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# Understanding of Research Bias in Herbal Medicine: A Comprehensive Review

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***Abstract***

***Background:*** *The communication and generation of knowledge are central to research. In herbal medicine, with its deep historical roots, research must be methodologically rigorous and unbiased to validate traditional knowledge in modern contexts. Bias, defined as any tendency preventing objective evaluation of a research question, compromises validity and reliability.* ***Objective:*** *To highlight types of research bias in herbal medicine and discuss strategies for minimization to ensure credible and applicable findings.* ***Methods:*** *A narrative review of literature was conducted to identify common forms of bias in herbal drug research and approaches for mitigation. Classical texts and modern scientific perspectives were synthesized to present a structured understanding of research bias in this domain.* ***Results:*** *Research bias in herbal medicine may arise during study design, participant selection, data collection, analysis, and publication. Key biases include design bias, selection/participant bias, measurement bias, analysis bias, publication bias, unconscious bias, and channeling bias. These can lead to misinterpretation of results and reduced applicability of findings. Minimization strategies include proper study design, randomization, rigorous data collection tools, triangulation, transparent analytical processes, respondent validation, and ethical oversight. Quantitative studies require robust sampling, follow-up, and randomization, whereas qualitative studies demand purposeful sampling refinement, avoidance of early closure, and methodological transparency.* ***Conclusion:*** *Bias is inherent in research designs, but it can be mitigated through ethical, methodological, and analytical safeguards. Recognizing and minimizing bias is essential for authenticating herbal drug research, preserving validity, and enabling evidence-based integration of traditional knowledge into modern healthcare.*

**Keywords:** Data collection, evidence-based practice, herbal medicine, research design, selection bias

## INTRODUCTION

The communication and generation of knowledge are central to the concept of research. Effective research must be thoroughly planned, methodologically sound, scientifically executed, and conducted with integrity – free from bias. In the field of herbal medical sciences, which has existed for centuries, long before the Common Era, this is especially important.

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Herbal medicine is not a recent development; it has deep historical roots supported by classical texts. Therefore, researchers conducting studies on herbal drugs must ensure that the substances under investigation are authentic and referenced in classical literature. The research should then be conducted using scientifically rigorous methods to validate traditional knowledge in modern contexts.

Bias refers to the tendency or possibility of deviation from factual accuracy during various stages of research, including data collection, analysis, interpretation, and publication. Such deviations can lead to false conclusions and misinterpretations of

 

findings [1]. Simply put, bias can be defined as any tendency that prevents objective and impartial consideration of a research question [2, 3].

Bias introduces systematic inconsistencies into research, thereby compromising the purity of primary comparisons and negatively affecting the internal validity of a study [4]. Recognizing and mitigating bias is, therefore, critical for ensuring the credibility and applicability of research findings, particularly in the domain of herbal medicine.

## UNDERSTANDING OF BIAS

Understanding bias in research is very important for several reasons. First, bias exists in most research, across various research designs, and is challenging to eliminate. Second, bias can occur at all phases of the research process. Third, and most importantly, bias affects the validity and reliability of research findings and can lead to misinterpretation of data (Figure 1) [5]. In herbal drug research, bias may also be present – such as during the selection of drugs, environment, volunteers, literature sources, and research design.

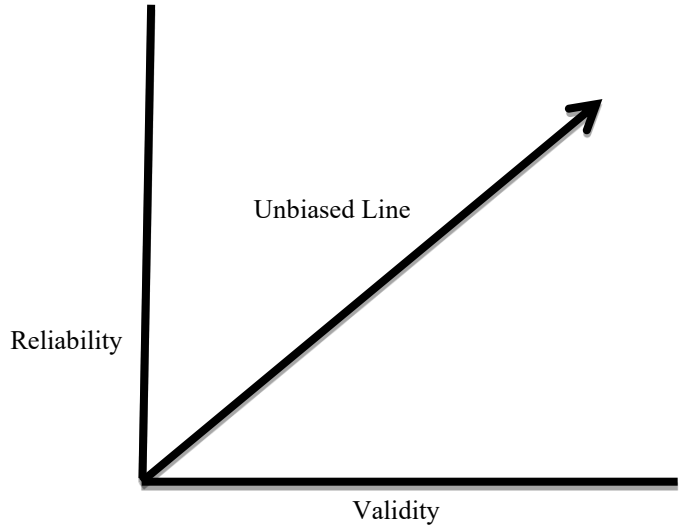


**Figure 1.** Unbiasedness increases, validity, and reliability increase.

Bias can be related to the study duration. For example, if the literature shows that a herbal drug works after 15 days, but the researcher plans the study for only 10 days, it may affect the study results.

## TYPES OF RESEARCH BIAS IN HERBAL MEDICINE

There are different types of research bias that are depicted in Table 1.

