

International Journal Research Publication Analysis

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ISOLATED AND COMBINED PRACTICES OF YOGA, NATUROPATHY AND AYURVEDA ON SELECTED PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES ON IMMUNITY AMONG ADOLESCENTS

***Bhatt Vipul Natwarlal, Dr. Gurtej Kataria**

Assistant Professor, Sunrise University, Alwar, Rajasthan.

Article Received: 07 August 2026

*Corresponding Author: Bhatt Vipul Natwarlal

Article Revised: 27 August 2026

Assistant Professor, Sunrise University, Alwar, Rajasthan.

Published on: 17 September 2026

DOI: <https://doi-doi.org/101555/ijrpa.3372>

ABSTRACT

Adolescence is a period of rapid physical, cognitive, emotional and social development during which health behaviours can influence both immediate well-being and later health. This paper examines the potential contribution of isolated and combined practices of yoga, naturopathy and Ayurveda to selected physiological and psychological variables relevant to immunity and adolescent well-being. The paper adopts a narrative, evidence-informed review approach rather than presenting fabricated primary data. Recent systematic reviews and controlled studies suggest that yoga may influence stress, anxiety, well-being and selected inflammatory or immune-related markers, although the evidence remains heterogeneous and is generally stronger for psychological outcomes than for direct immune endpoints. A large school-based Indian cluster randomized trial also reported improvements in stress, salivary cortisol, metabolic measures and attention following a standardized yoga programme. The present framework therefore proposes that an integrated approach should be studied through measurable physiological, psychological and immune-related outcomes, while maintaining clear separation between traditional-health practices and clinically established medical treatment. The paper identifies a research pathway for adolescent populations, including baseline assessment, standardized intervention, monitoring, ethical safeguards and post-intervention evaluation.

KEYWORDS: adolescents; yoga; naturopathy; Ayurveda; immunity; physiological variables; psychological variables; integrative health; stress management.

1. INTRODUCTION

Adolescence, generally defined by the World Health Organization as 10–19 years of age, is characterized by rapid physical, cognitive and psychosocial change. These changes make adolescence an important period for establishing patterns of physical activity, sleep, diet, stress management and health-seeking behaviour. WHO emphasizes that adolescent health interventions should be evidence-based and responsive to the developmental needs of young people. [1,2]

Yoga is increasingly studied as a mind–body practice that combines physical postures, breathing regulation, relaxation and, in many traditions, meditation. Naturopathy emphasizes lifestyle, diet, physical activity and nature-based approaches, while Ayurveda provides a traditional framework involving individualized routines, diet and health practices. In a research setting, these systems can be examined as complementary components rather than as substitutes for diagnosis or treatment of disease.

2. Rationale and Research Problem

The health of adolescents cannot be understood through a single physiological indicator. Stress, sleep, physical activity, nutrition, emotional regulation and social context can interact with autonomic and endocrine responses and may influence health-related behaviour. Psychological stress is particularly relevant because prolonged stress can affect sleep, mood, concentration and behavioural choices. WHO notes that adolescence is a formative period for mental health, and that anxiety, depression and behavioural disorders are important contributors to adolescent illness and disability. [2,3]

The literature on yoga in children and adolescents is encouraging but uneven. A 2024 integrative review of 16 studies involving more than 1,000 children and adolescents reported benefits across symptoms, self-control, cognitive functioning, relaxation and well-being, while also calling for stronger evidence. [4] Earlier systematic reviews similarly found reductions in anxiety and some improvements in psychological outcomes, but emphasized heterogeneity in study design and intervention content. [5,6] These findings justify further investigation, but they do not support a blanket claim that yoga or traditional health systems improve immunity in every adolescent.

3. Objectives

- To examine the theoretical and empirical basis for studying yoga, naturopathy and Ayurveda in relation to adolescent health.

