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Determinants of Immunization Among Children Aged 0-24 Months in Kendujhar District of Odisha: A Case - Control Study

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ABSTRACT

A cross-sectional study among 44 children (0–24 months) in Kendujhar district (2024) assessed immunization status and birth weight. Data from interviews were analyzed using logistic regression (predictors of immunization) and Fisher's Exact Test (birth weight vs. dietary/feeding factors). Key factors included supplementary food, breastfeeding frequency, rice/protein intake, cooking oil use, Iron Folic Acid Syrup, Deworming tablet, junk food, morbidity and sex ratio. The logistic regression model was statistically significant ($\chi^2 = 13.58$, df = 3, $p = 0.0035$), identifying family size and birth order as important predictors of child nutritional status. Children from larger families (≥6 members) and higher birth orders (3rd/4th) had significantly lower odds of adverse outcomes compared to smaller families and first/second-borns. Maternal belief that multiple immunizations at the same visit are unsafe showed a negative association, though not statistically significant. Nutritional and feeding practices emerged as strong protective factors. Children receiving supplementary food (multigrain mix and egg) from the Anganwadi Centre had markedly lower risk of low weight (14% vs. 75%; OR = 0.06, 95% CI: 0.012–0.26). Frequent breastfeeding (≥9–10 times/day), high rice consumption, intake of protein-rich foods, and use of soybean/sunflower oil were all associated with substantially reduced risk of low weight. Intake of IFA syrup also conferred significant protection, with nearly half the risk of (Low Weight) LW compared to non-consumers (RR = 0.53; OR = 0.22). Child morbidity and dietary exposures showed consistent associations with growth outcomes. Frequent morbidity episodes (≥4–5/year) nearly doubled the risk of LW (RR = 1.88, OR = 4.5), while daily junk food consumption tripled the risk of excess weight gain (RR = 2.95; OR ≈ 9). Attributable fraction analysis suggested that a large proportion of adverse outcomes could be explained by these modifiable risk factors. Deworming significantly reduced disease occurrence, with risk in the exposed group (20.8%) much lower than in the unexposed group (55%). Statistical tests confirmed this protective effect, showing about 62–78% lower risk/odds of disease among the exposed. The study highlights the role of family characteristics, maternal perceptions, feeding practices, morbidity, and dietary exposures in influencing child growth outcomes. Interventions focusing on improving nutrition (supplementary feeding, protein intake, IFA supplementation, deworming tablet), promoting optimal breastfeeding and reducing morbidity could substantially reduce the burden of low weight and abnormal growth among children consuming junk foods.

***Keywords**: Immunization, Weight, Supplements and Dietary Factors.*

Introduction

Immunization is one of the most indispensable public health interventions to reduce major illnesses that lead to child mortality and morbidity. The immunization program is a global program for the control of vaccine-preventable diseases (VPDs) among children through high immunization coverage. VPDs account for 17% of global under-five mortality each year. Vaccination is one method of preventing common childhood illnesses such as diphtheria, hepatitis B, measles, mumps, pertussis, pneumonia, polio, rotavirus diarrhea, rubella, cervical cancer, and tetanus, which are prevented through high immunization coverage.

If low routine immunization coverage persists (partial vaccination as well as non-vaccination), children are more likely to become ill, disabled or even have ahigher risk of morbidity and mortality. Vaccination can help prevent and avoid infections and, consequently, improve health outcomes, schooling, and productivity in adulthood. In addition, the objectives of the Global Immunization Agenda 2030 include equitable immunization coverage between and within countries, dealing with disadvantages by gender, age, and other socioeconomic characteristics. Some of these factors may include immunization programs, services, stock-outs, logistics and health infrastructures, as well as the perception of adverse effects, knowledge, beliefs, hesitancies, social influences and other general parental and family attitudes towards childre. Furthermore, studies analyzing low- and middle-income countries have identified low income, lack of access to health care, low parental education and unassisted childbirth as risk factors for low vaccination rates. All these factors listed above could lead to higher or lower (under-immunization) rates of childhood vaccination, especially in certain population subgroups. In this context, immunization rates differ significantly between countries with completely different income levels.

