

# Prevalence of Subclinical Mastitis in Ghanaian Women Based on Elevated Sodium:Potassium Ratio

## A.S. Leaflet R2204

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### Summary and Implications

Human subclinical mastitis (SCM) is inflammation of mammary tissue without any overt manifestations but is associated with lactation failure, sub-optimal infant growth during the early postpartum period, and increased risk of mother-to-child-transmission of HIV via breast milk. We carried out a rapid survey to determine the prevalence of SCM among lactating Ghanaian women between 3 and 4 months postpartum. Bilateral breast milk samples were obtained from 117 lactating women in Manya Krobo, Ghana and analyzed for sodium (Na) and potassium (K). Additionally we measured maternal mid-upper arm circumference and recorded recent maternal health history. Elevated sodium-potassium ratio above 1.0 was considered indicative of SCM. Overall SCM prevalence among these women was 45.3% of which 29.9% was unilateral. There were no associations between Na/K and maternal health perception, and nutritional status. The high SCM prevalence suggests the need for immediate intervention to reduce SCM and other related maternal and child outcomes.

### Introduction

Exclusive breastfeeding for the first 6 months of life and with appropriate complementary feeding thereafter is recommended by the World Health Organization. The nutritional, immunological and psychosocial benefits derived from breastfeeding are especially beneficial in low income countries where a combination of infection and undernutrition usually limits children's opportunity to achieve optimal growth and survival beyond the first few years of life.

Sub-optimal infant growth may occur with conditions such subclinical mastitis (SCM) that affects maternal ability to breastfeed optimally. SCM is an acute asymptomatic inflammatory condition of the lactating breast. The condition is associated with a number of adverse outcomes including lactation failure, infant growth faltering during the early postpartum period and increased risk of Mother-To-Child-Transmission of HIV.

SCM is thought to be caused primarily by milk stasis, which is inadequate milk removal from the breasts.

Infrequently, milk stasis may precipitate bacterial infection of stagnated milk in the breast which may lead to infectious mastitis. During an episode of SCM, the tight epithelial junctions separating milk and plasma become compromised, leading to leakage of plasma components including sodium and chloride ions into milk. Elevated sodium-potassium ratio (Na/K)>1.0 is therefore considered indicative of SCM.

SCM commonly occurs in the early postpartum period with decreasing incidence over time. The present study was carried out to determine the prevalence of SCM among lactating Ghanaian women during the 3 to 4 month postpartum period. There has previously been no study on SCM among lactating women in Ghana. This study was part of a larger study to determine the mechanism(s) linking SCM with infant growth faltering.

### Materials and Methods

#### *Study area and participants:*

The study was an exploratory rapid survey conducted in the Manya Krobo district in the Eastern region of Ghana between November 2005 and February 2006. Manya Krobo is well-known as having the highest prevalence of HIV in Ghana (5%) until a recent report indicated Koforidua, also in the eastern region, as the city with the highest HIV rate of 6.4%. The district is served by 2 governmental and 1 private hospitals, all of which offer voluntary counseling and testing for HIV.

One hundred and seventeen lactating women were recruited from 10 child welfare clinics (CWC) to participate in this study. CWC's were selected based on ease of access. Participants were included in the study if they were within 3 to 4 month postpartum, at least 18 years old, resident in the Manya Krobo district, and willing to participate voluntarily in the study. Also, participants were recruited only after the study procedures have been explained to them and they had given informed consent by endorsing a written consent document.

Ethical approval was obtained from the Institutional Review Boards of Iowa State University (ISU) in the United States and the Noguchi Memorial Institute for Medical Research (NMIMR) in Ghana. Additionally, a formal letter of approval and support was obtained from the Manya Krobo District health administration.

#### *Data collected from participants:*

Study participants completed a one page survey on recent health history including self-reported overall health evaluation, breast health, and recent disease occurrence. The survey responses were filled out by trained interviewers who also measured the Mid-Upper-Arm-Circumference (MUAC) on the left arm of each participant, as a crude

indication of nutritional status, using a non-stretchable tape measure. A spot milk sample of at least 10ml from each breast by manual expression was also provided by each participant.

### *Milk collection protocol and storage:*

Each participant, before expressing breast milk, washed both hands thoroughly with disinfectant liquid hand soap and running tap water, rinsed with deionized water and dried their hands with clean paper towels. The first few squirts of milk expressed were discarded after which the nipple and surrounding areola was sterilized with cotton soaked in 70% ethyl alcohol. Milk expressed thereafter was collected in 60ml plastic vials with snap-on caps. Upon completion of expression from one side, participants repeated hand rinsing with deionized water and breast surface sterilization with ethyl alcohol before expressing from the other breast. All milk samples collected were immediately stored in a cold chest for transport to the field laboratory and stored at  $-18^{\circ}\text{C}$ . Samples were later transported to Accra, the national capital for storage at  $-32^{\circ}\text{C}$  until analyses.

