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Association between Maternal Postpartum Vitamin A Supplementation and Child Vitamin A Vaccination Coverage in Pakistan: Evidence from the PDHS 2017–18

Irzah Farooq[1*], Manahl Imran[2], Aqsa Mukhtiar[3], Alzumar Gull Khan[1], Maha Ikram[1] and Nida Shabbir[4]

[1]Department of Public Health, University of the Punjab, Lahore, Pakistan
[2]College of Statistical Sciences, University of the Punjab, Lahore, Pakistan
[3]Department of Human Nutrition, School of Health Sciences, University of Management and Technology, Lahore, Pakistan
[4]Department of Biochemistry, The University of Lahore, Lahore, Pakistan

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***Corresponding Author:**
Irzah Farooq
Department of Public Health, University of the Punjab, Lahore, Pakistan
irzahfarooq@gmail.com

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ABSTRACT

Maternal postpartum vitamin A supplement is a necessary intervention for maternal and child health. It has not been properly investigated regarding its impact on the Pakistani child vaccination coverage of vitamin A. **Objectives:** To evaluate the maternal postpartum vitamin A supplementation and child vitamin A vaccination coverage, that is, first-dose, second-dose, and full two-dose coverage. **Methods:** A survey was carried out among 200 mother-child pairs. Information on the maternal postpartum vitamin A supplementation and the child's vitamin A vaccination status was available. Associations and the effect size were assessed on descriptive statistics, Spearman correlation, and ordinal and binary logistic regression. **Results:** There was a strong correlation between the child vaccination and the presence of maternal postpartum vitamin A supplementation. The children of supplemented mothers were much more likely to take 100% of vitamin A (100% vs. 51.3; OR = 84.39, p=0.001) and 25.9% vs. 0.8% coverage (OR = 41.30, p=0.001). The second dose effect was less but significant (odds ratio, OR = 2.64, p=0.004). In Spearman correlation, there was a strong positive correlation with the first dose (r = 0.733, p=0.001) and a weak positive correlation with the second dose (r =.204, p=0.004). **Conclusions:** Maternal postpartum vaccination with vitamin A is a key factor that determines child vaccination with vitamin A, especially the first dose. In Pakistan, continuity of postnatal care, the combination of supplementation with routine immunization, and better caregiver counseling are needed to realize full vaccination and the best preventive health care outcomes of children.

INTRODUCTION

Vitamin A deficiency (VAD) is a large-scale health problem in the low- and middle-income nations, especially in South Asia, where maternal and child under-nutrition has been playing a significant role in the prevalence of preventable morbidity and mortality [1]. Vitamin A is an important immunomodulator for vision, epithelial integrity, and child growth, and a lack of vitamin A in early life was linked to the predisposition to infections and an increased risk of death. To deal with this overload, massive vitamin A supplementation (VAS) programs of children aged 6 to 59 months have been extensively implemented, and in many countries, they are combined with regular immunization services [1]. Moreover, the past practice recommends that mothers should be provided with postpartum vitamin A supplementation to maximize the breast milk retinol concentration to improve infant vitamin A levels in the early postnatal period [2]. Although decades of use have passed, the coverage on both maternal postpartum vitamin A