To assess childhood immunization and weight as dependent variable and the most significant predictors among children 0-24 months.

The primary objective is to focus on optimising and sustaining strong immunization programmes, by demonstrating the critical link between robust immunization systems and the achievement of the 2030 SDGs.

Operational and Term Definition

Fully vaccinated/complete immunization: A child between the ages of 0 and 12 months who received one dose of BCG, at least three doses of pentavalent, three doses of OPV/IPV, three doses of rotavirus vaccine, and one dose of measles and JE -1, vaccine by card, before reaching one year of age. Child between 16-24 months who had received DPT Booster-1, OPV Booster, JE-2 and MR-2

Incomplete immunized/defaulters: A child who missed at least one dose among the recommended vaccines before reaching two year of age.

Primary caretaker: Mother or caregiver who was directly involved in vaccinating the child in the previous two years of life and who was in charge of childbirth in the previous two years of life.Lack of men's involvement in care: Societal norms often limit men's involvement in caregiving and health visits, reducing shared responsibility and undermining timely care and better health outcomes.

Methods, Data Collection Tools and Techniques

To assess childhood immunization, bithweight and the significant predictors oamong children 0-24 months 44 children among 0-24 months were sampled randomly which comprises of 20 boys and 24 girls. The mother age was 14-26 years; were agricultural/ wage labourer and Goverment worker. Data was collected by interview method with pretested questionnaire and assessed by Logistic Regression, the independent predictors are significant of dependent variable Immunized and non- immunized children. Fisher Exact Test method, birth weight as dependent variable and independent variable as Supplementary food from AWC, No.of times of breast milk on previous day, Rice Consumption and Protein consumption on previous day, Consumption of Commonly used Cooking oil, junk food, morbidity among children, IFA syrup, Deworming tablets and the Sex ratio. The study was conducted in district of Kendujhar, Joda (M) Ward.02, Joda (M) Ward.07, Balagoda (Bolani) (CT) W.01, Champua (CT) Ward.01, Suakati, Beladiha and Golabandh, Rasabantala villages; block of Joda, Saharapada, Kendujhar, Champua, Ghatagaon in the year of 2024.

Result and Discussion

Study Variables 1

Dependent Variables

Childhood immunization (0-24 months)

- **Independent Variable:** Birth order, family size and multiple immunizations on same visit are unsafe.

Analyzing the association between vaccination and health expenditure, with some articles showing a negative relationship; with negative responses in vaccine importance, safety, effectiveness, religious compatibility, place of delivery, and the distance to reach the AWC for health benefits.

Individual Predictors

- **Family size** (4 members = 0, 6 members = 1)

Coefficient (β) = -3.6567; Odds Ratio (OR) = 0.026 (95% CI: 0.0014 – 0.489, p = 0.0148). Families with 6 members had about 97% lower odds of the outcome compared to families with 4 members. Statistically significant predictor.

- **Birth order** (1st/2nd = 0, 3rd/4th = 1)

Coefficient (β) = -2.6947; Odds Ratio (OR) = 0.068 (95% CI: 0.0049 – 0.927, p = 0.0437). Children of 3rd or 4th birth order had about 93% lower odds of the outcome compared to 1st or 2nd born. Statistically significant predictor.

- **Multiple immunizations** on the same visit are unsafe (Yes = 0, No = 1)

Coefficient (β) = -3.7799; Odds Ratio (OR) = 0.023 (95% CI: 0.0004 – 1.386, p = 0.0712). Respondents who said "No" (i.e., multiple immunizations are not unsafe) had about 98% lower odds of the outcome compared to Borderline result (p = 0.071, not statistically significant but suggests a strong trend).

Summary

The logistic regression model was statistically significant (χ^2 = 13.58, df = 3, p = 0.0035). Family size and birth order emerged as significant predictors. Families with 6 members had substantially lower odds of the outcome compared to families with 4 members (OR = 0.026, 95% CI: 0.001–0.489, p = 0.015). Similarly, children of higher birth order (3rd/4th) had lower odds compared to 1st/2nd born (OR = 0.068, 95% CI: 0.005–0.927, p = 0.044). Belief that multiple immunizations at the same visit are unsafe showed a strong negative association (OR = 0.023, 95% CI: 0.0004–1.386), though the result did not reach conventional statistical significance (p = 0.071).

