



HOW TO WRITE AN EFFECTIVE SCIENTIFIC RESEARCH PAPER THAT JOURNALS TAKE SERIOUSLY

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Abstract- Gerard Piel (1915-2004), scientific editor of the life science magazine, once wrote, “Without publication, science is dead”. It explains the importance of publication of findings in scientific journals so that other scientists working in the field know about new findings. If after conducting an investigation, the research is not published and outcome is not shared, the data would have no meaning for investigators and other scientists. Such a scenario fits well with the saying “Publish or Perish”; if the findings are not published then investigators will be perished since their work will not receive any recognition. It is therefore, sharing the knowledge through paper writing and publication is important.

Writing paper is not an easy job; it requires skills, knowledge and patience that stress out people, specially young investigators. In the present paper, we brought methods, skills, techniques and information required to write an effective paper, specially for those who have just started their career in science and those who are in the middle of their scientific career as investigators, professor, scientists etc. The present paper will also help investigators to write their papers, which may not have English as their native language. We have made every effort to include in this paper as much information as possible to write effective scientific papers that journals take seriously.

Key words – Science, paper, writing, methods, publication.

1. HOW TO WRITE ABSTRACT

“A well-prepared abstract enables readers to identify basic contents of a paper quickly and accurately; it also determines its relevance to the interest of readers, and decides whether they need to read the document [1]. Every scientific journal publishes papers on the set format referred to as IMRAD [2], which represents the first letter of the five sections of research papers, i.e., Introduction, Materials and Methods, Results, and Discussion. These sections are not the entire list of what should be included in the paper; they rather show the pattern and format of scientific writing. There are other important sections such as the title, authors, abstract, key words, acknowledgements, references, etc., that scientific journals want authors to include in writing a scientific paper.

The title of the paper precisely tells readership about the type of study conducted, and inclusion of authors tells the names of investigators in the order of their contributions. The abstract of paper explains summary of research that helps readership to understand purpose of the study [3]. The abstract given in the beginning of a paper serves as the point of entry and a mini-version of the manuscript [4]. The keywords are search engines for readers, used for indexing and cataloguing.

The introduction explains boundaries of the subject, its scope with reference to current knowledge, importance and inherent interests to readers. The materials and methods section explain methodologies and materials used to conduct study. The findings of research conducted are described in

the result’s section with the help of tables, figures, images, etc. The inferences, conclusions and explanations as well as the significance of results and findings are described in the discussion section. Then comes acknowledgement, where help, assistance, support, funding etc., is acknowledged.

Finally, the list of references known as the section of references or bibliography is added, which includes all references that have been cited and referred in the manuscript. There are no set instructions to the authors; rather each journal has its own set of rules and style. Hence, it is prudent to authors to follow journal’s instructions and prepare manuscript accordingly in order to save time, efforts, money and chances of rejection.

The writing of the abstract must be definitive, since it conveys information about itself [5] and the research conducted. It is the unique section of the paper, where statements on rationale, objectives, design, methodology, approach, research implications and practical limitations are explained effectively in the minimal number of words. Brief explanations must be given to new discoveries, facts, or principals and key words are included for the purpose of cataloguing and indexing. Abbreviations, acronyms, complex writing, winding, verbose sentences, and long strings of scientific names must be avoided. The successful writing of abstract depends on the writer, who prepares and fine-tunes the title and abstract after when rest of the paper is written.

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2. CHOOSING KEYWORDS

Selection of keywords must be based on the importance and theme of the study, since papers are indexed and catalogued in scientific and biological abstracts. The words appearing in the title should not be repeated here. Journals have different criteria for choosing key words; some allows 6-8 words, others a string of several keywords, still others does not allow them at all. In any case, journal's criteria must be followed and best judgment should prevail when choosing keywords. The careful selection of keywords is to provide 6 to 8 words, which must include at least one word each from the concept, methodology, specificity and significance of the paper.

