APPLICATION AND UTILITY OF BIO-STATISTICS IN HOMOEOPATHY

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Statistics or datum means one measured or counted fact or piece of information stated as a figure. These are collected from experiments, records and surveys in all walks of life such as economics, politics, education, industry, business, administration and medicine including preventive medicine and public health. Statistics though apparently plural, when used in a singular sense is a science of figures. It deals with techniques or methods of collection of data, classification, summarising, interpretation, drawing inferences, testing of hypothesis, making recommendations etc. Everything in medicine, be it research, diagnosis or treatment, depends on counting or measurement. Thus medical statistics or biostatistics can be called as "*Quantitative Medicine*".

In one sense medical statistics are merely numerical statements about medical matters, how many people die from a certain cause in a year, how many hospital beds are available in certain area, how much money is spent on certain medical service etc. But such facts are clearly of administrative importance. A great deal of statistical techniques are available in the form of books, technical reports, monographs, research papers etc. applicable and useful to the scientists working in research laboratories. To start with we will first define *Statistics*.

Statistics may be defined as the discipline concerned with the treatment of numerical data derived from groups or individuals. These individuals may be animals, persons, patients or other organisms suffering from a certain disease. Tools for collecting and presenting numerical data is usually called Descriptive Statistics. It is important that a research should be able to improve the quality of the information by careful planning of the data collection and draw conclusions from the data about the issues under research using methods of statistical inference. Statistics applied to biological problems is simply called "Biostatistics" or "Biometry".

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Many are the biologists who will attempt the analysis of their research data only to find that too few data were collected to enable reliable conclusions to be drawn, or that much extra energy was expended in collecting data which cannot be much helpful in the analysis of the experiments. Hence, a knowledge of basic statistical principles and procedures is important even before an experiment is begun. Having collected the data it should be tabulated to give it a meaningful form. However, it might be now desired to make some generalisations from these data. The ability to make such generalisation conclusions, inferring characteristics of the whole from characteristics of its parts, lies within the realm of inferential statistics.

I. Types of Biological Data

A characteristics that varies from one biological entity to another is termed a "variable" (or a variate). Different sorts of variables may be encountered by biologists, and it is desirable to be able to distinguish between them.

Data on a Ratio Scale

Measurement scales having a constant interval size and a true zero point are said to be ratio scales. Besides lengths and number of entities, ratio scales include weights (mg., kg. etc.), volumes, (ml., lt. etc.) rates (cm./sec., mg./min. etc.) and lengths of time (hrs., years) etc., e.g. risk of cancer is more to the smokers than non-smokers. The height of a plant can be 35 cm., 36 cm., 35.07 cm., 35.3263 cm. or any other (may be infinite values) depending upon the sensitivity of the measuring device. But all plants will go in the interval 35-36 cm. The difference of height between 35-36 cm. plant is same as 37-38 cm. or 39-40 cm. plant.

Data on Interval Scale

Some measurement scales possess a constant interval size but not a true zero, they are called interval scales.

For e.g. 20°C - 25°C is equal to 68°F - 77°F while 5°C - 10°C is equal to 41°F - 50° F i.e. measurement scale is composed of equal sized intervals.

Data on Circular Scale

Say interval between 2 p.m. (1400 hr.) and 3.30 p.m. (1530 hr.) is the same as the interval between 8 a.m. (0800 hr.) and 9.30 a.m. (0930 hr.) But one cannot speak of ratio of timeof day because the zero point (midnight) on the scale is arbitrary.

Data on Ordinal Scale

Someone is interested in the relative position of a group say, blind people are more intelligent than those having both eyesor persons taking non- vegetarian food are more prone to coronary heart disease than the vegetarians. This kind of data is said to be an ordinal scale of measurement.

Data on a Nominal Scale

Sometimes the variable under study is classified by some quality that it possesses. For e.g., black and white persons having blue or black eyes, male or female etc. In such cases the variable is called an attribute and we are said to be using a nominal scale of measurement.

II. Frequency Distribution

When large amount of data is collected, to summarise it is often helpful to record the data in the form of a frequency table. Such a table simply involves a listing of all the observed values of the variable being studied and how many times each value is observed.

Example

A frequency tabulation of ordinal data below presents the number of sunfish observed and collected in each of the five categories, each category being a degree of skin pigmentation.

TABLE : Number of sunfish, tabulated according to amount of black pigmentation.

Pigmentation Class	Amount of Pigmentation	No. of fish
0	No black pigmentation	13
1	Faintly speckled	68
2	Moderately speckled	44
3	Heavily speckled	21
4	Solid black pigmentation	08

Measure of Central Tendency

Mean

There is always a value in the range of sample, around which the sample values can be called upon. This value can be termed as average of the sample. If $x_1, x_2, \ldots\ldots, x_N$ are N observations taken randomly then the mean of the sample will be :

$$\bar{x} = \frac{x_1 + x_2 + \ldots\ldots + x_n}{N}$$

$$\bar{x} = \frac{\sum_{i=1}^{N} x_i}{N}$$

Median

Median is the middle most value of the sample where there are as many observations larger as there are smaller to it.

Mode

It is the most frequent occurring value. This is rarely used in experimental research.

Measure of Dispersions and Variability

Range

X max. - X min.

Variance

It is the mean of the square of deviations about the central value or mean or average.

Sl. No.	x_i	Deviation to $\bar{x}$	$(x - \bar{x})^2$
		$(x-\bar{x})$	
1.	1.2	-.6	.36
2.	1.6	-.2	.04
3.	1.7	-.1	.01
4.	1.8	0	0
5.	1.9	+.1	.01
6.	2.0	+.2	.04
7.	2.4	+.6	.36
	Σx_i = 12.6	0	.82

$$\text{Mean } \bar{x} = \frac{\Sigma x_i}{n} = \frac{12.6}{7} = 1.8$$

$$S^2 = \frac{\sum_{i=1}^{n} (x-\bar{x})^2}{n-1} = \frac{.82}{6} = 0.1367$$

$$SD = \sqrt{0.1367} = 0.37$$

The positive square root of S^2 (sample mean square) or variance gives you standard deviation (SD).

Cofficient of Variation : CV $= \frac{}{} \times 100$

Since X and S have the same unit, therefore CV becomes unit less.

For e.g. any data measured in kilograms, pounds or tons instead of grams, the calculated CV would have been the same. It is to be calculated only for ratio scale data.

It is not valid to calculate CV of data of temperature measured in centigrade or fahrenheit temperature scales.

In Homoeopathic system of medicine especially under the Council the scope of statistics is tremendous and it can be utilised very efficiently in analysing the data and to minimise the variables in an acceptable range. In Pharmacology it can be used to find out the action of a drug after giving it to animals or human beings to see whether the changes produced are due to drug or by chance, the action of two different drugs or two successive dosages of the same drug and to find out the relative potency of a new drug with respect to a standard drug.

In medicine the help of statistics is taken to identify the signs and symptoms of a disease or syndrome, e.g. cough in typhoid is found by chance and fever is found in almost every case. The proportional incidence of one symptom to another indicates whether it is a characteristic feature of the disease or not. Similarly to compare the efficacy of a particular drug and operation or line of treatment - the percentage cured, relieved or died in the experiment and control groups are compared and the difference due to change or otherwise is found by applying statistical techniques. At the same time to find an association between the two attributes such as cancer and smoking or filariasis and social class, statistics plays such a role which is indispensible. Hence, being a medico, a Homoeopath one must learn to understand the application of statistics in diagnosis, prognosis, prescription and management of diseases in individuals and community.