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supplementation and child vitamin A vaccination coverage has not been homogeneous in most settings [3]. Recently, indicative evidence in the global sphere has shown that although there has been moderate adherence to the use of antenatal interventions like iron folic acid supplements, postnatal micronutrient interventions have often been overlooked and thus have gaps in the continuum of maternal and child care [4]. The research done in South Asia and sub-Saharan Africa indicates that maternal use of postnatal services is a robust predictor of child preventive health care use, such as immunization and intake of micronutrients [3, 5]. Nevertheless, there is little empirical data that links maternal postpartum-vitamin A supplementation to child-vitamin A vaccination. The current systematic reviews have cast doubt on the life-saving benefits of regular postpartum intake of vitamin A on infants, so the World Health Organization updated its guidelines. However, maternal supplementation is still being used in a number of countries where vitamin A deficiency is still endemic, mainly because it may have an indirect positive impact on maternal nutrition, breastfeeding quality, and healthcare compliance [4]. Notably, new research documents that maternal health practices throughout the postnatal life can be a proxy of the healthcare access, awareness, and adherence, which are critical predictors of child immunization uptake [2]. Findings on population-level surveys indicate that inequity in child vitamin A coverage remains high, and most cases of underdosing are often witnessed regardless of the first visit to health services. Literacies in opportunities to pursue follow-up, continuity of postnatal care, and the lack of awareness among the caregivers are recurrently named as obstacles in attaining complete coverage [1]. Although a number of studies have identified socioeconomic and healthcare determinants of child VAS uptake, few have used maternal-child association, specifically, whether maternal vitamin A postpartum vitamin A supplementation is associated with better child VAS vaccine uptake and completion. Even though in Pakistan, there is a national strategy to enhance maternal and child nutrition, the country has a dual burden of micronutrient deficiencies, as well as suboptimal immunization coverage. The information obtained in the Pakistan Demographic and Health Survey (PDHS) 201718 survey is a good chance to study these interrelationships on a population level [6]. Information on the relevance of maternal postpartum vitamin A supplementation to greater child vitamin A vaccination coverage could provide information about improving integrated maternal-child health prevention.

This study aimed to evaluate the relationship between the use of prenatal vitamin A supplements among mothers and the coverage of child vitamin A vaccines in Pakistan based on the PDHS 2017-18. In addition, to investigate associations between the first dose coverage, second dose coverage, and full coverage of vitamin A vaccination, and hence provide evidence on the effectiveness of postnatal mother nutrition interventions in child preventive health care use.

METHODS

The research design adopted in this study was a retrospective cross-sectional design with secondary data from the Pakistan Demographic and Health Survey (PDHS) 2017-18. The analysis of data was done between April and May 2025. a national representative cross-sectional survey of households, carried out by the National Institute of Population Studies (NIPS) in partnership with ICF International [6]. All participants willingly gave their consent to data collection with the help of the original PDHS survey [7]. The stratified two-stage cluster sampling design was employed by the PDHS to gather data on maternal, child, and household health indicators in all the provinces and regions in Pakistan. The survey gives comparable and standardized information on maternal nutrition, child health, and immunization practices [7]. This sample study included women of reproductive age (1549 years) who had delivered within the reference period and had at least one child who was eligible to receive vitamin A supplements. In this analysis, a subsample of 200 mother-child pairs that had complete information on mother postpartum vitamin A supplementation and child vitamin A vaccination status was used. The records that lacked or contained inconsistent information regarding the key variables were not used in the analysis. Maternal postpartum vitamin A supplementation was used as the primary independent variable, which was measured as No or Yes based on self-reported vitamin A intake after childbirth. Child vitamin A coverage was identified as the main outcome variables, which included receiving the first dose, receiving the second dose, and overall coverage of vitamin A (receiving both doses). Child vitamin A status was categorized into ordinal levels to reflect none, partial, or complete coverage. Additional child health variables, including recent iron supplementation and deforming status, were included for descriptive purposes. Descriptive statistics were used to summarize maternal and child characteristics, reported as frequencies and percentages. Pearson's chi-square test was applied to examine associations between maternal postpartum vitamin A supplementation and categorical child vitamin A outcomes. Effect sizes were assessed using Cramer's V to evaluate the strength of associations. Spearman's rank