3. CHOOSING TITLE OF THE PAPER

The title of the paper is one of the most important and widely searched criteria of any successfully written scientific paper. It is the title of the paper that readers searched most to explore their interests and further reading. Since, all scientific journals allow titles in 10 to 15 words, it becomes prudent for authors to choose topics cautiously, specifically, precisely and definitively that express the whole idea of the study. The readers explore papers in the sequence of titles, authors, abstract, results (that also include tables, images and figures), and discussion. Based on the statistics and trends, title of published papers receives maximum attention, since one individual in a thousand reads the whole paper out of hundreds of papers searched and decides to read it, followed by abstract, tables and figures (results) and discussion. An attractive and eye-catching title attracts readers to read the paper, which might otherwise pass and go to find other papers of his interest.

Presume just for the sack of example that research was conducted on pest control. Journal allows 10-15 words for the title, hence for the title choose few words describing specific and accurate theme of the study, without using any verb, abbreviations, formulas, jargons, low emphatic terminologies (e.g., Some observations...), fleshy or succulent words (e.g., chemicals kill all the pests to make disease free world) etc. Let us choose the topic by using the following three-step ladder with some examples.

- 1) *Select random words for the title based on the study to set an example:* A research on pest management conducted with some chemicals to manage or kill pests e.g., mosquitoes. It is always a good idea to take a time to choose random words and terminologies related to the study e.g., Observations, pesticides, concentrations, toxicity, mosquito, control. Obviously, these words may not be the best choices but they certainly meet the criteria to be the part of the perfect title.
- 2) *Modify words and make the title little bit more specific:* The above terms explain contents but they do not provide specificities of the study, hence narrow them down to some specific terms e.g., impact', name the pesticides, name dengue mosquito, name the region, residual toxicity etc. The modified words provide specific idea of the study which may still not be enough to entice readership as much as one wishes to.

- 3) *Modify words to make the title a lot more specific and arguable*

During the first three steps, three to four versions of the title may be written with precision and accuracy, meeting the criteria of the journal. Replace some words with more specific terminologies: the previous steps helped replacing general words with specific terminologies to make the title more specific. Now is the time to write few titles with the selected terminologies by avoiding verbs, abbreviations, formulas, jargons, low emphatic words, flesh and succulent words and choose the one that fits well with the study. A couple of titles e.g., "Comparison of ground and aerial ultra-low volume applications of malathion against *Aedes aegypti* in Jeddah, Saudi Arab" or "Ultra-low-volume ground aerosol of technical malathion for the control of *Aedes aegypti* in Jeddah, Saudi Arab" appears to be the best choice.

Many authors publish their findings in a series of papers with the main title suffixed as parts 1, 2, 3 etc. (e.g., Residual toxicity of Malathion against *Aedes aegypti* in Jeddah 1; Residual toxicity of Malathion against *Aedes aegypti* in Jeddah 2 and 3 etc.). This practice is handicapped in number of ways for regular subject readers, whose reading is jeopardized and hampered seriously when papers in the series is published in different journals and volumes at different times and the worst part is when one part of the series is not accepted for publication. It is therefore publishing papers in a series is not recommendable by most journals [4].

4. RANKING AUTHORS

The individuals who took part in the planning and conducting research, and preparing paper are the authors. Ranking of the authors can be a contentious issue, leading awkward situations, breaching high scientific ethical standards [6]. Ranking two individuals as the first and second author in a paper is easy. However, justifiable ranking in multi-authored publications, based on individual contributions [7, 8] is a difficult proposition, since it becomes more arbitrary. Although, the criteria of ranking authors in papers have been discussed, so far, no simple way of ranking authors is available anywhere in the literature [9, 10, 11, 12].

Ethically and traditionally, the individual who contributes most must be designated as the first author, followed by other individuals based on their contributions: while technicians and other helpers are given credits in acknowledgements. Alphabetical listing of authors was the past practice, which is not accepted any more by journals; however, the name of the graduate students must be listed as the first author, if the paper is coming out of his/her thesis, followed by the supervisor and other contributors. In many cases, supervisors have prerogative to name themselves, ethically as the last author. Author for correspondence must always be marked and highlighted with asterisk or some kind of notation to help journal making future correspondence. Other objectionable situations must be avoided while ranking authors in a paper e.g., laboratory manager or the head of department insist to be ranked as per their choices. Such a situation often arises when an overseas exchange visitor goes back to his/her institute with the data of the study and publishes papers upon returning home. It is always a good idea to seek consent of

overseas collaborators, since all journals ask final consent of co-authors. Once the author ranking is finalized, their proper affiliations, emails and other information as required by the journals must be provided.