- To identify physiological and psychological variables that can be measured objectively in future intervention studies.
- To examine the available evidence concerning yoga, stress, well-being and immune or inflammatory markers.
- To propose an integrated research framework that can compare isolated and combined interventions without overstating causality.

4. Research Questions

- What changes in selected physiological variables are associated with structured yoga-based interventions in adolescents?
- What changes in psychological variables such as perceived stress, anxiety and well-being can be observed?
- Do isolated and combined mind–body and lifestyle interventions show different patterns in immune-related indicators?
- Which intervention components and outcome measures should be standardized for future controlled studies?

5. Conceptual Basis

The proposed model treats physiological regulation, psychological well-being and immune-related outcomes as connected but distinct domains. Yoga may influence these domains through physical activity, breathing regulation, relaxation and stress management. Naturopathic and Ayurvedic components may contribute through routine, diet, sleep and lifestyle practices. The appropriate scientific test is therefore to measure each pathway separately rather than assuming that an improvement in one domain proves improvement in another.

This distinction is important because immune function is multidimensional. Inflammation markers such as C-reactive protein, interleukin-6 and tumour necrosis factor-alpha are not interchangeable with measures of cellular immunity, mucosal immunity or clinical resistance to infection. A well-designed study should predefine its primary outcome and avoid using the word “immunity” as a single undifferentiated endpoint.

6. Conceptual Framework

Figure 1. Conceptual framework for an integrated mind-body-lifestyle pathway

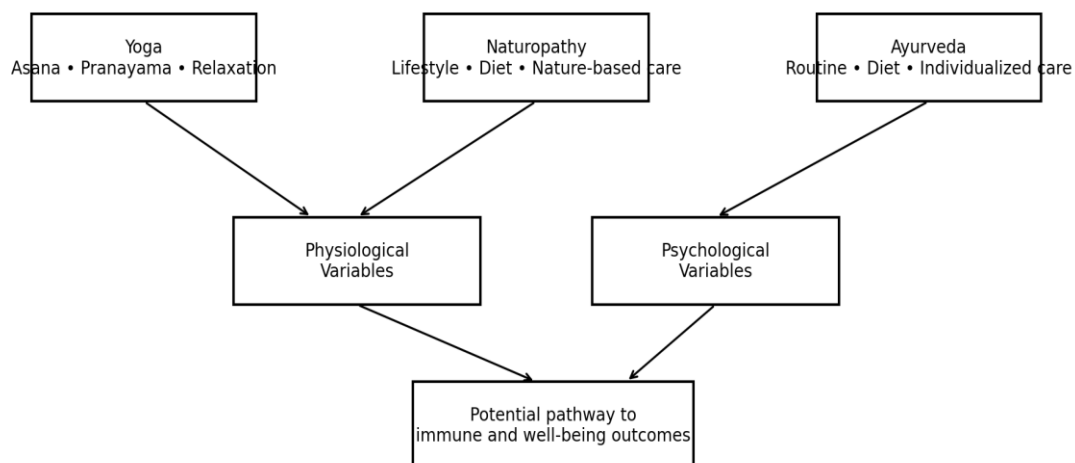


Figure 1. Conceptual framework linking intervention components with physiological, psychological and immune-related outcomes.

The framework places yoga, naturopathy and Ayurveda at the intervention level and separates the intermediate outcomes into physiological and psychological domains. The final domain consists of immune-related and broader well-being indicators. This structure helps prevent circular reasoning. For example, a reduction in perceived stress should be reported as a psychological outcome; it should not automatically be interpreted as proof of improved immune competence.