**Table 1.** Different types of research bias.

| S. N. | Types of research bias | Description |
|---|---|---|
| 1. | Design bias | Improper study design increases the probability of bias [5]. For example, a researcher working for a herbal pharmaceutical company may choose a research question that supports the usefulness of the herbal drug being investigated during research. |
| 2. | Selection/participant bias | Selection bias is an alteration in a measure of association between sample selection and the target population. Selection bias may occur when a researcher opts for improper procedures for selecting a sample size [6].<br><br>Sometimes, the number of participants remaining in the study and a few participants withdrawing from the study make a difference in the result [5]. For example, an assessment of weight loss with the intervention of honey-mixed hot water on an empty stomach may be affected by participant withdrawal, because the participant is not losing weight, may drop out, which may give biased findings. |

 

| | | |
|---|---|---|
| 3. | Data collection bias and measurement bias | Bias during data collection is defined as when a researcher's personal beliefs affect the way information is collected.<br><br>In quantitative studies, measurement bias can occur if a study-related tool or instrument is not valid or reliable (for example, using the attitude-related tool that measures patient satisfaction rather than attitude).<br><br>In qualitative research, the interview is a common technique of data collection; what type of questions asked will influence the outcome. For example, a leading question, "Are you feeling well after taking Senna Leaves as a laxative?", is likely to receive a closed answer of yes or no, and not give a complete experience of participants and could be replaced with, "Please can you describe your condition after using Senna Leaves as a laxative?" [5]. |
| 4. | Analysis bias | When analyzing data, the researcher may naturally look for data that confirms their hypotheses or confirms personal experience, overlooking data inconsistent with personal beliefs [7]. |
| 5. | Publication bias | Published studies nearly always have some degree of bias. For example, in quantitative research, if the result is statistically significant, then it is sent for publication [7]. In qualitative studies, because of a lack of depth and findings that are not clearly presented, it is not sent for publication [5, 8]. |
| 6. | Unconscious bias | Unconscious bias is defined as when a decision is taken based on our prior experience, deep-seated thought patterns, assumptions, or interpretations [9]. |
| 7. | Channeling bias | Channeling bias exists when patient prognostic factors or the degree of illness influences the study cohort into which patients are located. This bias is more likely in non-randomized trials [2, 10]. |

## MINIMIZATION OF BIAS DURING RESEARCH

In all study designs, bias exists, so researchers should try to minimize biases to enable authentication and greater critical assessment of the research findings and conclusions. Writing clearly and in a rational manner and choosing an appropriate research design according to the study aims can reduce bias. The ethical committee also plays an important role in considering whether the defined research design and methodological approaches are biased, and in addressing the problem being investigated. Feedback about research design should be given from peers, funding bodies, and ethics committees, because they often provide valuable practical directions to develop research design [5]. Brief descriptions of qualitative and quantitative research bias and how to reduce the bias are presented in Table 2.

**Table 2.** Types of research bias in quantitative and qualitative studies with strategies for minimization.

| S. N. | Type of research | Description of bias | Minimization of bias |
|---|---|---|---|
| 1. | Quantitative research | i. Selection bias in clinical trials.<br>ii. Sample bias if the dropout of participants [5, 11].<br>iii. Bias related to data collection and analysis [5, 12].<br>iv. For all other biases. | i. Randomization of participants and comparison groups.<br>ii. A researcher should not account for them [5, 11].<br>iii. By well-designed research protocol and maximizing follow-up [5, 12].<br>iv. Respondent validation, constant comparisons across participant accounts, prolonged involvement or persistent observation of participants, independent analysis of the data by other researchers, and triangulation [5, 12]. |
| 2. | Qualitative research | i. Purposeful sampling inculcates the sample bias [5, 13].<br>ii. Early closure of the selection of participants before complete analysis induces bias [5].<br>iii. Lacking transparency about the analytical processes [12]. | i. Constantly refining of sample to meet the study aims [5, 13].<br>ii. Avoidance of early closure of the selection of participants makes the qualitative research valid [5].<br>iii. By rigorous demonstration of the relationships among factors, it should be associated with openness, relevance to practice, and harmony of the methodological approach [12]. |

Minimization of bias is considered a key factor during the design and undertaking of research. The ethical duty of researchers is to find out the limitations of studies and should know potential sources of

 

bias. This will enable health professionals to assess and analyze study results and consider these when applying findings to health-related practices [5].

## DISCUSSION

The identification and minimization of bias are essential to ensuring the validity and reliability of research findings. This is particularly critical in herbal medicine research, where methodological inconsistencies can compromise both scientific integrity and clinical applicability. Bias, if unaddressed, can distort study outcomes at multiple stages – ranging from sampling to data interpretation – and may lead to misleading conclusions. Researchers must be proactive in recognizing potential sources of bias before initiating a study. Understanding the mechanisms through which bias can occur is vital for designing appropriate control strategies. For instance, in sampling bias, iterative refinement of the sampling process can help ensure that the study population accurately reflects the target population. In clinical trials, randomization of participants and balanced allocation to intervention and control groups serve as key strategies to minimize selection bias. Bias is inversely related to the validity and reliability of research outcomes: as bias increases, the credibility of results diminishes. Therefore, reducing bias is not only a methodological necessity but also an ethical obligation – especially in herbal medicine, where research findings may influence traditional therapeutic practices and public health decisions. By systematically addressing bias, researchers contribute to the generation of more accurate, reproducible, and impactful scientific knowledge, reinforcing the credibility of herbal medicine within the broader biomedical research landscape. Such efforts ensure that the integration of traditional wisdom into current medical frameworks remains both rigorous and scientifically defensible across all levels of global health implementation and policy.

## CONCLUSION

In herbal medicine research, understanding, and minimizing bias is crucial to ensure accuracy and credibility. Bias directly impacts the reliability and validity of findings, and, therefore, must be actively identified and reduced. Researchers must be vigilant about how bias arises and implement strategies to control it at every stage. Unbiased research strengthens clinical trials, literary analysis, and evidence-based policymaking in herbal medicine. A clear grasp of bias enhances both the scientific and practical value of herbal research.

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