For the benefit of science and scientific development, multidisciplinary scientific research must go on and misunderstandings must be resolved to provide current and future scientific communities to credit each author of their contributions. To overcome misinterpretations and arbitrariness, contributions of each author must be described briefly at the end of the paper. By doing so, the referees, readers and citation indices would be able to give due credit to each one of them.

5. HOW TO WRITE INTRODUCTION

First impression is the last impression; introduction is the first and the last chance to impress readers about the work, hence writing a good, impressive and enticing introduction is very important.

A well-written introduction guides readers to specialized research from a general area of specialization by explaining ideas, significance, present understanding and background of the topic[13].It is advisable to explain the purpose of study and present problems with the help of hypothesis and questions[13, 14].

A good and short introduction tells readers why the paper is interesting, why this study was undertaken, and it provides subject background to the understanding of readers. It explains problems and nature of previously conducted research, brief literature review, theme of the study and terminologies or abbreviations used in the paper. While writing introduction, one has to ensure that the introduction is short and precise in nature, and avoid repetition of the facts already described in other sections.

It is appropriate to mention about the grammar used in the introduction. Some journals have guidelines to use the type of grammar in paper writing. In the introduction, different tenses are used e.g., the present tense to write justification of the study (Mosquito sucks blood...), literature review is written in the past tense (Studies made on.....) or in the present perfect tense (Insects have shown that ...)[6].

A brief mention of methodology to be used while conducting research, elaborating approaches to research questions and predicting possible results of the study always make introduction a road map to attract readers to explore the entire paper. For example: Who else knew or worked with this subject?; what the reader will study in this paper; why the topic of this paper is so important and how the study will enhance subject understanding and contribute to the advancement of knowledge.

There are no set patterns to write the first paragraph of introduction, but the one that explains logic of argument, impression of mindset, style, skill, and quality of research conducted is most suitable. If the introduction is written in the perfect manner, it would allow readers to validate the subject, topic of research, the way study was conducted, and results obtained and analyzed. Readers always think highly about paper writing and analytical skills based on well-written introduction, rather than a vaguely, error filled and loosely written paper, which attracts least attention and create negative impression.

Which components should constitute introduction of a paper? Generally, introduction should elaborate important aspects of the paper so that readers must know what they are going to see in the paper. Besides, discussing other ongoing studies on the subject, current literature review, reasoning for choosing hypothesis, significance and relevance of the study must be given briefly at the end of the introduction.

Most journals ask authors to prepare papers on the standard format called IMRAD. The word IMRAD contains first letters of Introduction, Materials and Methods, Results, and, Discussion [2] with few exceptions, where journals ask authors to merge keywords with abstracts, results with discussion or discussion with conclusions. The term IMRAD sets the pattern of the paper but it does not represent the entire list of sections in a scientific paper e.g., Title, Authors, Keywords, Abstract, Conclusions, and References. Since IMRAD constitutes major portion of the paper, it has become the choice of most scientific journals [1].We suggest to the authors to consider the following steps and phases to write an effective and successful introduction(Table 1).

Table 1. Steps and phases to write effective introduction of a scientific research paper.

	Steps and Phases	Actions
1.	Investigate, choose, and establish an area of research.	<ul style="list-style-type: none"> • By writing general statements related to the subject, topic, aims and objectives and hypothesis, and conclusions. • By reviewing current research on the chosen subject.
2.	Identify a research topic.	<ul style="list-style-type: none"> • Identifying gaps in the existing research. • Asking questions and setting hypothesis.
3.	Identify and analyze your research within the scope of the subject.	<ul style="list-style-type: none"> • By identifying and outlining key points of the proposed study. • Describing, analyzing and explaining important results from previously carried out studies. • Analyzing and setting structure of the paper.
4.	Chose topical sentences for each paragraph of introduction.	<ul style="list-style-type: none"> • Also called as focus sentence i.e., a sentence that summarizes the whole paragraph in one sentence. Decide the subject of the paragraph and start with a topical sentence.

