***Original Research Article***

**Vitamin A Supplementation and Morbidity of Children (Aged 6 to 59 Months) in the Rural Municipality of Sinder, Tillabery, Niger**

Abstract

In Africa, vitamin A deficiency is responsible for approximately 6% of deaths in children under 5 years of age (1). Due to the significant risk that this deficiency has on infant morbidity and mortality (reduced resistance to infections, stunted growth, blindness, death), it is considered by the World Health Organization as a major public health problem (2). The strategy of supplementing children with vitamin A is said to be responsible for a significant reduction in the risk of infant morbidity and mortality (3). The objective of this study is to assess the impact of vitamin A supplementation on the morbidity of children aged 6 to 59 months in the rural island commune of Sinder. This is a descriptive cross-sectional study on a representative sample of mothers of children aged 6 to 59 months. The study was conducted in the rural commune of Sinder in Niger. A questionnaire was completed using a structured interview recorded on the ODK software. Thus, the data were collected with the ODK software and then analyzed with the SPSS and Epi Info version 7.2 software. In total, 166 mother-child couples were identified using the simple random probability sampling method. According to the data of this study, girls had significantly more vitamin A supplementation (43.42%) than boys (37.78%) p = 0.001. Children aged 12 to 23 months (50.85%) received more vitamin A than children in other age groups (p = 0.05). According to the mothers' level of education, it is noted that children of mothers with secondary and higher education received more vitamin A doses in the last 6 months before the survey, however the difference is not significant (p = 0.48). On the other hand, maternal occupation is predictive of vitamin A supplementation (p = 0.04). Married mothers have more children supplemented with vitamin A (41%) but the difference is not significant. Thus, farmers, breeders and those practicing small businesses and crafts have significantly more children supplemented with vitamin A.

**Keywords:** Vitamin A deficiency, malnutrition, morbidity, children, rural areas.

**I. Introduction**

In Africa, vitamin A deficiency is responsible for approximately 6% of deaths in children under 5 years of age (1). Due to the significant risk that this deficiency has on infant morbidity and mortality (reduced resistance to infections, stunted growth, blindness, death), it is considered by the World Health Organization as a major public health problem (2).

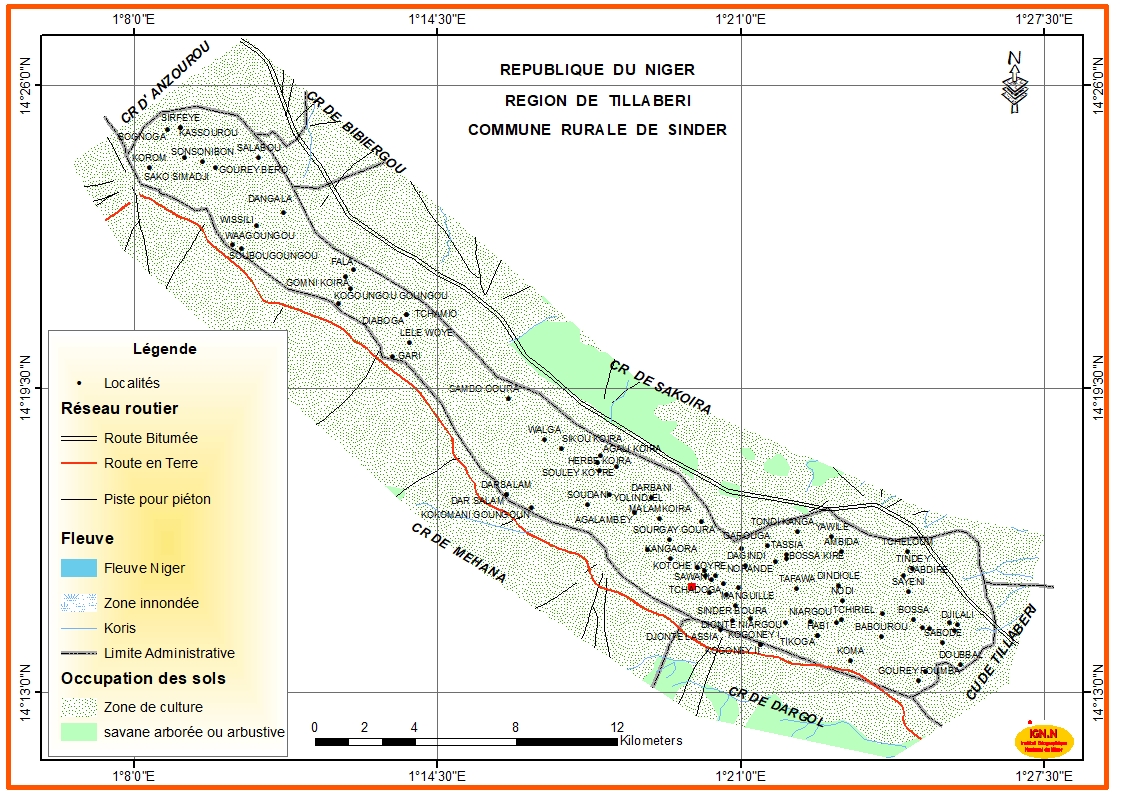
According to the World Health Organization, the strategy of supplementing children with vitamin A would be responsible for a significant reduction in the risk of infant morbidity and mortality (3). Thus, according to a study of forty-three randomized controlled trials involving 215,633 children, it showed a 24% reduction in the risk of mortality in children under 5, a 28% reduction in the risk of death due to diarrhea, and a reduction in the risk of death due to measles in children who received vitamin A supplementation (4). In order to fully benefit from the benefits of supplementation, children aged 6 to 59 months should receive two doses of vitamin A spaced 4 or 6 months apart (5). Niger was one of the first countries in the sub-region (West Africa) to associate vitamin A with national polio immunization days in 1996 (NVD+), thus achieving coverage rates of over 80% in children aged 6 to 59 months. Based on the success of the NID+, Niger was also the first country in Africa to organize national micronutrient days in 1999 to administer the second dose of VA to children six months later, achieving this time a coverage rate of more than 80% among children aged 6 to 59 months, and more than 50% of postpartum women (6).

