Summary of a Paper on

STATISTICAL METHOD AND EXPERIMENTATION.

by

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The aim of this talk is to illustrate some principles, and is not to instruct in the details of the arithmetical processes involved.

Need for Statistical Analysis: The characteristic feature of measurements on a group of animals, even under the most uniform conditions, is the spread of the measurements about some central value. A consequence of this variability is that the conclusions of an experiment with such material can be given only in terms of probabilities and not as certainties. The branch of applied mathematics appropriate for the calculation of such probabilities is statistical method.

Some of the technical terms of the subject are illustrated and discussed: mean, standard deviation, frequency distribution, frequency curve, normal curve, sampling distribution, sampling error.

Discussion of an Experiment: Data from an experiment to determine the effect of two different types of feeding on the gain in weight of calves is used to illustrate the nature of statistical inference.

The discussion of the results of the experiment involves the setting up of an hypothesis, in this case the "null" hypothesis that the treatments have made no difference in the gain in weight. The hypothesis is tested by calculating from the data a quantity (here the difference of the mean gains in weight) and a measure of the precision of this. These can be used to give the probability of the observed difference on the hypothesis taken. From the magnitude of this probability the experimenter decides to accept or reject the hypothesis.

The conditions for the valid application of the test require, among other things, that the mean difference be an unbiassed estimate; i.e., if the hypothesis be true the mean difference is, on the average, zero. As a means of ensuring this a process of randomization is adopted in allotting the treatments to the experimental animals. In order to obtain the measure of precision of the mean difference, (it is stressed that in all cases a mean or other statistical parameter should be accompanied by a measure of its precision), the experiment consists of a number of replications of the basic comparison.

These two requirements - randomization and replication - cannot be too strongly emphasised. The experiment must be carefully planned in order that these two features be properly incorporated. In this connection it is pointed out that it is worthwhile to draw up a skeleton analysis when the experiment is planned in order to see that the experiment is capable of providing an answer to the questions under investigation.

Conclusion: It is clear that the statistician who is to analyse the data should be consulted when the experiment is being planned and not just be presented with the results at the conclusion of the experiment.

Finally, it is urged that an adequate grounding in the principles of statistical method should be part of the training of all who are to be engaged in animal research, indeed, it is time that this were so for all students of the physical, biological and social sciences.

Reference: R.A. Fisher, Design of Experiments, Oliver & Boyd, Edinburgh. Chaps. 1-VI. (Later chapters more difficult)