Balanced relationships: Group dynamics foster balanced relationships between family, parents and healthcare providers. This is essential for creating a supportive environment where women feel respected, valued, and more likely to engage in health services.

Study Variables 2

The Fisher exact test statistics and statements of significance appear as below; the dependent variable is Weight 2.3-7.6 and 8.0-11.2 kg which is statistically correlated with independent variables.

- **Sex- Total no. of Boys 20 and Girls 24**

There was no significant difference in outcome between boys (exposed group) and female (unexposed groups) (RR = 0.94, 95% CI: 0.35–2.51; OR = 0.92, 95% CI: 0.24–3.52; Fisher's exact test p > 0.99)."

- **Supplementary food from AWC**

Highly significant protective effect against LW. The (exposed) who received Supplementary food had far lower risk (14%) compared with (unexposed), do not receive which is (75%). Both risk ratio (0.19, 95% CI: 0.07–0.49) and odds ratio (0.06, 95% CI: 0.012–0.26) confirm that supplementary food from AWC reduces the likelihood of LW by over **80–90%**. This is one of the strongest protective associations that had been observed.

- **No. of times of breast milk on previous day**

The risk of Low weight (LW) was 10% among 9-10 times breast fed (exposed group) compared to 41.7% in the (unexposed group) which is 7-8 times breast fed in a day. The risk ratio was 0.24 (95% CI: 0.06–0.97), indicating a 76% reduction in risk among the exposed. The odds of LW were also significantly lower in the exposed group (OR = 0.16, 95% CI: 0.03–0.83). Fisher's exact test showed a statistically significant association between exposure and outcome (p = 0.04)

- **Rice Consumption and Protein consumption on previous day** in was 9-78 grams which is for age groups 0-12 & 13-24 months with weight 2.3-7.5 & 8.0-11.2 kg had consumed parboiled rice 9-46 grams & 40-78 grams:

Consumption of Rice (exposure) was significantly associated with a reduced risk of LW. The risk of LW was 31.0% among the high consumption of rice (exposed) compared with 80.0% among the low consumption of rice (unexposed). Odds ratio analysis also confirmed a strong protective effect (OR = 0.11, 95% CI: 0.03–0.50). Thus, the exposure demonstrated a statistically significant protective association.

Protein consumption: Strong and statistically significant protective effect against LW. The risk in the Consumption of protein foods (exposed group), (4.8%) was much lower compared to the unexposed group (59.3%). Both Fisher's Exact and Mid-P tests confirmed statistical significance ($p < 0.05$). Odds ratio (0.03, 95% CI: 0.002 – 0.64) indicates a reduction in odds of LW among the exposed. Although the confidence intervals are wide (due to small sample size), the association is robust and highly suggestive of a protective effect.

- **Consumption of Commonly used Cooking oil**

Statistically significant protective effect against LW. The risk in the cooking oil soyabean and sunflower oil (exposed group) was 12.5% much lower compared to palm olein cooking oil (unexposed group) which was 45%, (OR = 0.17, 95% CI: 0.04–0.78).

- **Junk food frequency in a week**

A significant association was observed between the frequency of junk food consumption during weight gain (WG). Chi-square analysis ($\chi^2 = 10.75$, $p < 0.01$), along with Fisher's exact and Mid-P exact tests ($p < 0.01$), confirmed that the association was statistically highly significant.

Weight gain infants compared to those who consumed junk food only 2–3 times per week. The risk of WG in the exposed group (daily consumers) was 76.47%, whereas in the unexposed group (2–3 times per week) it was 25.93%. The calculated risk ratio (RR = 2.95; 95% CI: 1.48–5.88) indicates that daily junk food consumers were nearly three times more likely to (WG). The risk difference was 50.54%, suggesting that about half of the (WG) cases could be attributed to daily junk food consumption. The odds of weight gain were also substantially higher among daily consumers. The crude odds ratio was 9.29 (95% CI: 2.26–38.15), while the CMLE odds ratio was 8.73 (95% CI: 2.20–40.77), both confirming strong risk estimates. Etiologic fraction analysis further showed that approximately 43–58% of weight gain cases in the population were attributable to daily junk food intake, while among the exposed group, 66–89% of (WG) cases were directly linked to junk food consumption.