The objective of this study is to evaluate the impact of vitamin A supplementation on the morbidity of children aged 6 to 59 months in the rural island commune of Sinder.

**II. Methodology**

**II.1. Study setting**

The study took place in the rural commune of Sinder (Coordinates 14° 14’ 46″ N, 1° 19’ 04″ E) located in the far west of Niger in the Tillabery region. Sinder is an island commune of the Niger River sandwiched between the rural communes of Dargol and Méhanna on the right bank (South) and the rural commune of Sakoira on the left bank (North). It is bordered upstream (West) by the rural commune of Dessa and downstream (East) by the urban commune of Tillabery (6).



**Figure 1:** Map of the rural commune of Sinder (IGNN, 2021).

**II.2. Type and study population**

This was a descriptive cross-sectional study by two-stage cluster sampling, the data collection of which took place in the rural commune of Sinder in two rounds: during the lean season and during the post-winter period. Anthropometric measurements concerned all children in the households.

**II.3. Inclusion criteria**

The survey targeted households with at least one child aged 6 to 59 months during the year 2021. All children aged 6 to 59 months in the households concerned were included in the study.

**II.4. Non-inclusion criteria:**

Eligible households where there were no adult parents present at the time of the survey and/or refusing to participate in the survey by not giving their informed consent.

**II.5. Sampling**

The sample size was calculated using the Schwartz (1960) formula with a 95% confidence interval and a 5% margin of error.

n= za²p(1-p) deff/i²

n= 1.96²×0.09(1-0.09)×1.5/ 0.05²

n= 188.77 so the minimum size n of our sample is 189.

Where

* Za is the confidence level according to the reduced centered normal distribution, for a 95% confidence level, it is equal to 1.96.
* p is the prevalence of global acute malnutrition from June-July 2020 in the Tillabery region, it is equal to 9% or 0.09 (6);
* deff is the cluster effect. It is generally set between 1.5 and 2;
* In our study deff is set at 1.5;
* i is the tolerated margin of error it is equal to 5%

For this work we collected a sample of 250 children aged 0 to 59 months including 166 children aged 06 to 59 months.

**II.6. Statistical analyses**

The ODK Open Data Kit software (https://opendatakit.org) was used for data collection. The data were transferred to Excel and their processing was carried out with SPSS software (version 28.0) IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 10. Armonk, NY: IBM Corp and Epi info software version 7.2. Atlanta Center for Disease Control and Prevention (CDC), United States in collaboration with the World Health Organization (WHO) free software tools for public health practitioners and researchers worldwide. The analysis of anthropometric data was carried out using the ENA for SMART WHO/2008 software which has the NCHS-CDC-WHO anthropometric standards of 1977 and the new WHO international anthropometric standards of December 2006. The significance threshold chosen was 0.05 for all analyses.

