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Review
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Criticism of a Scientific Article, Discussion: Review

Abstract

In the developing and changing world, it is very important to present information to the service of humanity. Scientific articles, one of the ways of conveying information in written form, are defined as a written and published report describing original research results. The writing of a scientific research paper is a professional nature but very difficult task that requires significant knowledge, experience, and skill. The most important point that the researcher should know for scientific articles is that the article is scientific in nature and clear that the readers can understand. The accepted order in a scientific research article written in accordance with the writing criteria is title, abstract, introduction, material-method, results, discussion, and references, and each section has its own specific writing rules. The discussion section, which is among the article sections, is the most difficult part to write, although it is easy to write in terms of content. In this section, the researcher should critically investigate his own results and those of other researchers and interpret his conclusions from a scientific point of view. In this section, the researcher conveys his views, acceptances, and criticisms on the subject to the reader and the scientific world. In this review, it is aimed to emphasize the elements that should be included in the discussion section of a quantitative research article in line with the literature, and some important points to make the article attractive and acceptable for publication, especially for researchers who are just starting out in research writing.

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Introduction

In the developing and changing world, it is very important to present information to the service of humanity. While the transfer of knowledge to future generations was with the reliefs made on the cave walls in the past, today it is carried out with written sources. The information obtained as a result of research is published in scientific journals and presented to the service of science and humanity.[1] A scientific article is a report written and published according to certain rules, describing original research results. Article writing is a professional job that requires significant knowledge, experience, and skill.[2]

The most important point that the researcher should know for writing a scientific article is that the article should be of scientific quality and clear for the readers to understand, simple, understandable but in accordance with the rules of article writing.[3] The order accepted in a scientific research article written in accordance with the writing criteria is title, abstract, introduction, materials-methods, results, discussion, and references.[4,5]

In the writing of a scientific research article, each section should be written carefully and in accordance with the rules. Because, each department has certain rules that contain its own universal norms and must be followed.[5,6] The discussion section, which is among the stages of a scientific article, is easy to write in terms of content, but it is the most difficult part to write especially for young researchers.[5-7] This section first requires the researcher to have a good grasp of both his own and other researchers' results and method, then to investigate them critically and to interpret his conclusions from a scientific point of view.[8] Also, the discussion section is the only section where the researcher shares his views, acceptances, and criticisms with the reader and the scientific world, and where his thoughts and comments about the validity, limitations, difficulties, and applicability of the research are included.[1,9]

Another reason that challenges new researchers and requires writing this review is that the writing of the discussion section differs according to the type of research (whether it is a qualitative, quantitative, or systematic review).[9,10] In this review, it is aimed to emphasize the elements that should be included in the discussion section of a quantitative research article in line with the literature, and some important points to make the article attractive and acceptable for publication, especially for researchers who are new to research writing.

Writing the Discussion Section

Discussion section is the section where the data obtained as a result of the research and what the results mean are answered.[1,9,10] Since it is a continuation of the research, the meaning of the results is explained to the reader with the flow chart in the other sections. In other words, the writing of the discussion section, which is the place where the research article should convince the readers and editors of the accuracy and acceptability of the data, is very important.[4] It should be noted that when the discussion section is not well written and not written in accordance with the rules, the possibility of rejection, and scientific acceptance of the article increases.[1]

The general structure of the discussion section should be presented to the reader in the form of introduction, discussion of the research results, limitations of the research, conclusions, and recommendations.[10] In the introduction part of the discussion, a connection is made with the introduction part of the article in the light of current literature on why the subject of the article is important and a small reminder is made.[10,11] Then, with reference to the current work (to narrow the focus), the chosen topic is considered more closely why it is important to readers. The aim is not to distract the reader from the article and to increase the readability of the article. The better the introduction to the discussion, the greater the reader's interest in the article.[10-12]

The references used in the introduction part of the article are also used in the discussion part, but the purpose of the reference is different. It is planned to emphasize the importance of the subject and to give information about the subject by showing the literature information used in the introduction and the studies about the article as an example. In the discussion section, the same literature is used to interpret the results.[12] In the introduction part, one or more research questions are put forward based on the literature related to the research, while in the discussion part, the questions in the introduction part are answered in line with the results.[10,13] The main function of the discussion section is to provide a scientifically valid and reliable answer to the research question in the introduction. It is also to enable the research results to form a new research question.[14,15]