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correlation coefficient (ρ) was used to assess the relationship between maternal vitamin A supplementation and ordinal child vitamin A coverage variables due to their non-parametric nature. To further quantify the association between maternal postpartum vitamin A supplementation and child vitamin A outcomes, ordinal logistic regression models were fitted for child first-dose and second-dose vitamin A status. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported to estimate the likelihood of higher child vitamin A coverage categories among mothers who received postpartum supplementation. In addition, binary logistic regression was performed to assess the association between maternal supplementation and complete child vitamin A coverage (both doses received). Model fit was evaluated using chi-square statistics and Nagelkerke's R^2. The sample of 200 mother-child pairs included in this analysis was determined to be sufficient based on a sample size calculation for a binary logistic regression. Using an anticipated odds ratio of 3.0, a significance level (alpha) of 0.05, a statistical power of 80%, and an estimated exposure prevalence (maternal supplementation) of 40% from prior data, the minimum required sample size was calculated to be 180 pairs. Our final sample of 200 pairs exceeds this threshold, providing adequate power to detect significant associations. All statistical analyses were conducted using standard statistical software, with significance set at $p<0.05$. As this study involved secondary analysis of anonymized, publicly available PDHS data, no additional ethical approval was required.

RESULTS

These results indicate that there is a major maternal-child health service gap: whereas the adoption of iron supplementation in pregnancy is relatively high, postpartum vitamin A coverage is relatively low, and is associated with poor child immunization coverage rates. This non-connection implies that the continuity of postnatal care might be a successful intervention to improve the overall vitamin A compliance in the maternal-child dyad, which is currently vastly under-covered (Table 1).

Table 1: Descriptive Statistics of Study Variables (n=200)

Variable	n (%)
Currently Pregnant	
No	160 (80.0%)
Yes	40 (20.0%)
Iron During Pregnancy	
No	77 (38.5%)
Yes	123 (61.5%)
Maternal Postpartum Vitamin A	
No	119 (59.5%)
Yes	81 (40.5%)
Child Vitamin A – First Dose	
No	58 (29.0%)
Yes	82 (41.0%)
Don't know	60 (30.0%)
Child Vitamin A – Second Dose	
No	40 (20.0%)
Yes	137 (68.5%)
Don't know	23 (11.5%)
Child Iron (Last 7 Days)	
No	80 (40.0%)
Yes	120 (60.0%)
Child Dewormed (Last 6 Months)	
No	78 (39.0%)
Yes	122 (61.0%)
Child Vitamin A Coverage Pattern	
Both doses	61 (30.5%)
First dose only	21 (10.5%)
Second dose only	76 (38.0%)
Other/unknown	42 (21.0%)

The analysis provides a statistically significant and strong relationship between the maternal postpartum intake of vitamin A supplements and child vitamin A immunization results. Mothers who underwent supplementation had a much higher probability of giving birth to a child who had been given that initial dose of vitamin A (100 percent vs. 51.3 percent) and had full coverage (25.9 percent vs. 0.8 percent). The large effect sizes also support the significance of an association between maternal preventive health services and childhood preventive health services (Table 2).

Table 2: Association Between Maternal Postpartum Vitamin A and Child Vitamin A Coverage

Child Vitamin A Outcome	Mothers Receiving Vitamin A (n=81)	Mothers Not Receiving Vitamin A (n=119)	χ^2 (df)	p-value	Effect Size (Cramer's V)
Vitamin A1 Coverage	81/81 (100%)	61/119 (51.3%)	2 (112.39)	<0.001	0.750
Vitamin A2 Coverage	64/81 (79.0%)	96/119 (80.7%)	2 (34.61)	<0.001	0.416
Any Vitamin A Coverage	81/81 (100%)	119/119 (100%)	1 (7.22)	0.007	–
Complete Coverage (Both Doses)	21/81 (25.9%)	1/119 (0.8%)	1 (28.47)	<0.001	–

Maternal Vitamin A supplementation appears to have a limited direct influence on ensuring children receive their second Vitamin A dose. Other healthcare access, follow-up systems, or community-level factors may be more critical for completing the two-dose Vitamin A schedule (Table 3).

