or fertilizer or pesticide)** more productive (or effective)?
- **Medical science/field:** What is the **right amount of dosage of NSAID** to treatment?
- **Economics:** What will be the **unemployment rate next year (2024)**?
- **Technical problem:** How to **improve quality of LED bulbs or tube lights**?

Population?

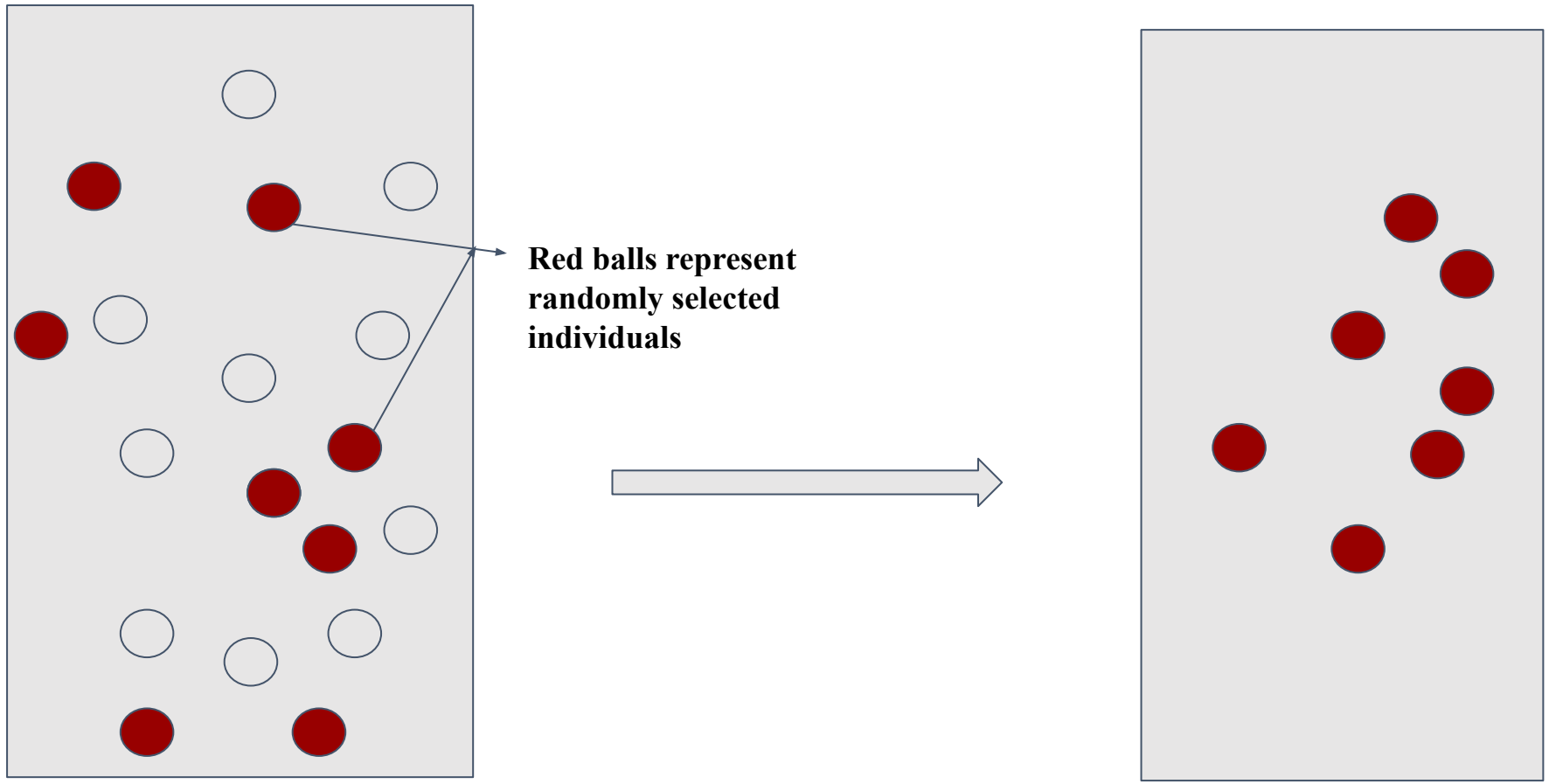
Population?