Describing the content of the discussion is more difficult to define than the content of other sections.[10,16] Before start writing, we need to create an outline of how we will write, how we will present the results. Because this section explains what the research results mean and how our results contribute to the field of study of the research.[14] More pragmatically, the discussion explains how the research question posed at the beginning of the article came to a conclusion.[15]

The order of the discussion section varies from author to author. Docherty and Smith (1999)[16] proposed a structure for discussion sections to improve standardization. While this structure is not a "one size fits all" formula, it can help new researchers prepare efficiently. This standard structure should help the author point out the most important issues to be covered in this chapter and help the reader find specific information in the discussion. Docherty and Smith (1999)[16] suggest using the following structure.

- The research should be entered with an introductory paragraph that includes the importance, purpose, and method of the subject.
- First of all, the main results obtained in line with the purpose of the research should be expressed.
- When discussing the results, the strengths and weaknesses of other studies, especially the differences in results, should be discussed.
- After the discussion of the results, the strengths and weaknesses of the study should be presented.
- Provide information on unanswered questions and future researches.

Expressing the Importance of the Subject, Purpose, and Method

Before presenting the important results of the research in the discussion section, a brief paragraph should be mentioned about the importance of the subject, its purpose, and the method used to achieve this aim, to remind the reader of the research question. In this example, "Urinary Incontinence is more common in women than men and affects women of all ages. However, it mostly affects middle-aged women. In this study, the mean age of women was found to be 54.17 ± 15.34 years."[17]In this example, it reminds the reader of general information by referring to the introduction and links with other parts of the research by giving examples from the results section.[15]

Expressing Key Results

The important results stated in the research are rearranged and a discussion is opened. Key results are questions that make up the research question/purpose stated in the introduction and should be addressed using the same terms.[15] If the research question was only partially answered, it should be explained which aspects of the question were answered and why. The answer to the research question represents the apex of the article. Therefore, the discussion should be started with the answer to the research question and the result obtained should be used to initiate a discussion for further applications or generalizations.[12,14]

When giving secondary results, results should be summarized and generalized rather than repeating them.[15] If necessary, reference should be made to figures or tables presenting the results discussed (such as Table 1, Figure 2). After stating the positive or negative results of the study, supporting evidence or other important results about the study should be presented.

Discussing Strengths and Weaknesses of Other Studies and Differences in Results

After presenting and discussing the main results of the study, the discussion should be strengthened by examining the main results of the current study with the results of similar studies in the literature. A number should be targeted when scanning studies related to the field of study for discussion purposes. Studies that are not mentioned in the introduction of the study can be mentioned in the discussion, but citing a large number of studies for the first time in the discussion can tire the reader, disrupt the integrity of the research and cause disconnections.[12] While the results of the study are interpreted with the results of the literature, the findings may be similar as well as different results. For example; "The study is consistent with the results." or "The study is different from the study of X...," "38% of the women in the study of X et al. (2014) were found to be smokers, and this result is consistent with the results of our study (38.44%)."

Although the results of the study may differ from the information or study results available in the literature, it can also expand the limits of the results. In line with the literature and research results, an improved or a new model can be suggested.[9,12,15] While discussing the results of the study, not only the statistically significant ones or the results that support the hypotheses but also the unexpected results that do not support the hypothesis should be discussed concretely.[9,18] These results can lead the researcher himself and other researchers to new discoveries and broaden the perspective of the study[15] or serve as useful indicators for the advancement of knowledge. When unexpected results change the focus of the study, this should be shared with the reader and briefly explained in an impartial and subjective manner.[9]

Research Strengths and Weaknesses

The research may need to highlight the research method and approaches used, along with their limitations, when describing strengths and weaknesses.[9] Although the study's strengths help convince readers of the validity of the conclusions drawn,[19] editors and readers may be more concerned with the study's limitations. Therefore, equal emphasis should be placed on strengths and limitations.[16] Limitations should be discussed assuming that there is no evidence to reject the hypothesis in general, and the experimental design used is reasonable,

and the limitations of the study should be implicitly given to the reader.[9] Knowing the limitations of the study allows its results to limit generalizations and show ways to improve future studies.[4,12,18] By outlining concrete future strategies to implement, you can create a more persuasive situation for readers.[19]