**III. Results:**

**III.1. Characteristics of mothers and children**

A total of 166 mother-child couples were enrolled in this study. This study shows a male predominance of 54.22%. Mothers who did not attend school represented the majority of the sample 61.44%. The majority of children, approximately 43%, were between 24 and 59 months old with 23±6.12 months. Approximately 40% of children were supplemented with vitamin A in the last 6 months before the survey. Approximately 38% were undernourished. Among the mothers, approximately 74% of them received information on optimal AME practices and more than half, 50.6% of them were unemployed at the time of the survey.

**Table I: Social characteristics of children and mothers/child guardians**

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Percent** | **Number** |
| **Sex of children** |  |  |
| Masculin | 54.22 | 90 |
| Féminin | 45.78 | 76 |
| **Scolarisation level** |  |  |
| unscholarised | 61.44 | 102 |
| Primary | 25.9 | 43 |
| Secondary and higher | 12.65 | 21 |
| **Age of children in months** |  |  |
| 6 to 11 | 21.69 | 36 |
| 12 to 23 | 35.54 | 59 |
| 24 to 59 | 42.77 | 71 |
| Average age of children | 23±6.2 months |  |
| **vitamin A supplementation** |  |  |
| Yes | 40.36 | 67 |
| No | 59.64 | 99 |
| **Children’s feeding status** |  |  |
| Children on complementary food | 37.95 | 63 |
| Children permanently weaned | 62.05 | 103 |
| **Marital status of mother** |  |  |
| Maried | 97 | 161 |
| Divorced and widowed | 3 | 5 |
| **Raising awarness among mother on EBF** |  |  |
| Yes | 73.49 | 122 |
| No | 26.51 | 44 |
| **Maternal Profession** |  |  |
| unemployed | 50.6 | 84 |
| Agriculture/ livestock | 07.83 | 13 |
| Work ODC | 11.45 | 19 |
| Commerce/ crafts | 30.12 | 50 |

**ODC: occasional, daily, civil servant**

**III.2. Vitamin A supplementation according to the characteristics of mothers and children.**

Girls were significantly more supplemented with vitamin A (43.42%) than boys (37.78%) p = 0.001. Children aged 12 to 23 months (50.85%) received more vitamin A than children in other age groups (p = 0.05). According to the level of education of the mothers, it is noted that children of mothers at secondary level and above received more a dose of vitamin A in the last 6 months before the survey, however the difference is not significant (p = 0.48). On the other hand, maternal occupation is predictive of vitamin A supplementation (p = 0.04). Married mothers have more children supplemented with vitamin A (41%) but the difference is not significant. Thus, women farmers, breeders and those practicing small businesses and crafts have significantly more children supplemented with vitamin A.

**Table II: Distribution of vitamin A supplementation according to the characteristics of the children and their mothers and guardians.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **Supplementation in vitamin A** | | **Total** | **Probability** |
|  | Yes | No |  |  |
| **Sex of children** |  |  |  |  |
| Male | 37.78(34) | 62.22(56) | 100(90) | **0.001** |
| Female | 43.42(33) | 56.58(43) | 100(76) |
| **Age of children (mois)** |  |  |  |  |
| 6 to 11 | 27.78(10) | 72.22(26) | 100(36) | **0.05** |
| 12 to 23 | 50.85(30) | 49.15(29) | 100(59) |
| 24 to 59 | 38.03(27) | 61.97(44) | 100(71) |
| **Scolarisation level** |  |  |  |  |
| Unscholarised | 36.27(37) | 63.73(65) | 100(102) | **0.48** |
| Primary | 44.19(19) | 5581(24) | 100(43) |
| Secondary and higher | 52.38(11) | 47.62(10) | 100(21) |
| **Raising awarness among mother on EBF** |  |  |  |  |
| Yes | 40.16(49) | 59.84(73) | 100(122) | **0.001** |
| No | 38.64(17) | 61.36(26) | 100(44) |
| **Marital status of mother** |  |  |  |  |
| Maried | 41(66) | 59(95) | 100(161) | **0.26** |
| Divorced and widowed | 20(1) | 80(4) | 100(5) |  |
| **Maternal Profession** |  |  |  |  |
| Uemployed | 32.14(27) | 67.86(57) | 100(84) | **0.04** |
| Agriculture/ livestock | 53.85(7) | 46.15(6) | 100(13) |
| Work (ODC) | 26.32(5) | 73.68(14) | 100(19) |
| Commerce/ crafts | 54(27) | 46(23) | 100(50) |

ODC: Occasional, Daily and Civil Servant.

