Effectiveness of an Educational Intervention on Immunisation Knowledge and Immunity-Boosting Practices among Mothers of Preschool Children in Hyderabad, India: A Pre-Post Interventional Study

Humera Ashraf Jahan 1, Nasreen Begum 2

1 Postgraduate Student, Department of Nutrition, St. Ann's College for Women, Hyderabad, Telangana, India

2 Head of Department and Assistant Professor, Department of Nutrition, St. Ann's College for Women, Hyderabad, Telangana, India

ORCID: 0009-0007-6652-7429 (Humera Ashraf Jahan); 0009-0006-5687-3611 (Nasreen Begum)

Abstract

Background: Childhood immunisation is one of the most effective public health interventions for preventing vaccine-preventable diseases. However, its success depends not only on vaccine availability but also on mothers' knowledge, awareness, and health practices. In addition to timely vaccination, immunity-boosting practices such as balanced nutrition, personal hygiene, adequate sleep, and physical activity play an important role in promoting children's immune health. Despite national immunisation programmes, misconceptions and inadequate awareness remain common.

Objective: To assess mothers' knowledge regarding childhood immunisation and immunity-boosting practices before and after a structured educational intervention among mothers of preschool children in Hyderabad, India.

Methods: A descriptive cross-sectional pre-post interventional study was conducted among 120 mothers of preschool children attending M.S. Creative School, Muradnagar, and Springfield School, Tolichowki, Hyderabad. Participants were selected using convenience sampling. Data were collected using a validated structured questionnaire administered through face-to-face interviews and Google Forms. Following the baseline assessment, a structured educational session on childhood immunisation and immunity-boosting practices was conducted. The same questionnaire was administered after the intervention to assess changes in knowledge. Data were analysed using descriptive statistics and presented as frequencies, percentages, means, and standard deviations.

Results: The mean age of the participating children was 4.27 ± 0.69 years. Most mothers were graduates or postgraduates, homemakers, and urban residents. Baseline findings showed that although many mothers were aware of childhood immunisation, knowledge gaps existed regarding vaccination schedules, vaccine-preventable diseases, and immunity-supporting practices. After the educational intervention, knowledge improved across all assessed domains, including immunisation schedules, completion of vaccine doses, balanced nutrition, hygiene, physical activity, sleep, and healthy lifestyle practices. Mothers also demonstrated greater awareness of the importance of timely vaccination and evidence-based methods for supporting children's immunity.

Conclusion: The structured educational intervention effectively improved mothers' knowledge regarding childhood immunisation and immunity-boosting practices. Regular health education programmes through schools and healthcare settings can enhance maternal awareness, improve immunisation compliance, and promote healthier child-rearing practices, ultimately contributing to better child health outcomes.

Keywords: Childhood Immunisation, Maternal Knowledge, Immunity-Boosting Practices, Health Education, Preschool Children, Vaccination, Public Health

1. Introduction

Immunisation is regarded as one of the most consequential achievements in public health, with millions of deaths prevented each year through protection against vaccine-preventable disease. The immune system is stimulated by vaccines to develop protective immunity against infectious agents, so that childhood morbidity, mortality, and long-term complications are reduced; herd immunity is additionally conferred by widespread coverage, limiting transmission at the community level. The global burden of diseases such as measles, poliomyelitis, diphtheria, pertussis, hepatitis B, and tuberculosis has been substantially reduced by childhood immunisation programmes [1,2].

Disease-specific protection is conferred by vaccination, but a healthy immune system also depends on several complementary practices. Immune function is supported by adequate nutrition, exclusive breastfeeding in infancy, sufficient intake of vitamins and minerals, regular physical activity, personal hygiene, adequate sleep, stress reduction, and a healthy environment; immune responses can be impaired, and susceptibility to infection increased, by deficiencies in nutrients such as vitamins A, C, and D, zinc, iron, and protein [3,4]. Immunisation and immunity-enhancing lifestyle practices should therefore be regarded as complementary, rather than alternative, strategies for improving child health.

A central role in determining a child's vaccination status and day-to-day health practices is played by mothers, who as primary caregivers are responsible for timely vaccination, hygiene, diet, and health-seeking behaviour. Immunisation coverage and immunity-supporting behaviour have each been shown to be influenced by maternal education, socioeconomic status, healthcare access, cultural beliefs, and access to reliable health information [5]. Vaccine acceptance continues to be affected in many communities by misconceptions about vaccine safety, fear of adverse effects, misinformation circulating on social media, and limited understanding of vaccination schedules [6].

