

Prevention of Pre-Eclampsia and Eclampsia in Nepal: Findings from an Evaluation of a Calcium Supplementation Pilot Program in Dailekh District

INTRODUCTION

The Family Health Division (FHD) of the Ministry of Health and Population (MOHP) in Nepal implemented a one-year calcium pilot program, with technical and financial support from the USAID-funded Maternal and Child Health Integrated Program (MCHIP), which is led by Jhpiego. The program tested an approach to providing calcium supplements to pregnant women for prevention of pre-eclampsia/eclampsia (PE/E) during antenatal care (ANC) services. Dailekh district, located in the mid-western region of Nepal, was selected as the implementation area. MCHIP, in collaboration with the FHD, conducted an evaluation of the pilot program. This brief presents a summary of the evaluation findings. A detailed study report is being prepared and will be made available upon completion at mchip.net.



Photo by: Dipendra Rai, MCHIP/Nepal

Dailekh district.

BACKGROUND AND RATIONALE FOR THE STUDY

The clinical efficacy of calcium consumption during the prenatal period in reducing the incidence of PE/E among women with low calcium intake has been well-established by multiple, randomized clinical trial studies.¹ There is a lack of programmatic evidence, however, on how best to reach pregnant women with calcium supplements during pregnancy and the acceptability of use of the supplements among pregnant women and their families. “Acceptability” includes the length of time, frequency and consistency with which pregnant women are willing to: consume calcium during pregnancy, recommend it to other pregnant women and use it again during a future pregnancy.

Key Maternal Health Statistics for Nepal

- Maternal mortality ratio: 229/100,000 live births*
- Antenatal care, at least one visit: 84.8%**
- Antenatal care, at least one visit from skilled provider (doctor, nurse, or ANM): 58%**
- Antenatal care, four or more visits: 50.1%**
- Median months pregnant at first ANC: 3.7**
- Institutional deliveries: 35%**

Data Sources: *Nepal Maternal Mortality and Morbidity Study 2009, **Nepal Demographic Health Survey 2011

In light of the growing body of evidence regarding the beneficial effects of calcium supplementation for pregnant women with low calcium intake, many low- and middle-income countries are interested in potentially integrating calcium supplementation into their health care delivery system. Nepal is one such country. To this end, the Government of Nepal requested assistance from MCHIP and Jhpiego in designing a pilot program and evaluation to generate programmatic evidence upon which to base future decisions regarding if and how to scale up the intervention.

¹ Hofmeyr GJ, Lawrie TA, Atallah AN, Duley L. Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. *Cochrane Database Systematic Reviews* 2010, Issue 8.

PROGRAM INTERVENTIONS

The primary program intervention evaluated was counseling about and distribution of calcium to pregnant women by ANC providers at government health facilities as a strategy for primary prevention of PE/E. All antenatal health care workers in Dailekh district, both skilled and other cadres, were trained to counsel and distribute calcium during ANC services. This was identified as the most ideal distribution mechanism for antenatal calcium supplements, given the relatively high attendance for at least one visit and the bulky size of the calcium bottles, which make community-based distribution (for example through Female Community Health Volunteers [FCHVs]) logistically problematic, and also because FCHVs are already overburdened. ANC providers were also trained in screening for PE/E during ANC, and health facilities were given urine test strips and collection bottles to strengthen the “secondary prevention” of PE/E. More detailed information about the pilot program interventions and implementation steps can be found in a separate brief titled, “A Summary of the Calcium Supplementation Program for Pregnant Women in Nepal for Prevention of Pre-eclampsia/Eclampsia.”



Photo by: Dipendra Rai, MCHIP/Nepal

A pregnant woman receives calcium during ANC services in Dailekh district.