According to the data of this study, vitamin A supplementation is not predictive of acute malnutrition (p = 0.085). However, children not supplemented are relatively more victims of acute malnutrition (62%). Vitamin A supplementation is also not predictive of the occurrence of chronic malnutrition (p = 0.11). Children not supplemented are relatively more affected by stunting (57.69%). The gift of vitamin A is not as statistically associated with the risk of underweight (p = 0.11). But we note that children not supplemented with vitamin A are more affected by underweight (65.43%). On the other hand, concerning other types of morbidity, we note that children not supplemented with vitamin A have a significantly higher risk of having diarrhea (p = 0.001), fever (p = 0.001), cough and ARI (p = 0.042) and malaria (p = 0.026).

**Table III: Distribution of vitamin A supplementation according to childhood morbidities.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **Supplementation in vitamin A** | | **Total** | **Probability** |
|  | Yes | No |  |  |
| **Acute malnutrition** |  |  |  |  |
| Yes | 38.03(27) | 61.97(44) | 100(71) | **0.850** |
| No | 42.11(40) | 57.89(55) | 100(95) |
| **Chronic malnutrition** |  |  |  |  |
| Yes | 42.31(33) | 57.69(45) | 100(78) | **0.110** |
| No | 38.64(34) | 61.36(54) | 100(88) |
| **Underweight** |  |  |  |  |
| Yes | 34.57(28) | 65.43(53) | 100(81) | **0.110** |
| No | 45.88(39) | 54.12(46) | 100(85) |
| **Diarrhea** |  |  |  |  |
| Yes | 40.54(15) | 59.46(22) | 100(37) | **0.001** |
| No | 40.31(52) | 60.69(77) | 100(129) |
| **Fever** |  |  |  |  |
| Yes | 44.19(19) | 5581(24) | 100(43) | **0.001** |
| No | 39.02(48) | 60.98(75) | 100(123) |
| **ARI/Cough** |  |  |  |  |
| Yes | 47.06(8) | 52.94(9) | 100(17) | **0.042** |
| No | 39.6(59) | 60.40(90) | 100(149) |
| **Malaria** |  |  |  |  |
| Yes | 41.67(5) | 53.33(7) | 100(12) | **0.026** |
| No | 40.26(62) | 59.74(92) | 100(154) |

ARI: Acute Respiratory Infection

**IV. Discussion**

This study aimed to assess the impact of vitamin A supplementation on the morbidity of children aged 6 to 59 months in the rural island commune of Sinder.

A biannual high-dose vitamin A supplementation is recommended by WHO for children aged 6 to 59 months in countries where vitamin A deficiency and infant mortality are public health problems (3). In sub-Saharan Africa, for more than twenty years the prevalence of vitamin A deficiency was the highest in the world (48%) and it is responsible for 2% of all deaths in children under 5 years in the region (7). In this study, only 40.36% of children were supplemented with vitamin A in the last 6 months. In a previous study conducted in 23 countries in sub-Saharan Africa, the overall coverage of vitamin A supplementation among children aged 6 to 59 months was 59.4% (8). Similarly, in a study conducted in southwest Ethiopia, the recorded coverage of vitamin A supplementation was 58.0% (9). This poor performance is thought to be due to households refusing supplementation on the grounds that it is not necessary and that it may prevent the child (girls) from procreating in adulthood (10). This refusal could be explained by the poor knowledge of mothers and caregivers about vitamin A supplementation (10).

**IV.1. Vitamin A Supplementation and Gender of Children**

In this study, female children were more likely to receive vitamin A supplementation than male children. It was observed in a study in South Dayi, Ghana that girls had 2.3 times higher vitamin A vaccination coverage than boys (11). However, it was reported in a study on vitamin A coverage in India that coverage was higher in boys than girls, but the difference was not significant (12).