In India, childhood vaccination coverage has been substantially improved by the Universal Immunisation Programme (UIP) and Mission Indradhanush; however, disparities in uptake and maternal awareness persist across socioeconomic and educational groups, and the continued need for community-based health education is underscored by this [7]. Awareness of immunity-promoting practices remains similarly variable, particularly with respect to nutrition, hygiene, physical activity, and sleep.

Childhood immunisation knowledge and immunity-boosting practices have rarely been examined together among mothers of preschool children in Hyderabad. A more complete picture of maternal awareness is obtained when these related domains are assessed jointly, and areas where targeted education is likely to be most useful can thereby be identified. The present study was therefore undertaken to assess mothers' knowledge of childhood immunisation and immunity-boosting practices, and to evaluate the effectiveness of a structured educational intervention among mothers of preschool children in Hyderabad, India.

2. Materials and Methods

2.1 Study Design

A descriptive, cross-sectional study incorporating a pre-post educational intervention was conducted to assess maternal knowledge of childhood immunisation and immunity-boosting practices. Baseline knowledge was assessed, followed by a structured educational programme and a post-intervention assessment using the same instrument.

2.2 Study Setting

The study was conducted at M.S. Creative School, Muradnagar, and Springfield School, Seven Tombs, Tolichowki, both in Hyderabad, Telangana, India. These schools were selected because an adequate number of enrolled mothers with preschool-aged children meeting the study criteria were present at each.

2.3 Study Duration

The study was conducted over a period of three months, during which participant recruitment, baseline assessment, the educational intervention, and post-intervention evaluation were completed.

2.4 Study Population

The study population comprised mothers of children aged 3-5 years enrolled at the selected schools. Only mothers who met the eligibility criteria and provided voluntary consent were included.

2.5 Sample Size and Sampling Technique

Sample size was estimated using the single-population proportion formula, based on a reported maternal knowledge prevalence of 91.9%, and a minimum requirement of 115 participants was obtained. To allow for incomplete or non-responses, the final sample was increased to 120 mothers, recruited using convenience sampling during the study period.

2.6 Inclusion Criteria

- Aged 18 years or above.
- At least one child aged 3-5 years.
- Willing to participate, with informed consent provided.

2.7 Exclusion Criteria

- Unable to communicate effectively.
- Critically ill at the time of data collection.
- A child with a chronic illness likely to influence immunity-related practices.
- Declined to participate.

2.8 Data Collection Procedure

Data were collected using a researcher-developed, expert-validated structured questionnaire, administered through face-to-face interviews and Google Forms. The baseline questionnaire assessing knowledge of childhood immunisation and immunity-boosting practices was completed by mothers first. A structured educational session covering childhood vaccination schedules, vaccine-preventable diseases, nutritional strategies supporting immunity, personal hygiene, sleep, physical activity, and healthy lifestyle practices was then attended by participants. The same questionnaire was re-administered after the session so that the change in knowledge could be assessed.

2.9 Study Instrument

The questionnaire comprised two sections. Socio-demographic characteristics, including maternal age, education, occupation, family type, number of children, and residence, were recorded in Section I. Knowledge of childhood immunisation, vaccination schedules, vaccine-preventable diseases, immunisation practices, nutrition, hygiene, sleep, physical activity, and immunity-enhancing behaviours was assessed in Section II.

2.10 Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to data collection. Permission was obtained from the participating schools, and written informed consent was obtained from all mothers before enrolment. Confidentiality and anonymity were maintained throughout, and participation was entirely voluntary.

2.11 Statistical Analysis

Data were entered in Microsoft Excel and analysed using descriptive statistics. Continuous variables are expressed as mean and standard deviation (SD); categorical variables are presented as frequencies and percentages. Participants' demographic characteristics and pre- to post-intervention changes in knowledge are summarised in tables.

3. Results

3.1 Socio-Demographic Characteristics of Participants

A total of 120 mothers of preschool children participated in the study. The economically productive age range was represented by most participants, and relatively high educational qualifications were held by most. The mean age of the participating children was 4.27 years (SD 0.69); 45.0% were four years old, 40.8% were five years old, and 14.2% were three years old.

An age of 26-35 years was reported by most mothers (66.6%). With respect to education, 45.8% were graduates and 40.0% were postgraduates, indicating a comparatively well-educated sample. Homemakers accounted for 61.7% of participants, and approximately one-third were employed in the private sector. Urban residence was reported by most respondents (77.5%), with the remainder from rural or semi-rural communities. Overall, the sample consisted predominantly of educated, urban mothers, providing a reasonable context in which knowledge of childhood immunisation and immunity-promoting practices could be evaluated.