It is the collection of all individuals (also known as items) under consideration in a biostatistical/statistical study.

Example: Suppose that we are interested in knowing average milk production on a particular day of dairy farm (as in previous example), then we will have to add total milk(morning milk + evening milk) and divide it by total number of milked animals on that day.

- So **total milked animals** constitutes **population for this problem**.

Figure1: Population Vs Sample



Sample?

Sample ?

- It is ***that part/proportion of the population from which information is collected***.
- Let us consider same problem of finding average milk production on a particular day of dairy farm.
- If we add **milk production of only randomly selected animals** (not each and every one which were milked on that day) **and divide this sum by total number of randomly selected animals** then this will be average of sample data.
- So **group of randomly selected milked animals constitute the sample**.

***Population and sample are two basic concepts of statistics or biostatistics*.

Statistical terminology

- **Parameter ?**

  Parameter is any numerical property, characteristic or fact that describe the entire population. Example : population mean, standard deviation of the population etc.

- **Statistic?**

  The numerical characteristics which describe the sample is referred as statistic. Example: mean or standard deviation of the given sample.

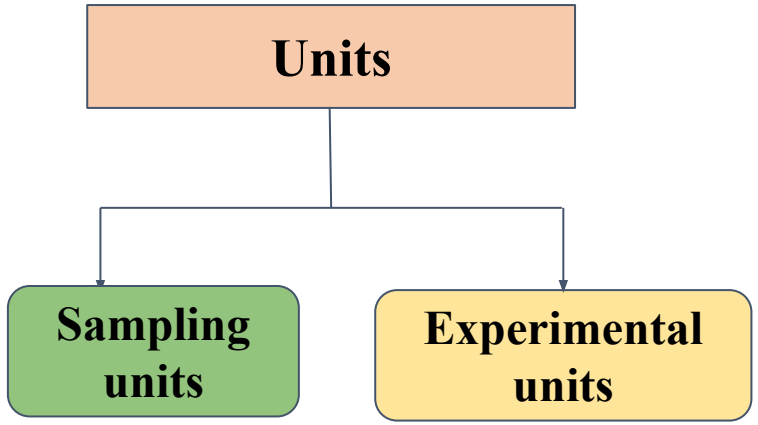
Parameter and Statistic

We know that **Parameters and statistics are descriptions of a population and sample respectively**, hence population as well as sample can have many parameters as well as statistics. Some examples are as below:

Description	Parameter with symbol		Statistic with symbol	
Mean	**Population Mean**	**μ**	**Sample mean**	**$\bar{x}$**
Proportion	**Population Proportion**	**p**	**Sample proportion**	**$\bar{p}$**
Standard Deviation	**Population standard deviation**	**σ**	**Sample standard deviation**	**s**
Variance	**Population variance**	**σ^2**	**Sample variance**	**s^2**

Unit?

Unit: It is the **smallest object or individual that can be investigated** as the source of collection of information. eg. Individual animal at a dairy farm or individual student from a class.



Sampling units: If survey is done, then individuals will be known as sampling units.

Experimental units: Individuals of experimental population are known as experimental units.

Inference vs Accuracy

Inference?

Inference is conclusion about a population or sample, drawn on the basis of appropriate analysis.

Accuracy?

Accuracy is defined as the closeness of a measured or computed value to its true value. **Example:** Suppose that in a question of animal science, if we are interested to find out the **average birth weight of Sahiwal calf in a given district of a state.**

Then **all the Sahiwal calf born will be our Population of interest (let 1000)**.

Total number of calves whose birth weight will be noted will constitute sample size (let 250).

Then: **Sample mean ($\bar{x}$)will be our result for average birth weight of Sahiwal calf** in a given district.But Accuracy will be **closeness** between Sample mean ($\bar{x}$) and population mean (μ).

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