7. Evidence for Yoga and Immune-Related Outcomes

Evidence concerning yoga and immunity is promising but should be interpreted cautiously. Falkenberg, Eising and Peters reviewed 15 randomized controlled trials and reported a general pattern toward reductions in some pro-inflammatory markers, including evidence concerning IL-1 β and indications for changes in IL-6 and TNF- α . The authors also noted that the evidence base was small and inconsistent for several immune parameters. [7]

A later systematic review of randomized controlled trials identified 11 eligible trials and concluded that yoga may have favourable effects on anti-inflammatory markers, while noting substantial heterogeneity and limitations in study quality. [8] A 2024 systematic review and meta-analysis of 26 studies also reported favourable findings for several inflammatory

markers, but highlighted high risk of bias in most studies and the absence of statistically significant pooled effects for some markers. [9] These reviews support further research, not definitive claims of immune enhancement.

8. Evidence in Adolescents

Adolescent-focused evidence is particularly relevant to the proposed topic. In a large cluster randomized controlled trial involving 2,000 Indian adolescents aged 13–15 years from 24 schools, a 17-session yoga programme including pranayama, basic asanas, meditation and relaxation was associated with significant improvements in stress, salivary cortisol, metabolic parameters and attention compared with an education group. [10] This study is useful because it demonstrates the feasibility of evaluating physiological and psychological variables in school settings.

A mixed-method study of adolescents aged 13–15 years also reported improvements in happiness, perceived stress, quality of life and psychological general well-being following Yoga-nidra sessions. [11] More recent controlled evidence continues to suggest that structured yoga-based programmes can improve adolescent psychological outcomes, although intervention dose, participant characteristics and comparison conditions differ substantially across studies. [4,12]

9. Why Combined Practices Need Separate Evaluation

Combining yoga with naturopathic or Ayurvedic lifestyle components may reflect real-world integrative practice, but it creates an attribution problem. If a combined programme produces improvement, the investigator cannot know which component was responsible unless the study design includes appropriate comparison groups. A factorial or multi-arm design can therefore be more informative than a single pre–post group.

10. Proposed Methodology for a Future Controlled Study

Because the present paper is an evidence-informed research framework, it does not invent participant numbers, laboratory results or statistical findings. The following methodology is proposed for a future empirical study.

Table 1. Suggested outcome structure for a future adolescent intervention study.

Domain	Suggested variables	Possible measures
Physiological	Resting heart rate, blood pressure, BMI, waist circumference	Validated clinical instruments; standardized measurement protocol
Stress physiology	Salivary cortisol	Validated collection and laboratory assay
Psychological	Perceived stress, anxiety, depressive symptoms, well-being	Validated adolescent scales
Immune/inflammatory	CRP, IL-6, TNF- α , selected immune markers	Laboratory assays selected a priori
Lifestyle	Sleep, physical activity, diet adherence	Validated questionnaires and/or activity monitoring

11. Suggested Intervention Arms

A four-arm design could compare: (A) usual school health education; (B) yoga alone; (C) a standardized lifestyle programme based on predefined naturopathic and Ayurvedic components; and (D) a combined programme. Such a design would permit comparison of isolated and combined effects. The exact content should be specified before recruitment and should not be changed according to interim results.

A practical yoga protocol could include warm-up, selected asanas appropriate for adolescents, breathing exercises, guided relaxation and a brief mindfulness or meditation component. The programme should be delivered by appropriately trained personnel, with attendance recorded. Any Ayurvedic or naturopathic component should be operationally defined, including dietary advice, daily routine, sleep recommendations and any practitioner-led practices. Herbal products should not be introduced casually in an adolescent research protocol; their safety, standardization, dose and interaction profile require formal ethical and clinical review.