It is necessary to explain the reasons for the limitations found and the effects of these limitations on the results of the study.[19,20] To positively affect future studies on the same subject and to minimize or eliminate "errors", changes and improvements in study design are recommended. In certain cases, the impact of limitations is reduced by reporting that other researchers have experienced similar problems or that the current state of knowledge cannot solve the problems being compared.[9] When talking about limitations in research: "Limitation in the structure of the study." or "Another important limitation." "This study has some limitations." sentences may be included. For example; "As the sample analyzed was outpatients presenting at a geriatric clinic, our results from the study cannot be generalized to all elderly people living at home in Italy."[21,22] Here, the limitations regarding the sample group are presented to the reader. Authors should be given an opinion on how limitations affect the quality of the evidence, and the direction and magnitude of biases should be discussed. For example, a recent study reporting the relationship between "quality of life of the elderly, retirement home placement and death" discussed the potential mechanism of selection bias by economic status. The authors concluded that a selection bias based on economic status is unlikely because access to health care and therefore choosing to work does not depend on economic situation."[19–23]

As described above, few authors discuss how limitations affect the strength of conclusions that may have been drawn. However, authors need to leverage their knowledge of the content and familiarity with the work and the methodological context to avoid misinterpretation of the limitations of interpreters and readers. It is necessary to discuss strengths that may offset or outweigh the limitations of the study. However, as stated earlier, the topic should be sticky and not push too hard on the discussion.

One of the mistakes made in the discussion section is to exaggerate the significance of the results[9,24] or use very strong statements. For example, saying "Results of current study support..." or "these results..."; It is more appropriate to say, "The results of the current study prove it." or "that means..." Words such as "likely", "possibly" or "suggested" should be used to soften the results.[9,25–27] Particularly when writing how the study was implemented, one should be clear about the strengths and the discussion should not be limited to general statements about the study design.[28,29] Strengths "This study has several strengths." should contain the expression. The statement "One of the strengths of this study is to provide the first evidence to evaluate the effect of probiotics added to maternal nutrition on infantile colic symptoms",[21] which is given in strengths, mentions how valuable the study is by showing that it is being implemented for the first time.

Concluding part of the study

At this point in the discussion, describing the theoretical or practical results includes emphasizing the results from which the results can be used or lead to the development of new applications in the future. Listing key results allows the reader to understand the value of research beyond the narrow goals of the research.[12,30] In some cases, it may also make sense to emphasize what the results do not show, to prevent readers from drawing unjustified conclusions.[16] It is also possible that there are no clear implications for the study.[12] "The Quality of Life Questionnaire of the Elderly (QOL) can be used, at least in outpatient settings, as a tool to screen for issues of vulnerability to poor health outcomes of the elderly and thus better plan appropriate interventions to improve their prognosis."[21,31,32] This statement shows that the researcher made inferences with the usability of YYKA.

Unanswered Questions, Conclusion and Recommendations

Questions that remain unanswered by the research results should be discussed, and ways for future research should be briefly proposed to address these questions further.[16] At the end of the discussion, the article should be concluded by writing a summary of the main points that the reader is asked to remember based on all the issues discussed.[9]

Results should form the basis of the methods presented in the article (taking into account both the study's strengths and limitations) and the evidence (taking into account your findings and those of other studies). It should be noted that both negative and positive findings in the study are equally important.

The conclusion and recommendations section is the most important message of your article to the scientific world. Suggestions should be given based on the results and it should be emphasized what can be done about the issue discussed. It should inspire other researchers with suggestions, but not too many and not exceeding two or three suggestions. The discussion should end with a brief summary or conclusion stating the importance of the study. According to Day and Gastel (2017), Aderson and Thistle state that "the result of a good article is like the pinnacle of good music." Many papers lose the impact of research because it often expands into a delta in the flow of the discussion and does not bring it to a clear peak."

For this reason, before starting to write, it should be created a draft containing the answers to the following questions. **The following questions should be answered while writing the discussion section:**[9,13–16]:

What are the most important results of your study?

- Do the results accept or reject your hypothesis?
- Do your results suggest an alternative hypothesis?
- What other factors might affect your results?
- What are the similarities of your results with other research results?
- How do your results differ from other research results?
- What research is needed to explain the problems arising from your results?
- What are the strengths and weaknesses of your research in relation to other research?
- Did you explain unexpected results?
- What assumptions were predetermined?
- How do your findings fit with current knowledge on the subject?
- How do your results affect knowledge about the problem under investigation?
- Why is the contribution of your research to science important?
- Can you develop your hypothesis or model?
- Which mechanisms explain the phenomenon under investigation?
- Does your research have a theoretical or practical application?
- Have you proposed changes to experimental designs that will be implemented in future studies that might address the problems or limitations you experience?
- What new questions arise from your work?
- What generalizations can be made from your work?
- How can your results be generalized to other fields of science?