Although, it is a matter of choice when to write introduction: in the beginning or in the end. However, it is always better to write it at the end, when all sections of the paper are written. The benefits of writing introduction at the end are manifold e.g., facts mentioned in the introduction and other sections can be matched and irregularities between introduction and other sections may be removed. The introduction can be rewritten easily when conflicts and contradictions are found in the paper.

6. HOW TO WRITE MATERIALS AND METHODS

Materials and methods should present all materials used and methods employed to conduct study. Refrain from using ambiguous, vagueness, verbosity and repetitiveness in the writing. The section of materials and methods describes, “What methods were used?, How were experiments performed?, When were experiments or treatments conducted?, and How was data collected, analyzed and presented. The methodology or techniques should be described in detail, if they are new in the study, otherwise a brief description with appropriate reference will suffice the requirements [15, 16]. Although, various units of measurements are well defined by scientific journals, if not, this is the time to explain them. In a nutshell, materials and methods should provide precise details of each and every parameter used to conduct experiments and to collect data in order to allow another researcher to obtain similar results with $\pm 5\%$ statistical error, when he/she repeats experiments under identical conditions. While writing materials and methods, the section should be organized chronologically to include all the important and required information, and leave aside all unwanted details (Table 2).

Table 2. Chronological order of writing materials and methods in a scientific paper.

	Actions	Parameters	Remarks
1.	Description of study location	Give all information related to the location of study e.g., laboratory or field study, place, latitude, longitude, temperature, air quality, climate, humidity, vegetation, etc.	If there is a need to give any reference, always provide.
2.	Experimental design	Mention number of replications for experiments, control and negative control. Method of sampling, sample collection and size.	If experimental design is new, explain it in detail if not then briefly describe with suitable reference.
3.	Are plants or animals involved in the study	Provide genus, species, strain, cultivar, line, etc. of the organisms and include Latin names in italics. Common names may be given only after introducing them in the section.	Check authors guide for naming organisms. If original authors are needed mention their names with appropriate references.
4.	Are chemicals involved in the study	Technical specifications, chemical names, quantities and source of chemicals must be given.	Some journals want companies name along with the name of the chemicals. Follow it according to the author's guidelines.
5.	Data collection	Describe the methods, frequency, situations and techniques to collected data.	If the technique is new, detailed description is required, otherwise brief description with suitable reference will suffice.

6.	Data analysis	Name the methods and statistical programs used to analyze data along with the type of statistical tests applied.	E.g. Statistical programs: SPSS, SAS etc. Types of tests: Standard deviation, Tukey's multiple range test, Chi square test etc.
7.	Writing	Materials and methods are always written in the past tense and third person e.g., experiments were conducted at 98.4°F for 5 days” - NOT: “I conducted experiments at 98.4°F for 5 days.	There are no set rules but following authors guide is always advisable.
8.	SI system	SI system is known as the Le Système International d'Unités, used to report measurements.	Follow journal's guidelines for SI. Measurements not defined are called non-SI units. When using non-SI units, they must be defined in the text on their first appearance.
9.	Review of the writing	Always a good idea to show materials and methods section to one of the colleagues asking whether there is any difficulty in reading and understanding methodology.	If so, ask them to give you suggestions.

In more than 80% of cases, scientists write materials and methods before writing any other section of the paper, the reason that materials and methods is the most easily written section of the paper. Is it so, yes it is; because all the information related to materials and methods are handy and ready to be written. It is however, surprising that the section of materials and methods, which looks so easy to write, is one of the reasons of paper rejection by referees and journals. Why is that so; authors take this section for granted, and show laxity when writing by leaving many important and finer details of methodology used during the study. Utmost attention must be given to finer details of materials, procedures, study design, instruments used, procedures of measurements etc., [17,18]. All scientific writings must give emphasis on the significance, indispensability, and importance of compliance with scientific writing rules. Complying and obeying grammar rules e.g., writing in the past tense and third person gives writing clarity. In conformity with grammar rules, use of verbs such as ‘conducted’, ‘collected’, ‘released’, ‘evaluated’ or ‘performed’ are most appropriate (Table 2). Writing in the third person is accepted by most journals but expressions depicting ownership of the action such as ‘I/we conducted’, ‘I/we collected’, ‘I/we evaluated’ etc. is now becoming a trend. Whatever is the grammar format, we believe that the important point in communication or writing is the message that should be very clear and understandable even to the person who knows little about the subject [17, 19].