12. Assessment Schedule

Figure 2. Suggested research and intervention pathway

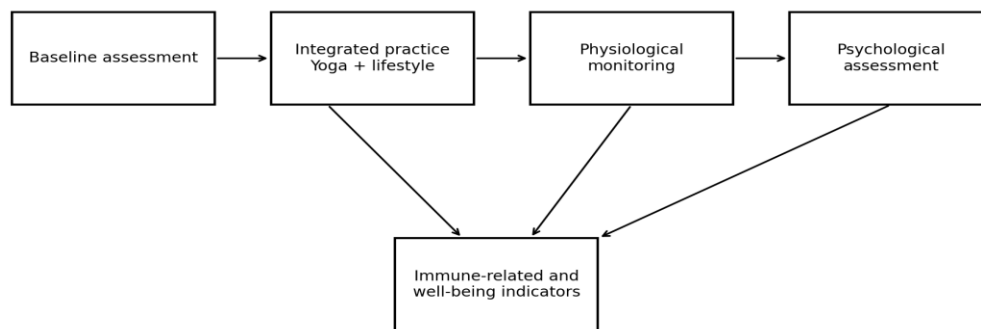


Figure 2. Suggested research and intervention pathway.

Measurements should be taken at baseline and after the intervention, with an additional follow-up where feasible. The same instruments, time of day and collection procedures should be used across groups. Laboratory personnel should ideally be blinded to group allocation. Statistical analysis should follow a prespecified plan and should report effect estimates and confidence intervals rather than relying only on p-values.

13. Physiological Pathways Relevant to the Study

The physiological rationale for the topic is best expressed through stress regulation rather than a simplistic claim that yoga “boosts immunity.” Structured physical activity and breathing practices can alter acute autonomic responses, while relaxation and stress-management components may affect perceived stress and endocrine measures. In adolescent research, resting heart rate, blood pressure and salivary cortisol can provide measurable indicators of physiological regulation. These measures do not directly measure immune competence, but they can help characterize pathways through which an intervention may influence health.

The Indian cluster randomized trial described above provides an important example. Adolescents receiving a standardized yoga programme showed improvements in stress, salivary cortisol, metabolic measures and attention. [10] Such findings support a model in which psychological and physiological regulation can be assessed together. However, the study did not establish that the intervention prevented infections or produced broad enhancement of immune function. That distinction should remain explicit in future research.

14. Psychological Variables and Adolescent Well-being

Psychological outcomes are central to this research topic because adolescence involves substantial social, emotional and academic pressures. Anxiety, perceived stress, depressive symptoms, self-regulation and subjective well-being can influence sleep, physical activity, dietary behaviour and adherence to health practices. Reviews of yoga interventions in children and adolescents generally report encouraging effects on anxiety, stress, relaxation and well-being, although methodological quality and intervention formats vary. [5,6,12]

The World Health Organization identifies healthy sleep, regular physical activity, coping skills, problem-solving and emotional regulation as relevant to adolescent mental well-being. [3] A yoga-based programme that includes breathing, movement and relaxation may therefore be particularly suitable for school health promotion when it is delivered as a complement to, rather than a replacement for, professional mental-health care.

15. Ayurveda and Naturopathy in an Evidence-Informed Framework

Ayurveda and naturopathy are broad traditions rather than single standardized interventions. For scientific evaluation, researchers should translate the intended components into reproducible protocols. For example, “Ayurvedic lifestyle” could be defined in terms of sleep routine, meal timing, dietary guidance and daily routine, while “naturopathic lifestyle” could be defined through nutrition, physical activity, exposure to natural environments and other clearly specified practices. This operational definition is essential for replication.

The purpose of such standardization is not to reduce traditional systems to a single biomedical variable. Instead, it allows researchers to examine which components are associated with measurable outcomes and whether combined approaches provide additional benefit. Any intervention involving dietary restriction, supplements, herbs or therapeutic procedures should be reviewed separately for safety, particularly because participants are adolescents.

16. Ethical Considerations

Research involving adolescents requires age-appropriate information, assent from the participant and informed consent from a parent or legally authorized representative as required by the governing ethics framework. Participation should be voluntary, confidentiality should be protected, and students should not be penalized for declining participation. Blood sampling, saliva collection and any therapeutic procedure should be

justified by the scientific question and approved by the relevant ethics committee. The intervention should not delay standard medical care.