STUDY OBJECTIVES AND RESEARCH QUESTIONS

The primary objectives of this operations research study were to assess the coverage and compliance achieved by the antenatal calcium supplementation intervention. Specific research questions included:

- What proportion of pregnant women attend at least one ANC visit?
- What proportion of pregnant women agree to take calcium offered during ANC services?
- What proportion of pregnant women who receive calcium during ANC take it according to the instructions?
- Do women who take calcium during pregnancy take iron folate as directed?
- What is the level of knowledge and experience with the calcium program intervention among FCHVs and ANC providers?

The study did not measure the incidence of PE/E and did not seek to measure the clinical efficacy of calcium supplementation, given that this has already been documented in a recent Cochrane review. Rather, this programmatic operations research study is the first to examine the results and challenges of integrating antenatal calcium distribution into an existing health system outside of a clinical trial. The study was intended to generate information that could inform the MOHP’s decision-making process regarding whether to scale up antenatal calcium supplementation to other districts.

METHODOLOGY

MCHIP/Jhpiego and the MOHP jointly designed a study to assess the programmatic effectiveness of the pilot calcium supplementation during pregnancy. Primary and secondary data were collected to understand program results and challenges:

- Post-intervention household interviews were conducted in August 2013 with women who had given birth in the last six months to measure ANC coverage, calcium coverage and compliance with the recommended calcium intake regimen.
- Post-intervention interviews were conducted with ANC health workers and FCHVs in August 2013.

- Secondary data collected by FCHVs during home visits and by ANC providers during ANC visits were gathered and analyzed throughout the program period.
- Secondary data collected by MOHP/MCHIP staff during technical supervision visits to health care workers and FCHVs were gathered and analyzed throughout the program period.

The household survey of recently delivered women (RDW) employed a cluster sampling approach, using Village Development Committees and wards as the units of clustering, to select women who had given birth in the last six months. Sample size calculations were based on estimating ANC coverage in the general population of pregnant women and among women who received calcium, as well as compliance with the recommended calcium regimen among women who received calcium. Calculations used a one-sample proportion with high precision (5%), including a design effect of 2 for the cluster design and estimated non-response rate of 10%. A total of 1,230 women were required to achieve statistical significance.

In August 2013, the Population, Health and Development Group, a local independent research agency, conducted the household survey of RDW and interviews with ANC health workers and FCHVs. The questionnaire for RDW included the validated NDHS formulation of questions that were relevant to the calcium study and was pretested and revised prior to data collection. The recall period for questions pertaining to antenatal care experience for respondents to the RDW interview in this study was much shorter (recall period up to 6 months) than international household survey programs such as the Demographic Health Survey (DHS - recall period up to five years) and the Multi-indicator Cluster Survey (MICS - recall period up to two years). Therefore the quality of the RDW self-report data was expected to be high and subject to less recall bias than the DHS and MICS. Self-report is the international standard for measuring iron coverage and consumption through the DHS and MICS and thus this approach was used in the current study for measuring calcium coverage and consumption among RDW.

Data were analyzed using SPSS. Descriptive analyses including frequencies, means, medians and crosstabulations were generated and chi square tests of significance used. Weights were applied to the sample to adjust for the urban/rural distribution of the population in Dailekh district based on the Population Census of 2011 (Central Bureau of Statistics, Volume 2, NPHC 2011) and using the same procedure as the NDHS.

This study received ethical approval from the institutional review boards of the National Health Research Council in Nepal and the Johns Hopkins Bloomberg School of Public in the United States.

FINDINGS

Sample Characteristics

A total of 1,240 RDW were interviewed post intervention after screening 12,901 households. In addition, 109 health workers and 112 FCHVs were administered questionnaires to assess their knowledge on calcium use and their experience of implementing the pilot program out of the total number in the district, 268 and 810, respectively.