Table 1: Socio-Demographic Characteristics of Study Participants (N = 120)

Characteristic	n	%
Age of child		
3 years	17	14.2
4 years	54	45.0
5 years	49	40.8
Mother's Age		
21-25 years	26	21.7
26-30 years	40	33.3
31-35 years	40	33.3
>35 years	14	11.7
Education		
No formal education	2	1.7
Higher secondary	15	12.5
Graduate	55	45.8
Postgraduate	48	40.0
Occupation		
Homemaker	74	61.7
Private employee	40	33.3
Government employee	4	3.3
Self-employed	2	1.7
Residence		
Urban	93	77.5
Rural	20	16.7
Semi-rural	7	5.8

3.2 Baseline Knowledge Regarding Childhood Immunisation

Before the educational intervention, awareness of the childhood immunisation programme was reported by 60.8% of mothers, partial knowledge only was reported by 25.0%, and 14.2% had never heard of it. Correct identification that vaccines protect children against infectious disease was made by a large majority (80.8%); however, limited knowledge of the recommended vaccination schedule, booster doses, Mission Indradhanush, contraindications during minor illness, and vaccine-preventable diseases was observed among many participants.

Although the general importance of immunisation was recognised by most mothers, misconceptions persisted: postponement of routine vaccination during mild fever or a common cold was believed necessary by a considerable proportion, and the full schedule recommended under the UIP was unknown

to others. These findings suggest that general awareness of childhood vaccination does not necessarily translate into the detailed knowledge required for appropriate health-seeking behaviour.

Table 2: Baseline Knowledge Regarding Childhood Immunisation (N = 120)

Variable	Correct Response (%)
Awareness of immunisation programme	60.8
Purpose of vaccination	80.8
Maintenance of an updated immunisation card	57.5
Complete vaccination status	71.7
Correct knowledge of vaccination during minor illness	41.7

3.3 Baseline Knowledge Regarding Immunity-Boosting Practices

Satisfactory baseline knowledge of healthy dietary habits was demonstrated by mothers, particularly with regard to the role of fruit and vegetables in supporting children's immune health: the importance of fruit consumption was recognised almost universally, and awareness regarding vegetables was similarly high. The importance of adequate sleep, regular physical activity, micronutrient-rich foods, and limiting processed food intake for immune function was, however, recognised by considerably fewer participants. Knowledge of vitamin and mineral supplementation and of comprehensive immunity-supporting lifestyle practices was comparatively limited before the intervention.

Table 3: Baseline Knowledge Regarding Immunity-Boosting Practices (N = 120)

Practice	Correct Response (%)
Fruit consumption	100.0
Vegetable consumption	91.7
Adequate sleep	65.8
Physical activity	60.8
Vitamin supplementation	14.2

3.4 Effect of the Educational Intervention

A substantial improvement in maternal knowledge was observed across all domains assessed following the educational programme. Awareness of childhood immunisation programmes increased markedly, and a better understanding of vaccination schedules, booster doses, vaccine-preventable diseases, and the importance of completing all recommended vaccinations was demonstrated. Knowledge of immunity-promoting practices also improved, with a better understanding of balanced nutrition, adequate sleep, physical activity, hand hygiene, safe drinking water, breastfeeding, and healthy dietary habits supporting immune function demonstrated by participants.

Greater confidence in completing routine childhood vaccinations was additionally reported by participants, and the value of obtaining health information from qualified professionals, rather than from informal or unverified sources, was recognised. Overall, a clear positive effect on maternal knowledge was produced by the intervention, supporting the value of structured health education in improving childhood health awareness.

Table 4: Improvement in Maternal Knowledge following the Educational Intervention (N = 120)

Indicator	**Pre-Intervention (%)**	**Post-Intervention (%)**
Awareness of immunisation	60.8	84.2
Knowledge of Mission Indradhanush	35.0	77.5
Knowledge of measles-mumps-rubella (MMR) vaccine	58.3	96.7
Hand hygiene practices	73.3	96.7
Healthy dietary practices	61.7	80.8
Physical activity	54.2	88.3
Completion of vaccination schedule	71.7	85.8

4. Discussion

Mothers' knowledge of childhood immunisation and immunity-boosting practices was assessed, before and after a structured educational intervention, among mothers of preschool children in Hyderabad. Although basic awareness of childhood immunisation was demonstrated by most participants, important gaps in knowledge of vaccination schedules, booster doses, and immunity-promoting practices were identified at baseline. A substantial improvement in maternal knowledge across all domains assessed was produced by the intervention, supporting the effectiveness of structured health education in this population.