**IV.2. Vitamin A Supplementation and Age of Children**

Children aged 12 to 23 received vitamin A more than children in other age groups and the difference was statistically significant (p=0.05). One study reported a significant difference in coverage between age groups (p<0.0001). However, according to these authors, it was those in the 6 to 11 month age group who were supplemented more, while low coverage was observed in the 24 to 59 month group (12).

**IV.3. Vitamin A Supplementation and Maternal Schooling**

Mothers with secondary and higher education are those who have significantly more children supplemented with vitamin A (p < 0.05). Two studies had both reported that maternal education of more than 10 years was significantly associated with the child's receipt of vitamin A (13; 14). However, in a study conducted in Ethiopia, the authors reported no association between the level of education of the mother and father and the intake of vitamin A (11).

**IV.4. Vitamin A Supplementation and Maternal Awareness.**

According to the results of this study, mothers without awareness had more children not supplemented with vitamin A. A study in Ethiopia reported that mothers who had a history of postnatal care were twice more likely to receive vitamin A supplementation than their counterparts (9). This could be because providing effective and efficient postnatal care services by health care providers will motivate the mother to frequently use postnatal care services. Other studies have also revealed that the number of antenatal care visits has been found to be a determinant of vitamin A absorption in their children. Mothers who had ≥3 antenatal care visits were approximately twice as likely to receive vitamin A supplementation (8; 15). This may be due to frequent antenatal care that allows pregnant women and lactating mothers to obtain important health information in broader areas such as nutritional care and counseling, facility delivery, exclusive breastfeeding, and vaccination (9).

**IV.5. Vitamin A Supplementation and Marital Status of Mothers**

In this study, married mothers had more children supplemented with vitamin A than divorced and widowed mothers. Studies have reported in various countries that the majority of decisions were made either by the husband or jointly. This is not surprising since the society is predominantly a society where men are the majority heads of households and make decisions for the households (16). The most common barrier to not supplementing with vitamin A was found to be disapproval from fathers. The possible reason for this may be related to the widespread socio-cultural belief that vaccines are harmful to children and are viewed with suspicion, especially its link to Western donor agencies (9).

**IV.6. Vitamin A Supplementation and Maternal Occupation**

In this study, children of mothers engaged in agriculture/livestock and small businesses and crafts were significantly more likely to receive vitamin A supplementation than children of unemployed mothers. These findings corroborate those of a study in Ethiopia that reported that children from families earning high monthly incomes were twice more likely to receive vitamin A supplementation than children from families earning less (9; 17; 18). This could be because mothers earning the highest monthly income are able to regularly use maternal and child health services, improve utilization of supplement by improving access to health information and reducing economic barriers to seeking health care compared to their unemployed counterparts (9).

**IV.7. Vitamin A supplementation and child morbidity**

In the rural commune of Sinder, children not supplemented with vitamin A are most affected by acute malnutrition (AM), chronic malnutrition (CM) and underweight (UL) but the differences are not significant (p=0.85); (p=0.11); (p=0.11) respectively. However, other childhood pathologies such as diarrhea, fever, cough and acute respiratory infections (ARI) and malaria are significantly associated with vitamin A supplementation with respective probabilities of (p=0.001), (p=0.001), (p=0.042) and (p=0.026). In India, children under five years of age who did not receive vitamin A supplementation had a higher prevalence of chronic malnutrition, underweight, and acute malnutrition than children who received vitamin A (19). A study in rural Indonesia observed a higher risk of underweight, stunting, wasting, anemia, diarrhea, and fever in children who were not regularly supplemented with vitamin A (20). In developing countries, the relationship between malnutrition and diarrheal disease is well established, with children who are underweight, stunted, and wasted at higher risk of diarrheal morbidity and mortality (20), and diarrheal disease increases the risk of vitamin A deficiency (21). Furthermore, children suffering from stunting and wasting are at higher risk of vitamin A deficiency (22), which in turn can lead to increased susceptibility to diarrheal diseases. Interventions such as vitamin A supplementation of young children are considered an excellent way to interrupt this cycle (20).

**V. Conclusion**

Vitamin A deficiency is a major public health problem that is detrimental to the health, particularly of children under five years of age. The coverage of at least one dose of vitamin A supplementation was 40%, which was still below the recommended coverage of 70%. This contributes significantly to the increase in child morbidity and mortality in Sinder rural district.

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