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Popular Article

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Graphical Representation: Importance In Surgical Practice

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Abstract: Figures and charts are pivotal for disseminating scientific information, impacting manuscript acceptance or rejection, and drawing the scientific community's attention to study findings. Graphical excellence hinges on three main criteria: maximizing data density (offering the most information per graph area), minimizing the ink-to-data ratio (avoiding unnecessary elements like shading, 3D effects, gridlines etc.), and providing clear, precise axis labelling. Researchers should include essential charts and plots in their graphical toolkit, such as histograms, bar charts and pie charts.

Keywords: Graphical representation, chart, figures, pie chart, histogram

Introduction: A fundamental principle in biomedical research is to "start with graphics" when analysing data. Creating a graph before diving into formal statistical analyses provides an initial view of the effect size, as well as the centre, distribution, and outliers of the data. Physicians, particularly surgeons, are visual learners who often grasp the key points of a clinical study more efficiently through graphical representations than through numerical data.

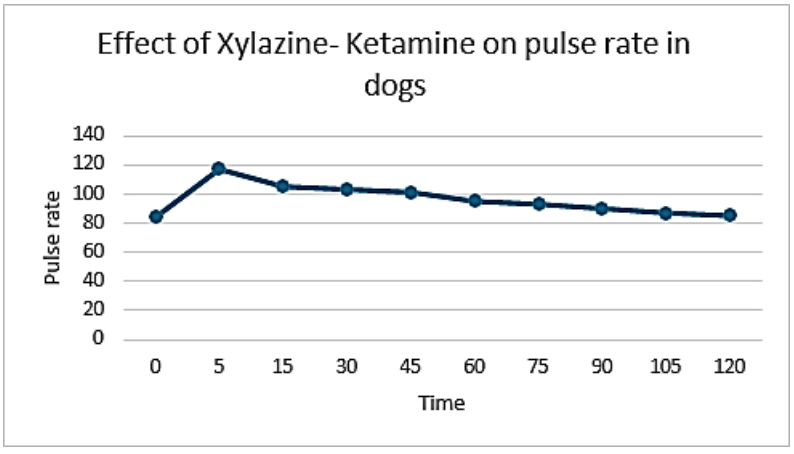
Types of graphical and diagrammatic representations are:

- **Line graphs** – a type of chart to visualize the value of something over time. Simplest form of diagrammatic representation of data
- **Histogram** – Graphical representation of continuous quantitative data in which the frequencies are represented as vertical bars
- **Frequency polygon** – It is a line graph for the graphical representation of frequency distribution. Midpoint of each class interval is calculated and measured on x axis and the corresponding frequencies are plotted along y axis.
- **Smoothed frequency curve –** It is a smooth curve for which the total area is taken to be unity. It is a limiting form of histogram or frequency polygon.
- **Ogive (Cumulative frequency curve) -** A curve that represents the cumulative frequency distribution of grouped data on a graph.

- **One dimensional diagrams (Bar diagrams) –** Height of bar is significant and not the width if the bar.
    - Simple bar diagram
    - Sub-divided bar diagram
    - Multiple or compound bar diagram
    - Percentage bar diagram
- **Two dimensional diagrams –** Areas, instead of lengths, are proportional to the given figures.
    - Rectangles
    - Square
    - Circular diagrams
    - Pie chart
- **Three dimensional diagrams –** Length , breadth and width are used for representing figures
- **Pictograph –** Data is shown using images
- **Cartograms** Numerical facts are shown in the form of maps

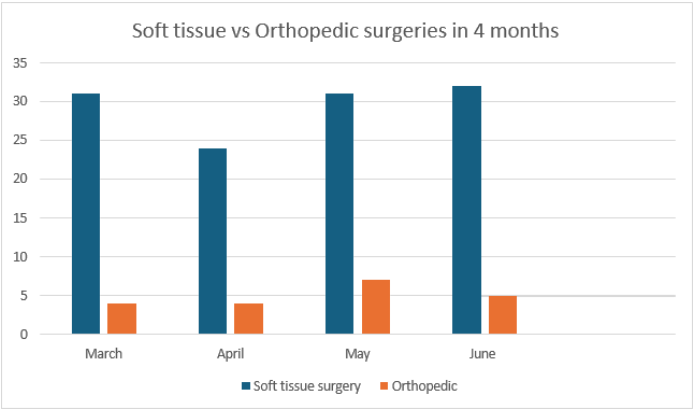
Following are some graphical representation of cases of Veterinary Surgery and Radiology (VSR) department as presented in Teaching Veterinary Clinical Complex (TVCC) Jabalpur.