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Table 3: Correlation between Maternal Postpartum Vitamin A Supplementation and Child Vitamin A Coverage

Variable 1	Variable 2	Correlation Coefficient (ρ)	95% CI	*p* -value
Maternal Vitamin A	Child Vitamin A1 (Dose 1)	.733	[0.67, 0.79]	<0 .001
Maternal Vitamin A	Child Vitamin A2 (Dose 2)	.204	[0.07, 0.34]	0.004

Note. Spearman's ρ was used due to the ordinal nature of the child's Vitamin A variables. Maternal Vitamin A coded as 0 = No, 1 = Yes; Child Vitamin A coded as 0 = None, 1 = Partial, 2 = Complete

Mothers who received postpartum Vitamin A supplementation were **84 times more likely** to have children with better first-dose Vitamin A coverage, showing an extremely strong association. For the second dose, the effect was much smaller but still significant. Mothers who received supplementation were **2.6 times more likely** to have children with better second-dose coverage (Table 4).

Table 4: Ordinal Logistic Regression: Predicting Child Vitamin A Status from Maternal Vitamin A Supplementation

Outcome Variables	Predictor	Coefficient	Odds Ratio (OR)	95% CI for OR	*p* -value
Child Vitamin A1	Maternal Vitamin A	4.435	84.39	[31.51, 296.19]	<0.001
Child Vitamin A2	Maternal Vitamin A	0.969	2.64	[1.39, 5.15]	-0.004

Children whose mothers received postpartum Vitamin A were **41 times more likely** to receive both Vitamin A doses, showing a very strong link to complete child coverage (Table 5).

Table 5: Binary Logistic Regression: Predicting Complete Child Vitamin A Coverage from Maternal Vitamin A Supplementation

Outcome Variables	Predictor	Odds Ratio (OR)	95% CI for OR	*p* -value
Complete Child Vitamin A Coverage	Maternal Vitamin A	41.30	[8.33, 749.26]	<0.001

Note. Complete coverage is defined as Child_VitaminA1 = 2 AND Child_VitaminA2 = 2. Model $\chi^2(1) = 28.47$, *p* <0.001, Nagelkerke $R^2 = 0.45$.

There is a strong relationship between the mother and child vitamin A. The comparative analysis of the maternal and child Vit-A relationship (Figure 1).

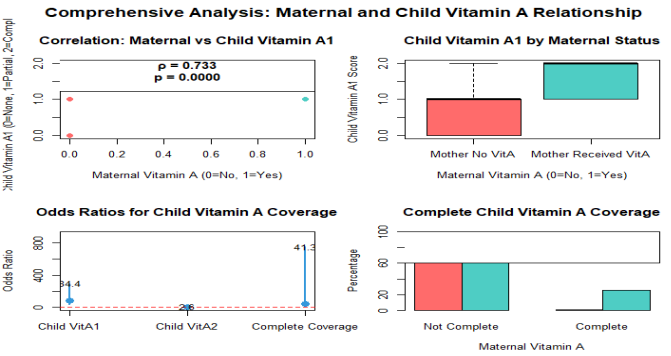

Figure 1: Comparative Analysis of Maternal and Child Vit-A Relationship

DISCUSSION

The present study demonstrates a strong and statistically significant association between maternal postpartum vitamin A supplementation and child vitamin A vaccination outcomes in Pakistan. Mothers who were given vitamin A during the postpartum period had a significantly higher likelihood of giving birth to children who had been given the initial dose of vitamin A and full coverage with the two doses. These results demonstrate the importance of postnatal maternal health interventions as an important point of entry to enhance child preventive care use, especially in such a country as Pakistan, where continuity of care is still disjointed. The fact that the correlation between maternal postpartum vitamin A supplementation and child first-dose coverage is very high (OR=84.39) is corroborated by and adds significantly to current literature. It supports the hypothesis that maternal, postnatal health service interaction is a strong facilitator of early child immunization practices [7, 8]. This is known as the gateway effect; research in the same low and middle-income country setting has repeatedly found that maternal linkage to the healthcare system in the postnatal stage is a robust predictor of the acceptance of first child health services, including vaccinations and micronutrient supplementation [9, 10]. It was observed that almost all children of supplemented mothers received the first dose, indicating that the very process of supplementation is an opportunity to contact the health system, and the maternal health-seeking behavior is seized immediately and used on behalf of the child [11]. The key and policy-relevant implication of this analysis is the significant difference between the impact of the first dose and the second dose of vitamin A coverage. Although there was an overwhelming association between maternal supplementation and first-dose uptake, the effect of maternal supplementation on second-dose coverage was significantly smaller (OR=2.64). This trend is not exclusive to vitamin A but indicates a greater problem in child health programming, the so-called drop-off in coverage between