Table 1: Socio-Demographic Characteristics of RDW Interviewed (n=1,240)

CHARACTERISTIC	WEIGHTED		UNWEIGHTED	
	Number	Percentage	Number	Percentage
Residence				
▪ Rural	1,140	91.9	1,080	87.1
▪ Urban	100	8.1	160	12.9
Age				
▪ <20	218	17.6	217	17.5
▪ 20–34	948	76.5	948	76.4
▪ 35–49	75	6.1	75	6.1
median	23			

CHARACTERISTIC	WEIGHTED		UNWEIGHTED	
	Number	Percentage	Number	Percentage
Education				
▪ None	484	39	473	38.1
▪ Primary	240	19.4	236	19.0
▪ Some secondary	338	27.3	340	27.4
▪ School Leaving Certificate (SLC) and above	177	14.3	191	15.4
Caste/ethnicity				
▪ Chhetri/Thakuri	531	42.8	534	43.1
▪ Bahun/Sanyasi	142	11.5	141	11.4
▪ Janjati*	148	11.9	149	12.0
▪ Dalit	420	33.9	416	33.5

*Janjati includes three Muslim groups and one Terai middle caste group.

Coverage of ANC and Delivery Services

The study showed that the vast majority of RDW (95%) attended at least one ANC visit at a health facility during their last pregnancy and the median gestational age at the first ANC visit was four months. Moreover, 71% of RDW made four or more ANC visits during their most recent pregnancy. More urban women (90%) reported having four or more antenatal visits than rural women (69%). Eighty-two percent of RDW received ANC from a skilled provider (a doctor, nurse, auxiliary nurse midwife [ANM]). Other cadres of providers that offer ANC services include auxiliary health workers and health assistants.

Table 2: Coverage of ANC and Delivery Services among RDW Interviewed

INDICATOR	NUMBER	PERCENTAGE
ANC among all women surveyed (n=1,240)		
▪ Attended at least one ANC visit	1,173	94
▪ Attended at least one ANC visit with a skilled provider	1,017	82
▪ Attended four or more ANC visits	877	71
- Urban (total n=100)	90	90
- Rural (total n=1,140)	785	69
Delivery care among women receiving calcium (n=1,173)		
▪ Institutional delivery among women who received calcium (n=1,173)	785	67

Calcium Coverage

Calcium coverage achieved by distribution through ANC services was very high. Of the total 1,240 RDW interviewed, 94.6% reported attending ANC at least once and 94.6% were counseled on calcium use and received calcium (100% of ANC clients received calcium). Staff nurses and ANMs were the main dispensers of calcium, as expected, with 82% of RDW reporting that they had received calcium tablets from them. No RDW reported receiving calcium tablets from FCHVs, as anticipated, given that FCHVs were not trained to distribute calcium and were not provided with tablets. Among those RDW who received calcium tablets (n=1173), 92.3% reported receiving calcium at their first ANC visit, 6.5% at their second ANC visit, 1% at their third ANC visit and 0.3% at their fourth ANC visit. Among those who received calcium at a second or higher ANC visit (n=91), 25% reported a gestational age of two or three months at their first ANC visit and thus were not eligible to receive calcium. It is unknown why the remaining women did not receive calcium at their first ANC visit. With respect to the number of bottles of calcium received, 82% of RDW who received calcium received three bottles of calcium, 14% received two bottles and 4% received only one bottle. Distribution of bottles of calcium by gestational age at which women started taking calcium (which is assumed to be the same month they received it) is presented in Table 3.

Table 3: Calcium Bottles Received by Gestational Age RDW Started Taking Calcium among RDW Who Received Calcium (n=1,173)

GESTATIONAL AGE AT TIME STARTED TAKING CALCIUM	NUMBER OF BOTTLES RECEIVED (%)		
	1	2	3
▪ Month 3 (n=88, 7.5%)	0	2.3	97.7
▪ Month 4 (n=856, 72.9%)	0.5	2.6	97
▪ Month 5 (n=60, 5.1%)	0	25	75
▪ Month 6 (n=118, 10.1%)	5.9	90.7	3.4
▪ Month 7 (n=31, 2.6%)	61.3	38.7	0
▪ Month 8 (n=18, 1.5%)	77.8	22.2	0
▪ Month 9 (n=3, 0.3%)	100	0	0

Women receiving calcium bottles also received promotional materials related to the calcium pilot program such as a bag (93%) and brochure (87%) about calcium. A total of 72% of RDW said that they started taking calcium from the fourth month of pregnancy, 20% after the fourth month and 8% even before the fourth month.