Case 1: A frequency polygon is a line graph of class frequency plotted against class midpoint. One way to obtain it is by connecting the midpoints located at the tops of the rectangles within the histogram. For an ungrouped frequency distribution, frequency polygon is prepared by joining the plotted points whose X-values are the variable values and Y-values are the corresponding frequencies. For a grouped frequency distribution, the mid points of the top of rectangles erected are joined, to get the frequency polygon. In a frequency distribution, the mid value of each class is obtained. Next, plot the frequency against the corresponding midpoint on the graph paper. These points are joined by straight lines. These straight lines maybe extended in both directions to meet the X-axis to form a polygon. Case 1 represents the effects of xylazine and ketamine on pulse rate in dogs. The X-axis on the graph shows the independent variable which is time (in minutes) and the Y-axis shows the dependent variable which is pulse rate (per minute) in this graph. The data interpreted here gives the conclusion that the effect of xylazine and ketamine does not much affect the pulse rate, although there is a spike observed in the beginning of the administration of the drugs but subsequent observation in the data depicted no significant change in the pulse rate with increase in time.



Time	0	5	15	30	45	60	75	90	105	120
Pulse rate (per min)	84	117	105	103	101	95	93	90	87	85

Case 2 : A bar graph or a bar chart is a type of graph in which each column (plotted horizontally or vertically) represents a categorical variable. A bar graph visually represents numerical data using rectangular bars. The graph usually compares different categories. The most usual type of bar graph is vertical. The first step of reading a bar graph is to know the title which is usually at the top. The title of the graph gives readers a broad understanding of what is being measured and compared. Next, we read the labels which are written just below the x-axis and adjacent to the y-axis. Once understanding what the bar graph represents, we refer to the scale, which consists of numbers along the left side of the graph. These help us to see the precise values in the given data. A double bar graph is used to display two sets on the same graph. These graphs enable us to compare or present multiple types of information, situations, or events using pairs of bars placed next to each other at different heights. It's crucial to note that every double bar graph should include a title and a legend. The key for a double bar graph will represent the groups being compared with two separate colours Case 2 represents the comparative study of the number of surgeries happening in TVCC Jabalpur in 4 months The key here is at the bottom of the graph depicting a blue box for soft tissue surgeries and an orange box for orthopaedic surgeries The results demonstrate that the number of soft tissue surgeries in 4 months period were significantly high as compared to orthopaedic surgeries occurring in the OT of TVCC Jabalpur surpassing the former's quantity as high as 4-7 times of latter's magnitude.



Month	March	April	May	June
Soft tissue surgery	31	24	31	32
Orthopedic	04	04	07	05

Case 3: A circle is used to represent a given data. The various parts of it are proportionally represented by sectors of the circle and this type of graph is called a pie chart or a pie graph. Case 3 represents the monthly case load of total 1000 cases of VSR department at TVCC Jabalpur through a pie

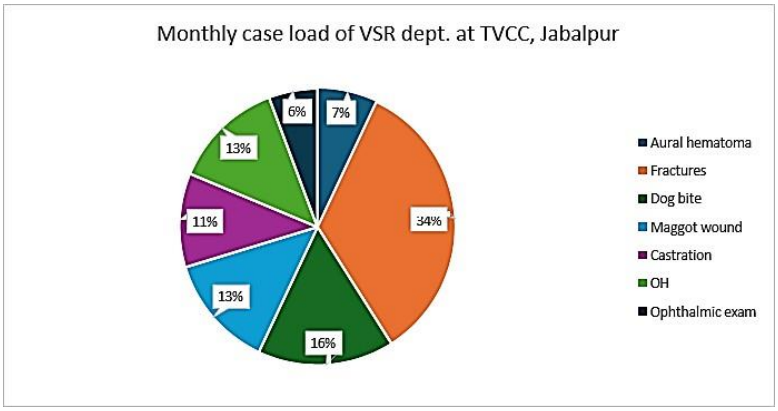


chart. The number on each sector of the pie chart represents percentages of different cases recorded in a month irrespective of their breed, age, sex, season, species. The box at the right corner of the pie chart shows the different types of cases observed in a month. There are 7 different types of cases observed. The overwhelming majority of those cases were of the fractures and dog bite among all the cases. The figure was 34% and 16% respectively. Furthermore, only 13% of them were of maggot infestation. Meanwhile, the pattern appears to be different for aural hematoma, castration, OH and ophthalmic examination comprising only 37% of the whole circle with individual percentages of only 7%, 11%, 13% and 6% respectively.