Most mothers were educated to graduate or postgraduate level, yet knowledge gaps persisted, suggesting that adequate awareness of immunisation and childcare practices is not guaranteed by formal education alone. This finding is consistent with earlier work in which improved child health outcomes were associated with maternal education, without vaccine-related misconceptions being fully eliminated [8,9].

Baseline awareness of childhood immunisation was moderate, and misconceptions about vaccination during minor illness and about the recommended schedule were common, in line with findings reported by Ndaki et al. [6] and Kumar et al. [12], both of which highlight the ongoing need for parental education.

Understanding of immunity-boosting practices, including nutrition, hygiene, physical activity, and sleep, was also improved by the intervention, consistent with previous evidence that parental knowledge and healthier childcare practices can be supported by structured educational programmes [5].

These findings should be interpreted in view of the study's limitations: the sample was drawn from only two schools, and generalisability may accordingly be limited. Larger, multicentre studies with longer follow-up are required for these results to be confirmed and extended.

Overall, the use of structured educational interventions to improve mothers' knowledge of childhood immunisation and immunity-boosting practices is supported by these findings, and it is suggested that child health outcomes and vaccination coverage may be further strengthened when immunisation education is integrated with nutrition counselling in schools and primary healthcare settings.

5. Conclusion

Mothers' knowledge of childhood immunisation and immunity-boosting practices among preschool children was assessed before and after a structured educational intervention in this study. Although moderate baseline awareness of childhood vaccination and healthy lifestyle practices was held by mothers, notable gaps remained in understanding of immunisation schedules, vaccine-preventable diseases, immunity-enhancing behaviours, and evidence-based childcare practices.

A substantial improvement in maternal knowledge across all domains assessed was produced by the educational intervention, demonstrating the value of structured health education in promoting childhood immunisation and healthy lifestyle practices. Improved childhood health outcomes and a reduction in vaccine-preventable disease may, in turn, be supported by increased awareness of vaccination schedules, balanced nutrition, hygiene, sleep, physical activity, and healthy dietary behaviour.

The important role of maternal education in supporting child health is highlighted by these findings. Regular, community-based awareness programmes delivered through schools, healthcare facilities, and primary health centres should be encouraged, so that maternal health literacy is improved and complete childhood immunisation is supported. Immunity-supporting practices may be further strengthened, and healthier future generations supported, when nutrition education is integrated with immunisation counselling.

6. Strengths of the Study

- Childhood immunisation knowledge and immunity-boosting practices were jointly evaluated within a single sample.
- The effectiveness of the health education programme was able to be assessed directly through the pre-post educational intervention design.
- Data were collected using a structured, validated questionnaire.
- Participant diversity was improved through recruitment from two distinct educational institutions.
- Locally relevant evidence that may inform maternal education programmes developed by healthcare professionals and policymakers is provided by the findings.

7. Limitations of the Study

- The study was conducted among 120 mothers from two schools in Hyderabad, and the generalisability of the findings may accordingly be limited.
- Selection bias may have been introduced by convenience sampling.
- Data were self-reported and may be subject to recall or social desirability bias.

- Only immediate post-intervention knowledge was assessed; long-term retention and behavioural change were not evaluated.
- Clinical outcomes such as vaccination completion and incidence of infectious disease were not assessed.

Future multicentre, longitudinal studies involving larger populations are recommended, so that the long-term effectiveness of educational interventions on maternal practices and child health outcomes can be evaluated.

8. Recommendations

1. Regular educational programmes on childhood immunisation should be conducted through schools, Anganwadi centres, and primary healthcare facilities.
2. Nutrition counselling should be integrated with routine immunisation services, so that immunity-promoting practices among caregivers are strengthened.
3. Evidence-based counselling should be provided by healthcare professionals to address misconceptions regarding childhood vaccination.
4. Digital health education campaigns using social media and community outreach should be strengthened, so that public awareness is improved.
5. Periodic parental education programmes should be supported by government agencies, so that vaccination compliance and healthy childcare practices are improved.
6. Larger samples across multiple geographical regions should be involved in future research, so that the external validity of findings is improved.