Compliance with Calcium Intake Instructions

Compliance with the recommended calcium supplementation instructions was examined in two ways: by measuring the number of days RDW reported taking calcium during their most recent pregnancy and determining whether they took the calcium as directed, i.e., two tablets daily in the morning.

The number of days calcium was consumed was divided into three categories: a “full course,” or at least 150 days, a “partial course,” or 90–149 days, and “low compliance,” or fewer than 90 days.

The proportion of women who received calcium and completed a full course of calcium was high, at 67% overall. About a quarter of RDW reported taking a partial course (24%) while 9% reported low compliance. Every woman who received calcium reported taking it for two or more days. There was some variation in calcium consumption by socio-demographic characteristics of RDW respondents and the gestational age at which they received and started taking calcium (see Table 4). Crosstabulations using chi square statistic revealed significant differences in consumption by the mother’s age, education and gestational age at which calcium consumption began:

- A slightly higher proportion of women ages 20–29 and 30–45 completed a full course of calcium than those less than 20 years old.
- A smaller proportion of women with no education completed a full course of calcium than those with any education.
- As expected, women who started taking calcium tablets from an early gestational age, such as 3 or 4 months, show significantly higher proportions completing a full course (over 80%) of calcium than those who received/took calcium later during their pregnancy.
- No women who started taking calcium at 6 months gestational age or later reported completing a full course, as expected, given that they would have had fewer than 150 days left in their pregnancy and would not be able to do so.
- Caste did not appear to have any effect on calcium consumption.

Table 4: Percent Distribution of the Amount of Calcium Consumed during Pregnancy by Socio-Demographic Characteristics of RDW Who Received Calcium (n=1,173)

BACKGROUND CHARACTERISTICS		DEGREE OF COMPLIANCE				
		Full Course (150+ days)	Partial Course (90–149 days)	Low compliance (< 90 days)	%	Number
Mother's age at birth*						
	<20	62.0	29.3	8.7	100.0	208
	20–29	69.4	23.3	7.3	100.0	792
	30–45	64.5	21.5	14.0	100.0	173
Residence						
	Rural	66.4	24.9	8.7	100.0	1,076
	Urban	76.5	15.3	8.2	100.0	98
Education**						
	No education	63.9	24.2	12.0	100.0	443
	Primary	69.0	25.8	5.2	100.0	227
	Some secondary	68.3	25.0	6.7	100.0	328
	SLC and above	71.8	20.1	8.0	100.0	175
Gestational age received calcium***						
	Month 3	87.5	9.1	3.4	100.0	88
	Month 4	80.7	15.4	3.9	100.0	857
	Month 5	35.6	55.9	8.5	100.0	59
	Month 6	0.0	82.4	17.6	100.0	119
	Month 7	0.0	30.0	70.0	100.0	30
	Month 8	0.0	16.7	83.3	100.0	18
	Month 9	0.0	0.0	100.0	100.0	3
Caste/ethnicity						
	Chhetri/Thakuri	68.6	23.8	7.7	100.0	508
	Bahun/Sanyasi	67.9	24.4	7.6	100.0	131
	Janjati	65.7	26.9	7.5	100.0	134
	Dalit	66.0	23.5	10.5	100.0	400
Total		67.3	24.1	8.6	100.0	1,173

*p<.05, **p<.01, ***p<.001

The study also examined whether RDW reported taking the calcium as instructed during their most recent pregnancy with respect to dosage, frequency and timing. Of the respondents who received calcium, nearly all (99%) reported taking two tablets every day and taking the tablets after eating in the morning. However, some RDW who received calcium tablets reported discontinuing consumption; about 10% of RDW said they stopped taking the tablets before giving birth. Reasons for discontinuation were: they became sick/ill (48%), experienced side effects (23%), forgot to take (20%), difficult to take because tablet is too big (18%), inconvenient to take every day (15%), fear of side effects (13%), vomiting (10%) and away from home (5%).