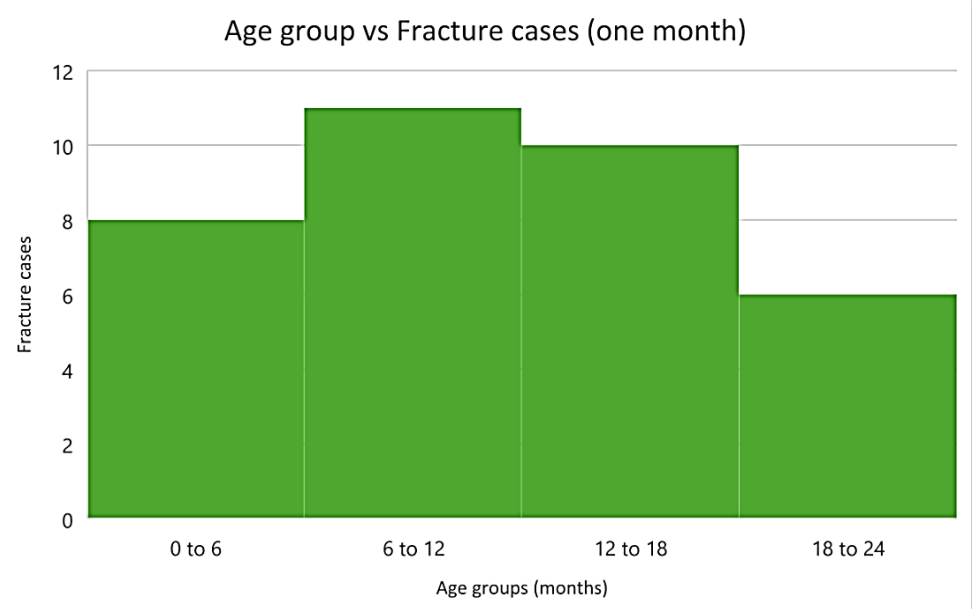
Aural hematoma	70
Fractures	340
Dog bite	160
Maggot wound	133
Castration	110
OH	130
Ophthalmic exam	57

Case 4: Histogram

A Histogram is a graphical representation of the grouped frequency distribution of data with continuous classes. A Histogram shows numerical data by grouping it into equal-width bins. Each bin is represented as a bar, with the height indicating the number of data points within that bin. Bins are also sometimes called "intervals", "classes", or "buckets." The heights of rectangles are proportional to corresponding frequencies of similar classes and for different classes, the heights will be proportional to corresponding frequency densities. The heights of the bars indicate the count of data points within each bin. Histograms can be categorized into different types depending on how the data frequencies are distributed. There are different types of distributions, such as normal distribution, skewed distribution, bimodal distribution, multimodal distribution and so on. The histogram can be used to represent these different types of distributions.

Case 4 represents the fracture cases observed in different age groups in one month The X-axis on the graph represents age groups of animals in a month and the Y-axis shows the numbers of fracture cases of those different age groups. While Histograms may resemble other graphs, they differ slightly in that they do not contain gaps between successive bars.

Age groups (months)	Fracture cases
0 to 6	8
6 to 12	11
12 to 18	10
18 to 24	6



Result & Discussion: The above-mentioned cases give a bird- eye view of the entire data and provides an immediate overview of the values of different variables in a simple, clear and comprehensive manner.

Figures should complement, not duplicate, the written text. As a general guideline, a figure is necessary when an illustration can convey information more clearly and simply than a complex written passage. They are attractive to the eye; figures are dry but diagrams delight the eye. They have greater memorizing effect. But they are approximate indicators and fail to disclose small differences when large figures are involved.

The following are key graphical tools essential for illustrating nearly any study result:

1. Frequency Polygon: helps to make sure that the data is sorted out and represented. These are much easier to understand and gives a clear picture of the distribution of data.
2. Bar charts: To contrast 2 or more data points from a specific data set and to show a relationship between parts of set of data.
3. Pie-charts: Used for percentage distribution and angles of sectors are proportional to the respective values or measurements of different components.
4. Histograms: While they may take up more space than other figures, histograms are excellent for showing the full range of data and identifying bimodal distributions.

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