17. DISCUSSION

The available evidence supports a cautious but meaningful research case for studying yoga in adolescent health. The strongest and most consistent signals appear in psychological and stress-related outcomes, while immune and inflammatory findings remain more heterogeneous. [4,7–9] This difference matters. A research paper should distinguish between evidence that an intervention may improve stress or well-being and evidence that it changes clinically important immune protection.

The concept of isolated and combined practices is useful because it addresses a practical question: whether a multi-component programme provides benefits beyond a single component. However, combining interventions increases complexity. Differences in adherence, instructor quality, programme intensity, diet, sleep and family environment can all influence outcomes. Future studies should therefore record adherence and important confounders, use validated measures, and report intervention content in sufficient detail for replication.

Another important issue is the choice of immune outcomes. A study that measures only CRP or IL-6 should not describe its outcome as a global improvement in immunity. Conversely, an intervention that changes stress and inflammatory markers may provide evidence for a plausible biological pathway even if no clinical infection outcome is measured. A strong research protocol should therefore define a primary endpoint and treat other measures as secondary or exploratory outcomes.

18. Strengths of the Proposed Approach

- It integrates physiological, psychological and lifestyle domains without treating them as interchangeable.
- It emphasizes measurable and reproducible intervention components.
- It avoids fabricating primary research data and clearly distinguishes literature evidence from the proposed methodology.
- It provides a framework for comparing isolated and combined interventions.
- It places adolescent safety, consent and standard medical care within the research design.

19. Limitations

This paper is a narrative, evidence-informed review and conceptual research framework rather than a systematic review with a registered protocol or a primary clinical trial. The cited literature includes studies with different populations, intervention durations, outcome measures and methodological quality. Therefore, the paper cannot calculate a pooled effect size for the proposed integrated intervention. In addition, evidence specifically examining combined yoga, naturopathy and Ayurveda in adolescents in relation to direct immune outcomes remains limited. These limitations should guide, rather than weaken, future empirical research.

20. Implications for Future Research

Future studies should use adequately powered randomized designs, preregistered protocols, standardized intervention manuals, validated adolescent psychological measures and clearly defined biological endpoints. School-based trials may be particularly useful because they permit structured delivery to relatively large groups. Longer follow-up is needed to determine whether improvements in stress, behaviour or biological markers persist after supervised sessions end. Researchers should also examine feasibility, adherence, acceptability and equity, not only statistical significance.

21. CONCLUSION

Yoga, naturopathy and Ayurveda offer a potentially useful integrative framework for studying adolescent health, but their effects should be tested with the same methodological discipline applied to other health interventions. Current evidence provides reasonable support for investigating yoga in relation to stress, anxiety, well-being and selected physiological measures. Evidence concerning immune and inflammatory markers is encouraging but inconsistent and should not be overstated. [7–9]

The most defensible research position is therefore that structured mind–body and lifestyle practices may influence pathways relevant to adolescent health, while the magnitude and clinical importance of immune-related effects remain to be established. A well-designed study comparing isolated and combined interventions can address this gap by measuring physiological, psychological and immune-related outcomes separately and longitudinally.

22. Recommended Research Model

For a doctoral or institutional research project, the proposed model can be developed into a controlled intervention study with four groups, standardized delivery, baseline and post-intervention assessment, and a follow-up period. Primary outcomes should be selected before recruitment. Secondary outcomes can include psychological well-being, stress, sleep and selected inflammatory markers. Statistical analysis should account for baseline differences and clustering when schools or classes are used as the unit of randomization.

23. Practical Relevance

The topic has practical relevance for school and community health because adolescence is a period when health behaviours are established. A low-cost, supervised programme that combines movement, breathing, relaxation and healthy routines may be feasible in educational settings. However, implementation should be inclusive, culturally appropriate and voluntary. Adolescents with significant mental-health symptoms, chronic disease or other medical concerns should have access to qualified healthcare professionals, and complementary practices should be coordinated with appropriate clinical care.

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