Ethical Approval

Ethical approval for this study was obtained from the Institutional Ethics Committee prior to commencement of the research. Administrative permission was obtained from the participating schools before data collection, and written informed consent was obtained from all participants after the study objectives had been explained. Confidentiality, anonymity, and voluntary participation were maintained throughout the research process.

Funding

No financial support was received by the authors from any funding agency, commercial organisation, or institution for this study or for preparation of the manuscript.

Authors' Contributions

Humera Ashraf Jahan: conceptualisation, literature review, methodology, data collection, data analysis, interpretation of results, manuscript writing, and final manuscript preparation.

Nasreen Begum: study supervision, research guidance, methodology validation, critical review of the manuscript, and final approval of the manuscript.

Conflict of Interest

No conflict of interest regarding the publication of this manuscript is declared by the authors.

Acknowledgement

The Department of Clinical Nutrition and Dietetics is thanked by the authors for academic guidance and support provided throughout the study. The management and staff of M.S. Creative School, Muradnagar, and Springfield School, Tolichowki, Hyderabad are also thanked for permission to conduct the research. All participating mothers are gratefully acknowledged for their cooperation.

Authors' Biography

Humera Ashraf Jahan is a postgraduate student in Clinical Nutrition and Dietetics. Her research interests include maternal and child nutrition, public health nutrition, childhood immunisation, therapeutic nutrition, lifestyle disease management, and community nutrition education.

Nasreen Begum is Head of the Department of Nutrition and Assistant Professor at St. Ann's College for Women, Hyderabad.

References

1. 1. Plotkin SA, Plotkin SL. The development of vaccines: how the past led to the future. Nat Rev Microbiol. 2011;9(12):889-893. https://doi.org/10.1038/nrmicro2668

2. Fine P, Eames K, Heymann DL. Herd immunity: a rough guide. Clin Infect Dis. 2011;52(7):911-916. https://doi.org/10.1093/cid/cir007

3. Wintergerst ES, Maggini S, Hornig DH. Immune-enhancing role of vitamin C and zinc. Ann Nutr Metab. 2006;50(2):85-94. https://doi.org/10.1159/000090495

4. Besedovsky L, Lange T, Born J. Sleep and immune function. Pflugers Arch. 2012;463(1):121-137. https://doi.org/10.1007/s00424-011-1044-0

5. Oyo-Ita A, Oduwole O, Arikpo D, et al. Interventions for improving coverage of childhood immunisation in low- and middle-income countries. Cochrane Database Syst Rev. 2023;12:CD008145. https://doi.org/10.1002/14651858.CD008145.pub4

6. Ndaki P, Kinyonga M, Mwita S. Knowledge, attitude, and practice towards child immunisation among mothers attending Magu District Hospital, Mwanza. East Afr Health Res J. 2024;8(1):80-85. https://doi.org/10.24248/eahrj.v8i1.752

7. World Health Organization. Immunization agenda 2030: a global strategy to leave no one behind. Geneva: WHO; 2020. https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/immunization-agenda-2030

8. Williams SV, Akande T, Abbas K. Systematic review of social determinants of childhood immunisation in low- and middle-income countries and equity impact analysis of childhood vaccination coverage in Nigeria. PLoS One. 2024;19(3):e0297326. https://doi.org/10.1371/journal.pone.0297326

9. Siddiqui NS, Gaikwad AK, Bina MK, et al. Is mothers' knowledge and practice regarding childhood immunization compliant with immunization completeness? Int J Community Med Public Health. 2017;4(3):775-780. https://www.ijcmph.com/index.php/ijcmph/article/view/518

10. Powell-Jackson T, Fabbri C, Dutt V, Tougher S, Singh K. Effect and cost-effectiveness of educating mothers about childhood DPT vaccination on immunisation uptake, knowledge, and perceptions in Uttar Pradesh, India: a randomised controlled trial. PLoS Med. 2018;15(3):e1002519. https://doi.org/10.1371/journal.pmed.1002519

11. Kaufman J, Ryan R, Walsh L, et al. Face-to-face interventions for informing or educating parents about early childhood vaccination. Cochrane Database Syst Rev. 2018;5:CD010038. https://doi.org/10.1002/14651858.CD010038.pub3

12. Kumar C, Bijalwan S, Panwar A, et al. Knowledge regarding immunization among mothers of under-five children in Uttarakhand. Int J Community Med Public Health. 2024;11(4):1523-1526. https://doi.org/10.18203/2394-6040.ijcmph20240885