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the first and subsequent health contacts [12]. This gap is described by previous studies as a result of systemic issues, such as the ineffectiveness of postnatal follow-up systems, the geographical problems faced by individuals caring for infants, and the ineffectiveness of reminder systems, instead of the absence of intentions initially [10, 13]. The lesser correlation of the second dose is a strong indication that maternal postpartum supplementation, though superior in the initiation of care, cannot be efficient alone in ensuring schedule adherence. It highlights the importance of overshadowing such interventions at the individual level with enhanced mechanisms of the health system aimed at fostering retention and follow-up [14]. The observation that children born to supplemented mothers had more than 40 times the likelihood of full vitamin A coverage also supports the conclusion that the intervention of maternal postnatal nutrition is a strong proxy of greater healthcare access, maternal agency, and health literacy [7, 15]. Such an association probably indicates a group of favorable conditions, such as increased maternal education, increased household wealth, improved geographic access to facilities, and enhanced trust in health services that allow the maternal supplementation uptake as well as regular vaccination of children [16]. The recent multi-country study, in particular, had shown that institutional delivery and timely postnatal care (both are close correlates of maternal supplementation) were strongly related to increased chances of full childhood vaccination [13]. This point of view changes the emphasis on the direct biological connection to the interpretation of maternal interventions as parts of the integrated service delivery platforms. Specifically, the data provided by us are descriptive; therefore, the reported iron supplementation during pregnancy is 61.5%, and postpartum vitamin A is 40.5%. This is a steep drop in national and regional reports that show that antenatal services are always more covered compared to postnatal interventions, mainly because of the reduction in healthcare contact in the postpartum period [17, 18]. This is a missed opportunity and a critical antenatal- postnatal connection. It postulates that the maternal-child health programs might not be successful in terms of bridging this care continuum and thus restricting an important time frame to encourage a full immunization and supplementation schedule of the child [8, 14]. Findings of this study also add a touch to the current debate on whether postpartum vitamin A supplementation is programmatic or not. Although the recent WHO guidelines have redirected attention to the fact that their suggestion was to decrease infant mortality, our results indicate that in endemic VAD regions such as Pakistan, infant maternal supplementation can still have considerable indirect worth by enhancing the maternal-child health services connection and serving as an incentive to alleviate child preventive health outcomes [19, 20]. This favors new views that highlight the non-textual advantages of maternal interventions, behavioral, service-delivery, and program-synergy, in contrast to the limited emphasis on the biological efficacy itself.

CONCLUSIONS

This paper offers solid reasoning that maternal postpartum vitamin A supplementation has a significant correlation with child vitamin A vaccination coverage, especially the first dose, in Pakistan, which can be an important indicator of maternal health-seeking behavior and effective health system utilization. Programmatic initiatives to maximize child health outcomes must combine maternal postnatal nutrition with child immunization services, and intensify postnatal follow-up systems in ensuring that vaccination schedules are enforced to provide a strategic platform in sealing endemic gaps in maternal and child health service coverage.

Authors Contribution

Conceptualization: IF
Methodology: MI, NS
Formal analysis: MI
Writing and Drafting: IF, AM, AGK, MI
Review and Editing: IF, MI, AM, AGK, MI, NS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

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