Subject experts, professionals and people from allied subjects read scientific papers written by us. If any material, fact, organism, measurement unit, experimental parameter

etc., are not described clearly, it will generate confusion, which may lead to paper rejection. Each entity of materials and methods must be defined and described clearly (Table 2). Measurement units, international abbreviations, parameter definitions, and other such terminologies must be defined at their first appearance in materials and methods [20]. Sentence written as, "ULV applications on MR of *Ae. Aegypti* in KSA" is difficult to understand, due to abbreviated terminologies. Keeping in mind that the paper will be read also by scientists in other subjects e.g., biology, medicine, public health etc., the sentence needs modification. Rewriting the above sentence as "The Ultra-Low-Volume (ULV) applications on the Mortality Rate (MR) of *Aedes Aegypti* in Kingdom of Saudi Arabia (KSA)" presents the purpose and meaning that will be understood even by a non-technical person.

Last but not the least, methods of evaluation and measurements indicated in the result section must be propounded in "Materials and Methods". Any expressions used in the results such as the median body mass index of the patients was 27.42 kg/m², then comparative evaluation of median body mass index must be explained in "Materials and Methods". Alternatively, it should be stated that the patients were evaluated based on their BMIs as normal (18–24.9 kg/m²), overweight (25 kg/m²–40 kg/m²), and morbid obesity (>40 kg/m²) etc., for comparisons" [17, 19, 21, 22].

Statistical program and tests used to analyze data must be described in the last paragraph of materials and methods. It is advisable that a statistician should write this paragraph with description and justification of statistical tests applied e.g., data in the population distribution of mosquitoes was analyzed by applying Chi Square test or Tukey's multiple range test was applied to compare various parameters.

7. HOW TO WRITE RESULTS

Writing results is the next stage of a scientific paper, which describes research findings, new knowledge, outcome of the study and facts hitherto unknown to us. The 'Results' section also serves as conduit between 'Materials and methods' and 'Discussion, since it presents findings of the study, using materials and methods and inferred in Discussion. The findings must be presented in the same order as they were presented in materials and methods for the convenience of readers, or else confusion and misunderstanding prevail. The type and quality of new findings presented in results give weight age to the paper; therefore, presentation of results must be very precise, clear and in the right amount of words.

The results should be described precisely, without any interpretation or inferences with the help of figures, tables and other illustrations. Explanation of statistical tests applied to analyze data must be summarized in the text or it may be attached with the tables, or figures as shown in Table 3. To serve the purpose, results, tables, figures and other illustrations should be organized in a sequential manner for the convenience of readers. Results section should also be used to describe negative results and all results must be written in active voice and past tense as much as possible.

The results are the outcome of the study conducted by setting hypothesis and questions, which can be answered by collecting samples and data under defined experimental conditions and by gathering important observations about

organisms, mechanisms and phenomenon. Regardless of complexities of the study and data analysis, initial approach must be consisted of visual inspection of tables, figures, images and statistical values.

The section of results is the way to provide as much information as possible about differences, similarities or relationships in the precise and least descriptive manner. For example, if the differences are tested between the effects of two concentrations (5 % and 10%) of Malathion on *Aedes aegypti*, and significant differences were found, it will not suffice to report, "mosquito mortality at 10% concentration of Malathion was significantly different from 5% concentration of malathion. The reason why and how mortality is different at two concentrations must be reported. Therefore, it is more relevant and informative to write "mosquito mortality after 15 days was 49% at 15% concentration of malathion as compared to 5%, where mosquito mortality was significantly less (27%)(P < 0.05).

It is very important to report results in the way where they show direction (smaller or larger), magnitude (higher or lower) and effects (% difference, how much etc.). It is also not advisable to write in each and every sentence that this result or that result is significantly or not significantly different; instead indicate such observations in the form of statistical values such as standard deviations, standard errors, level of significance, r values etc., in parenthesis and where necessary in tables and graphs.