Difficulties and Faults in Writing the Discussion Section

Given the broad focus of the discussion, researchers have difficulties and make mistakes in this section.[1,10] One of the most common mistakes is not discussing the significance of the results at all or not being discussed adequately, or misinterpreting the findings. As a result, even if the data in the article are valid, reliable and interesting, misinterpretation of the data may cause the journal editor or the referees to ignore the article, reject it and ignore an important data within the scope of the study.[10] Another mistake is that many young researchers limit the discussion to comparing their results with those of other researchers or to research findings that are similar to those of other researchers. However, in this section, it is important for the researcher to present the results that are similar to the research results as well as the results that are not similar to the reader with their own comments. In addition to these mistakes, here are the points to avoid when writing the discussion section:[9,15,21]

- Too little or too much explanation included in the discussion.
- In the discussion, starting the text with a narrow focus and not generalizing afterwards.
- Inclusion of data not presented in the results section into the discussion.
- Not defining the detailed aspects of the results.
- Not using linked sentences to associate results with interpr etations.
- Emphasizing the irrelevant and incidental results given in the results (must focus on the hypothesis).
- Presenting uncertain data source (are you writing about your study or another study?).
- Criticism of other researchers (being professional).
- Making unwanted fictions.
- Not emphasizing the importance of your results.
- Presenting the result that is not supported by the data or that the results are disseminated more than necessary.
- Reaching conclusions in the discussion that are not related to the objectives presented in the introduction.

Suggestions for Writing the Discussion Section

The first step in preparing the discussion section is to prepare an outline in order to organize and present it in a logical way in line with the research results. Also, one should always keep in mind the purpose/hypothesis of the study during the writing process to avoid obscuring the message with topics outside the scope of the research.[22,23] For long discussions, you should also use subheadings in the discussion section in accordance with the subheadings in the results to ensure reader understanding and highlight the main points you want.[4,24] The discussion should be presented in the same flow order as the research questions/hypotheses and the tables given in the results. This will make it easier to read, understand and follow the research. To avoid plagiarism, the researcher should write the discussion part in his own words after interpreting, summarizing, and generalizing the relevant articles.[25]

The grammar rules that should be used in the discussion section should not be used in the first person singular and active sentences to make the discussion writing more lively and interesting. Even if there is only one author of the article, it is necessary to use the plural "us." When talking about results, the simple past tense should be used, and when talking about general or correct information, the present tense should be used. Also, the present tense should be used when answering a question or stating your research question.[15,33,34] The indefinite past tense ("we defined") should be used to describe what has been achieved in research.[9] The work of others (established knowledge) should be told in the present tense, but their own research results should be told in the past tense.[1] The conclusion part of the discussion should be written in the past tense, and the recommendations part should be written in the present tense, as it gives the finished results of the research. Except those, the length of the "discussion" section should not exceed the sum of the other sections and should be completed within 6-7 paragraphs. Each paragraph should not contain more than 200 words, words should not be written repeatedly. As in other parts of the article, the text of the discussion section should be written in simple language, as we spoke with our colleague. A single point should be specified in each sentence and should not exceed 25-30 words.[9,26,27,33]

Regarding the writing of the Discussion section, the information given so far is generally related to the quantitative research method most used in research. Apart from this, research methods such as qualitative, systematic review and meta-analysis are also used in research. In these research methods, the writing of the discussion section shows some differences and changes according to the research types, and the authors should pay attention to this situation.

Conclusion

When writing the discussion section of research, scientists should first think about the topic being researched, the quality of the studies conducted, and what can be changed in future studies. In this section, in addition to the importance of the research, it is necessary to interpret the important results of the research by taking support from the literature. While demonstrating the practical use of research, it should also show what the study might reveal beyond your own research question. When the results of the study differ from the hypotheses, possible ways for future research can be suggested based on the knowledge learned about the given problem. It should also be stated what the innovations brought by the research are. This last part of the discussion should provide readers with practical information and new research ideas for other researchers.

Peer-review: Externally peer-reviewed.

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