- **Intake of IFA syrup during <2 year children**

Significantly associated with reduced risk of LW. The risk of LW among IFA consumers was nearly half that of non-consumers (RR = 0.53, 95% CI: 0.30–0.96), and the odds of LW were reduced by about 78% (OR = 0.22, 95% CI: 0.06–0.80). These findings highlight the protective role of IFA supplementation in improving birth outcomes.

- **Association Between Morbidity and Low Weight**

Chi-square testing indicated a statistically significant association between frequent maternal morbidity and the occurrence of low weight (LW) ($p < 0.05$ across all methods). Both Fisher's exact test ($p = 0.04$) and Mid-P exact test ($p = 0.023$) further confirmed the robustness of this finding.

Children who experienced frequent morbidity (4–5 episodes per year) demonstrated a markedly higher risk of LW compared to those with only 1–2 episodes annually. The risk of LW in the exposed group was 75.0%, whereas it was 40.0% in the unexposed group. The estimated risk ratio (RR = 1.88; 95% CI: 1.05–3.36) suggested that children with recurrent morbidity were nearly twice to LW infants. The risk difference of 35% indicated that over one-third of LW cases could be attributed to frequent illnesses.

The odds of LW were also significantly elevated among women with frequent morbidity. The crude odds ratio was 4.50 (95% CI: 1.24–16.28), and the CMLE odds ratio was 4.33 (95% CI: 1.20–16.91), both confirming strong risk estimates. Etiologic fraction analysis revealed that 32–54% of LW cases in the population were attributable to frequent morbidity (population attributable fraction), while among the exposed group, 47–78% of cases were directly linked to recurrent morbidity.

- **Deworming tablets**

Chi-square analysis ($\chi^2 = 5.50$, $p = 0.0189$) revealed a statistically significant association between exposure and disease occurrence. The Yates corrected chi-square ($\chi^2 = 4.13$, $p = 0.042$) and

Mantel-Haenszel chi-square ($\chi^2 = 5.38$, $p = 0.020$) confirmed the result. Fisher's exact test ($p = 0.041$) and Mid-P exact test ($p = 0.024$) further supported this significant association.

The risk of disease in the exposed group was 20.8%, compared to 55.0% in the unexposed group. The risk ratio (RR)was 0.38 (95% CI: 0.16–0.91), indicating that exposure reduced the risk of disease by approximately 62%. The risk difference was –34.2% (95% CI: –61.36 to –6.98), suggesting that about 34 cases per 100 individuals could be prevented through exposure. The prevented fraction in the population was 33.9%, while the prevented fraction among the exposed was 62.1%.

The odds ratio (OR)was 0.22 (95% CI: 0.06–0.81), indicating that the odds of disease among the exposed group were nearly 78% lower than in the unexposed group. The CMLE odds ratio (0.22; 95% CI: 0.05–0.83) was consistent with this finding.

Suggestions

Implement a robust digital tracking system to monitor vaccine coverage, identify gaps, and ensure timely follow-ups for multi- dose vaccines. Expand mobile vaccination units to reach undeserved and hard to access population. SMS-reminder system for immunization in Africa (Manakongtreecheep, K; 2017). Low-tech, high-impact solutions: Physical job-aids and short videos via WhatsApp effectively reached frontline workers.

Conclusion

The analysis demonstrated that several maternal, child, and dietary factors significantly influence weight outcomes in children under two years. Larger family size and higher birth order were protective against unsafe immunization perceptions. Supplementary food from AWC, frequent breastfeeding, adequate rice and protein intake, use of quality cooking oils, IFA supplementation, and deworming tablets all showed strong protective associations against low weight. Conversely, frequent morbidity and daily junk food consumption emerged as significant risk factors, markedly increasing the likelihood of adverse weight outcomes. These findings highlight the critical role of nutrition, supplementation, morbidity prevention, and health education in improving child growth and development.

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