As far as tables, figures and other images are concerned, prepare and arrange them in the most sequential and logical manner after when the data analysis is completed. Leaving short notes on each table and graph that you want to address in the text is always a good idea to streamline your results.

7.1 Creating a table: Table is an important and significant part of results, a badly or incompletely prepared table will not be confusing only but it will reduce chances of the paper been accepted. On the other hand, a well-prepared table will boost understanding of results and raise chances of paper acceptance. A well-prepared table removes confusion, ambiguities and misinformation. In its entirety, tables should be self-explanatory, where the reader should understand the outcome of the study without accessing other portions of the paper. The table should have a caption that fits well with the purpose of the study. For example, "Effects of Malathion on the mortality of *Aedes aegypti*", "Rate of mortality of *Aedes aegypti* at various concentrations of Malathion" etc. The table should have defined columns and rows with appropriate units if needed.

When necessary to highlight results, use statistical values to signify them. Inclusion of footnotes that many journals ask to have the least, but it is the best way to use few words such as statistical values or methods applied e.g., significant at 95% or significant at P < 0.05, PCR technique etc., with the help of asterisks. Table 3 and Table 4 show correct and incorrect tables. Tables (Table 1, Table 2, Table 3....), graphs (Figure 1, Figure 2, Figure 3....) and images (Image 1, Image 2, Image 3....) must be separately numbered depending upon journal's requirements.

7.2 Drawing a graph: Drawing a graph needs same rules as those applied to create a table. Selection of a graph type depends on the nature of data. There are various types of graphs such as bar, line, pie, histograms, scattered, frequency distribution, time line etc., to choose the most appropriate in order to present data in a simple and convincing way. Figure 1 is a complete and well-prepared graph, which otherwise presents confusing observations and reader misinterpret results leading to paper rejection (Figure 2).

If Figure 1 (correct) is compared with Figure 2 (incorrect), one can notice that in Figure 2, the unit on Y-axis is missing (does not explain what is plotted on Y-axis), the unit of X-axis is incomplete (whose species are those), the standard error bars and letters are missing from the vertical bars, which will confuse readers.

Table 3. Effect of various concentrations of Malathion on the rate of mortality of *Aedes aegypti*. *M±SE = Mean ± Standard error; @= Coefficient of Variation; ** Significant at P < 0.05). (Table prepared in the right manner).

Malathion Concentrations	<i>Aedes aegypti</i> mortality								
	5 days			10 days			15 days		
	Range	M±SE*	CV [@]	Range	M±SE	CV	Range	M±SE	
5%	8-12	9.0±0.9	2%	12-18	15±1.3	6%	18-31	27±2.3	
10%	12-19	16.0±1.1	3%	13-21	18±1.1	8	25-39	34±1.9	**
15%	25-29	27±1.3	5%	27-37	30±1.6	9	42-64	49±2.1	**

Table 4. Effect of various concentrations of Malathion on the rate of mortality of *Aedes aegypti*. (Table is not prepared in the right manner).

Malathion Concentrations (%)	<i>Aedes aegypti</i>								
	5 days mortality			10 days mortality			15 days mortality		
	Range	M±SE*	CV [@] (%)	Range	M±SE	CV [@] (%)	Range	M±SE	CV [@] (%)
5	8-12	9.0±0.9	2	12-18	15±1.3	6%	18-31	27±2.3	9
10	12-19	16.0±1.1	3	13-21	18±1.1	8	25-39	34±1.9	**
15	25-29	27±1.3	5	27-37	30±1.6	9	42-64	49±2.1	**

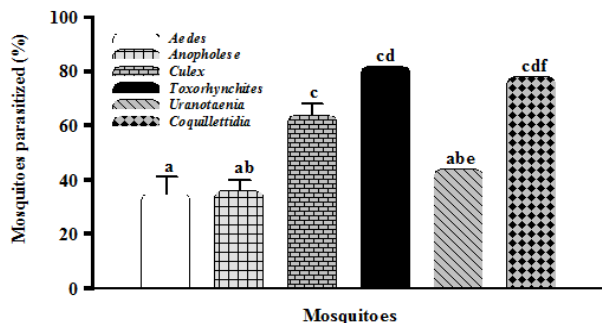


Figure 1. Preference of aquatic mites to parasitize mosquito species. Tukey's multiple range test applied to compare preferences; significant at P < 0.05). Letters on bars show statistical similarities and dissimilarities (Complete and correct graph).