Of the RDW who discontinued taking the calcium tablets, more than half of them (55%) returned the tablets to FCHVs, 30% kept them, 12% threw them away, 3% returned them to the health facility and a few said they gave them to others.

RDW were asked about their food consumption while taking calcium. About 71% of RDW reported that their food intake during pregnancy did not change after taking calcium tablets, 21% reported that their food intake increased while 8% reported their food intake decreased.

Calcium Intake and Consumption of Iron Folate

Of the total RDW interviewed, 95.1% received iron tablets (n=1180) and of these, 99% received advice on iron tablets and 95% received iron tablets from a health worker or FCHV. Among the RDW who attended ANC and received calcium (n=1,173), 98.6% received both calcium and iron tablets, and all of these women reported taking both tablets. Among women who reported taking both calcium and iron, approximately 98% reported taking them at different times of the day as instructed.

Knowledge and Attitudes about Calcium

RDW who attended ANC (n=1173) were asked about the benefits of taking calcium. Most RDW (60%) said that calcium saves the mother and child from death, 40% said that taking calcium prevents unconsciousness, while 39% said calcium controls blood pressure. Thirteen percent of the RDW said that calcium helps the baby become healthy. The vast majority of respondents (99%) said that pregnant women should take both iron and calcium tablets and that pregnant women should take calcium for five months (93%). Over 98% of the respondents mentioned the correct time of taking tablets, correct frequency and correct number of tablets to take every day (see Table 5).

Table 5: Knowledge about Calcium and Iron among RDW Who Attended ANC (n=1,173)

KNOWLEDGE TEST ITEM	CORRECT ANSWER	%
Number of times a day that calcium should be taken	One time	97.9
Number of calcium tablets that should be taken each day	Two tablets	99.6
Time calcium tablets should be taken each day	In the morning after a meal	99.6
Number of iron tablets that should be taken each day	One tablet	99.1
Time iron tablets should be taken each day	In the evening after a meal	98.7

An overwhelming majority of the respondents (97%) said that their husbands knew that they were taking calcium while only half of their mothers-in-law knew about it, followed by fathers-in-law (26%) and sisters-in-law (8%).

Although FCHVs were not involved in distributing calcium tablets in Dailekh, over four in five RDW respondents reported that FCHVs visited them during their last pregnancy: over half of RDW said FCHVs visited them four or more times; 26% of RDW said that FCHVs visited them three times; and 20% of RDW reported being visited two times or less.

Eighty-four percent of RDW found the taste of calcium acceptable and only 1% of RDW reported difficulty in storing calcium packets. The overwhelming majority of RDW would like to take calcium tablets if they become pregnant again, and would recommend calcium to other pregnant women.

Screening for PE/E

A total of 98% of RDW who attended ANC and received calcium had their blood pressure taken and 97% had a urine test. Of those respondents who ever had their blood pressure measured during ANC, fewer (88%, 85.8% of all women who received calcium) had this service at every ANC visit. Of those women who ever had their urine sample taken during ANC, 70% had their urine taken at every ANC visit (67.8% of all women who received calcium).

Knowledge and Experience with Calcium Program among ANC Providers

A sample of ANC providers were interviewed and asked about their usual practices during ANC visits. All ANC providers interviewed said that they checked for swelling/edema, provided counseling on danger signs of pregnancy, delivery and postpartum; and distributed iron tablets.

A total of 99% of ANC providers said that they distributed calcium tablets and conducted blood pressure measurements, while 98% of ANC health workers said that they performed urine tests for protein using a dipstick.

From observation at health facilities where ANC health workers were based, it was found that the storeroom was managed according to the system of First Expired, First Out (FEFO). Except in a few sub-health posts, behavior change communication materials on calcium were present in the ANC service delivery area. They were found in waiting halls and examination rooms of service providers.

Knowledge of the purpose of calcium distribution during pregnancy was very high among health care workers interviewed:

- 100% of health workers interviewed from hospitals, primary health care centres and health posts correctly reported that calcium prevents PE/E while the corresponding figure for sub-health posts was 94%
- 93% of health workers said that calcium should be used to: save the lives of the mother and child; control high blood pressure (84%); and prevent loss of consciousness (82%)

ANC health worker knowledge of the timing and dosage of calcium and when to take iron was extremely high (see Table 6).

Table 6: Knowledge about Calcium Intake Instructions among ANC Health Workers (n=109)

KNOWLEDGE TEST ITEM	CORRECT ANSWER	%
Can iron and calcium be taken together?	No	97
Number of calcium tablets that should be taken each day	Two tablets	99
Time calcium tablets should be taken each day	In the morning after a meal	99
Month calcium should be started	Fourth month	99
Time iron tablets should be taken each day	In the evening after a meal	99

The health workers shared their experiences working in the pilot calcium program in Dailekh. One provider said: *“pre-eclampsia/eclampsia has been controlled and because of calcium program, ANC checkup has become regular among pregnant women in their health facilities.”*

Knowledge and Experience with Calcium Program among FCHVs

Of the 112 FCHVs interviewed, every FCHV reported discussing calcium with pregnant women during home visits, and 90% had referred pregnant women for ANC services in the last month. Ninety-six percent of FCHVs discussed birth preparedness with pregnant women and 72% distributed iron tablets. Sixty-six percent of FCHVs referred pregnant women to the health facility for delivery services and 39% referred women with danger signs of pregnancy, delivery and postpartum to the health facility.

Over 90% of FCHVs had organized monthly meetings in their health facility in the last month and 66% had organized biannual review meetings and 65% participated in the meeting. FCHVs organize Mothers' Groups in their communities and conduct meetings every month where they discuss calcium.

More than half of FCHVs interviewed (55%) said they advised women to break the tablet into two pieces if it was difficult to swallow. Some women complained of dizziness, nausea after taking calcium. When asked whether they would be interested in distributing calcium tablets in the future, 38% said that they would be and considered it their responsibility. Another 19% responded that some pregnant women do not go for ANC visits in health facilities; therefore, FCHVs can



Photo by: Dipendra Rai, MCHIP/Nepal

An FCHV at a pregnant women's group in Dailekh district talks about the risks of PE/E and the use of calcium for prevention of PE/E.

distribute calcium tablets in the same way that they distribute iron tablets to these women. A small proportion of FCHVs (14.3%) put forth some conditions before they would accept to become involved in calcium distribution in the future such as receiving training and incentives.

CONCLUSIONS

- Distribution of calcium through ANC services produced very high coverage of calcium among pregnant women, with 95% of all women surveyed receiving calcium.
- Compliance was high, with 67% of women who received calcium taking the full course (150 days) and the vast majority of all women who received calcium reporting that they took it as instructed with respect to dosage, frequency and timing.
- RDW, FCHVs and ANC health care providers achieved high levels of knowledge about calcium through this program approach.
- Calcium consumption did not appear to reduce iron consumption, and the majority of women who received calcium and iron followed instructions to take iron at a different time of day than calcium.
- Calcium distribution is acceptable to ANC providers and feasible to incorporate into their current responsibilities.
- FCHVs are willing to incorporate calcium counseling into their work.

RECOMMENDATIONS

- The MOHP should consider scaling up the current model of calcium distribution to other districts in Nepal.
- If calcium supplementation is scaled up to additional districts, the MOHP can consider integrating training of health care workers and FCHVs into regular district review meetings or other ongoing meetings, and calcium procurement and distribution to health facilities could be incorporated into the government's logistics management system.

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