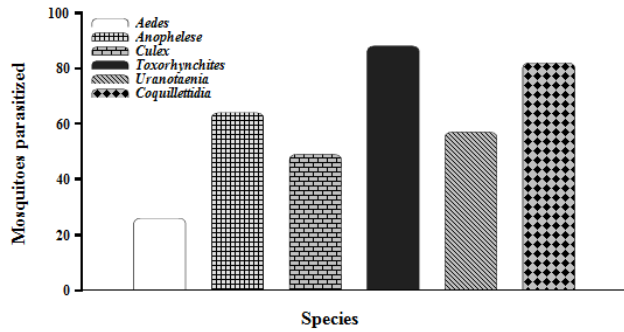


Figure 2. Preference of aquatic mites to attach mosquito species. Multiple range test was applied to compare preferences; significant at P < 0.05) (Incomplete graph).

Use Do's and Don'ts to exercise the best judgement when writing results, such as the following.

- Never repeat each and every value of the table and figures in text, refer only those which are very important, unique and new to the science.
- Avoid repeating same data in tables and figures, doing so will make the data and text redundant and useless.
- Exercise good judgment which method, table or text serves the best purpose.
 - Do not include raw data in tables or graph.
 - Prepare tables and graphs only when the data is analyzed using appropriate statistical tests.
 - Statistical tests and values (e.g., 'P' or 'F' or 'r') must always be reported parenthetically in relation to the results they are associate with.
 - Do not use entire sentences when reporting statistical results of the data.
 - Do not over use words e.g., significant or insignificant when explaining results, outcome or analysis. Giving statistical values as numerals in parenthesis would suffice the requirements.
 - Never hesitate to report negative results, since they are also the outcome of the study. It will elevate the importance of study and forms the basis of comparison with other similar studies.
 - Getting negative results may not confirm your hypothesis but it will tell why the study ended up with unexpected result. Do not feel discouraged but re-evaluate your experimental design, parameters and conditions under which study was conducted.
 - Data should always be reported in correct measuring units.
 - It is not necessary to include each and every result, use only those which are significant and relevant.
 - Determine whether text only, table, graphs or images are suitable to represent your data in results.

- k. Throughout the manuscript, data should be reported accurately, consistently and precisely.
- l. Present results in the simple and clear manner by citing tables and figures at appropriate places and avoiding verbose expressions.

		included in conclusions.
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8. HOW TO WRITE DISCUSSION

After introducing subject, proposing hypothesis, designing study, collecting data, analyzing and reporting data, now is the time to explain the meaning of results to readers [23]. Some of the important points (Table 5) to be included in discussion are the importance of the study, significance of data, relevance to previously published papers, limitations, merits of results etc., [23].

This section of the paper is comparatively more challenging to justify and write, since it includes interpretation of results, inferences made by authors and comparisons with previous studies. The acceptable, good written and well-composed discussion should never repeat what has been said in the introduction, materials and methods or result, except only when it is inevitable. Instead, establishing correlation between hypothesis and results and showing reasons of agreements and disagreements between the current and previously published studies would make the paper more enticing and informative for readers.

Table 5. Things that should be included and excluded from discussion.

	Include in the discussion	Exclude from the discussion
1	Description of the major findings of the study.	Over presentation of results.
2	Description of the meaning, scope and the importance of the outcome.	Unwarranted speculation.
3	Relationship between your findings and those of the previously published findings.	Inflation of the importance of the findings.
4	Present additional explanations and justifications of results and inferences.	Tangential issues.
5	Highlight clinical importance, significance and relevance of the outcome.	The “bully pulpit”.
6	Acknowledge the study’s limitations.	Any discussion, inferences or conclusions not supported by data.
7	Suggest ideas, questions or hypothesis for future studies.	Any concluding remarks, inferences, or take home messages, which may be

The very first paragraph of discussion must start with a topical sentence stating major findings in a direct, declarative, and succinct manner [23]. The discussion should begin with the sentence about the most important finding [24] e.g., “our study suggests that Malathion is effective against dengue mosquito and the rate of mortality was highest at 15% concentration”. Such statement follows the meaning and importance of the finding. The discussion should connect your study with other related findings published previously in such a way that they support your findings to motivate interest of readers. On the other hand, discussion must also focus and compare disagreements with other studies [25]. Avoid over presentation, exaggeration of interpretations and importance of your findings. The Tangential issues and the “bully pulpit” conclusions that do not support data must be avoided and it is better to include them in conclusions [26].

In a nutshell, discussion pulls up everything together, such as study outcome, new finding, and negative results into one argument, which authors have to explain, defend or justify by giving logics and reasoning. It is therefore, authors have to be careful when interpreting results and drawing conclusions since a well-composed and logically written discussion will arouse interests in the readers and raise the importance of the paper.

In discussion, significant results of the study must be highlighted, theoretical background explained and its impact on future research must be discussed. Results obtained during the current study must be discussed and inferences drawn swaying away from general, ambiguous, speculative and conjectural statements to substantiate arguments; statements should be supported by factual evidences and citations. Depending on what authors are discussing, writing should be both in the past and present tenses; anything new and current is presented in the present tense, whereas all previously published work is written in the past tense. Analytical approach is very important when writing discussion; unfortunately, many authors do not follow this approach and end up in writing discussion that lacks insight, facts and relevance to the correct study. Other problem of common occurrence in writing discussion is the weakness of the author to deviate from the main objectives and questions of the study and try to explain everything that comes to his/her mind. There are many interesting examples which describe the way questions are answered and interpretations made by the authors while writing discussion of their papers. However, an interesting story “Sherlock Holmes and the mystery of stars” is worth to mention here [2].

“Mr. Sherlock Holmes and his sidekick Dr. John H. Watson went on a camping trip. After a good meal, they lay down for the night, and went to sleep. Some hours later, Holmes awoke and nudged his faithful friend. ‘Watson, look up at the sky and tell me what you see.’ Watson replied, ‘I see millions and millions of stars.’ ‘What does that tell you?’ Watson pondered for a minute. ‘Astronomically, it tells me that there are millions of galaxies and potentially billions of planets. Astrologically, I observe that Saturn is in Leo. Theologically,

I can see that God is all-powerful and that we are small and insignificant. Meteorologically, I suspect that we will have a beautiful day tomorrow.’ ‘What does it tell you?’ Watson asked. Holmes was silent for a moment, then spoke, ‘Watson, you fool, somebody has stolen our tent’ [2].

9. HOW TO CONCLUDE

Should the journal allow to include conclusions as a separate heading?, it must not repeat what has already been discussed. The conclusion must be written in few lines, telling the most significant outcome of the study and what has been inferred from the study. In the case, journal does not allow conclusion then discussion must end with conclusive remark.

10. WHOM TO ACKNOWLEDGE

Acknowledgement is the last and small section that journals allow the authors to thank individuals, institutions, and sources, who have helped in completion of the study. For example, the agency, which has granted funds to conduct study, an individual who has helped testing samples or writing paper, and statistician who has helped in analyzing data etc. [2].

11. HOW TO PREPARE LIST OF REFERENCES

Although, preparing the list of cited references appears an easy part of paper writing but every journal wants authors to prepare their papers according to journal’s format. Preparing a proper reference list is one of the most tedious aspects of finalizing a manuscript for publication. All cited references in the text must match with the list of references. The names of authors, year of publication, title, name of the journal, volume and page numbers must be given accurately and exactly as they appeared in the original publication. There are as many styles of reference citation as there are journals [2], nonetheless, following journal’s instruction is the best way to prepare your list of references.

12. WHAT SHOULD BE INCLUDED IN APPENDIX

Appendix, addendums, glossary etc., are subjected to journal’s policy. Such sections are included to explain experimental factors such as weather conditions, landscapes, soil conditions, water quality, socio-economic conditions, instruments, questionnaires, statistical analysis and other details, which are useful but cannot be included in other sections of the paper [2].

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