### *Laboratory methods*

Sodium (Na) and potassium (K) content analyses were performed on whole milk without any sample pre-treatment. Samples were thawed to room temperature ( $25^{\circ}\text{C}$ ). Thawed milk was then mixed using a vortex mixer to allow the aqueous and lipid compartments to mix uniformly and 0.1ml of sample was aspirated for analyses using ATAC 8000 ion-selective electrode analyzer (Clinical Data Inc, USA).

### *Data analyses*

All data was analyzed using SPSS 11.0. Results of milk analysis were expressed as Na/K ratio for each sample. Descriptive statistics including arithmetic mean, median, and standard deviations were computed for maternal health and MUAC data. In the case of Na/K, geometric means were computed because of lack of normality in data distribution. Prevalence of SCM was computed using Na/K ratio. Na/K ratios greater than 1.0 were considered to be indicative of SCM.

## **Results**

### *Population Characteristics:*

Over a period of 3 months, we encountered 1296 women visiting the selected CWC's out of which 154 satisfied the 3-4 months postpartum criteria. Of these, 6 women refused to participate while 31 were excluded because, the mother was not available to at the clinic ( $n=21$ ), below 18 years old ( $n=3$ ) had twin birth ( $n=1$ ) and previously participated in the study ( $n=6$ ). Eventually 117 women satisfied the inclusion criteria and were included in our analyses (figure 1). Women in our study were aged between 18 and 46 years old. They had a median of 2 live births; the woman with the

least number of children had 1 child and the maximum number of children recorded was 9 (Table 1). A majority of participants (92.8%) described their health as excellent/good; only 2 women described their health as "Not Good". Sixteen percent of women reported waist pain, fatigue or fever within the last 7 days. Also, 8% reported at least one episode of breast pain since delivery while 11% reported breast swelling. None of the participants reported or presented with cracked nipples, sore nipples or any other overt breast health problems at the time of sample collection. The median MUAC was 26.6cm with a range of 19.3cm to 36.5cm.

A total of 229 breast milk samples were collected constituting 112 bilateral samples and 5 unilateral samples resulting from participant inability or unwillingness to provide milk from that breast. The median duration of milk expression was within 5 to 10 minutes each for both right and left breasts.

### *Na/K and SCM prevalence*

The geometric mean breast milk Na/K from right and left breast was 0.83 and 0.85 respectively (Table 2). We found no significant differences between left and right breast milk samples for Na/K. However, there was significant between breast difference ( $p=0.006$ ) in Na/K among women with unilaterally elevated Na/K (figure 2). Also, Na/K in elevated breast were significantly different from Na/K in women without elevated Na/K in both breasts ( $p<0.001$ ). There was no significant difference between Na/K among women with bilateral and those with unilateral SCM ( $p=0.61$ ). Na/K was not associated with maternal MUAC, health perception, and parity.

Using Na/K ratio of 1.0 as a threshold, 45.30% of participants had elevated breast milk Na/K indicative of SCM. Unilaterally elevated Na/K was observed in 29.91% of the study population while 15.38% had bilaterally elevated Na/K.

## **Discussion and Conclusions**

This study was performed among a sample of healthy lactating women most of whom thought their health was good; they reported only health problems peculiar to the wider Ghanaian population. Based on MUAC measurements alone, none of the women was classified malnourished.

The focus of this study was on women who were between 3 and 4 months postpartum. Most earlier studies on SCM involved women who were 3 months postpartum or less. These earlier studies reported higher SCM prevalence during early lactation. However, the sustained high SCM prevalence of 23% and 36% at 14 weeks postpartum suggested that high SCM prevalence may persist beyond the third month postpartum. That is the reason why in our study, we chose to recruit women between 3 and 4 months postpartum to shed light on that period of lactation when

many mothers may have started complementary feeding among Ghanaian communities.

More than 45% of lactating women in this study had Na/K levels indicative of SCM. Prevalence observed in our study is higher than observed among lactating women of similar postpartum duration elsewhere. The unusually high SCM may be explained by the high HIV prevalence in the Manya Krobo district where the study was conducted. Indeed, the highest reported SCM prevalence in the literature have been reported in population with high HIV prevalence. Higher NA:K ratios were also seen in women who had more difficulty expressing breast milk, possibly indicating acute inflammation due to excess manipulation, or women with SCM have greater inflammation and potential duct blockage, thus leading to more difficult milk expression.

The high prevalence of SCM observed in this community suggest the need for further investigation to determine the factors that promote elevated Na/K among these women and immediate intervention to prevent adverse outcomes related to SCM among both infants and their mothers.

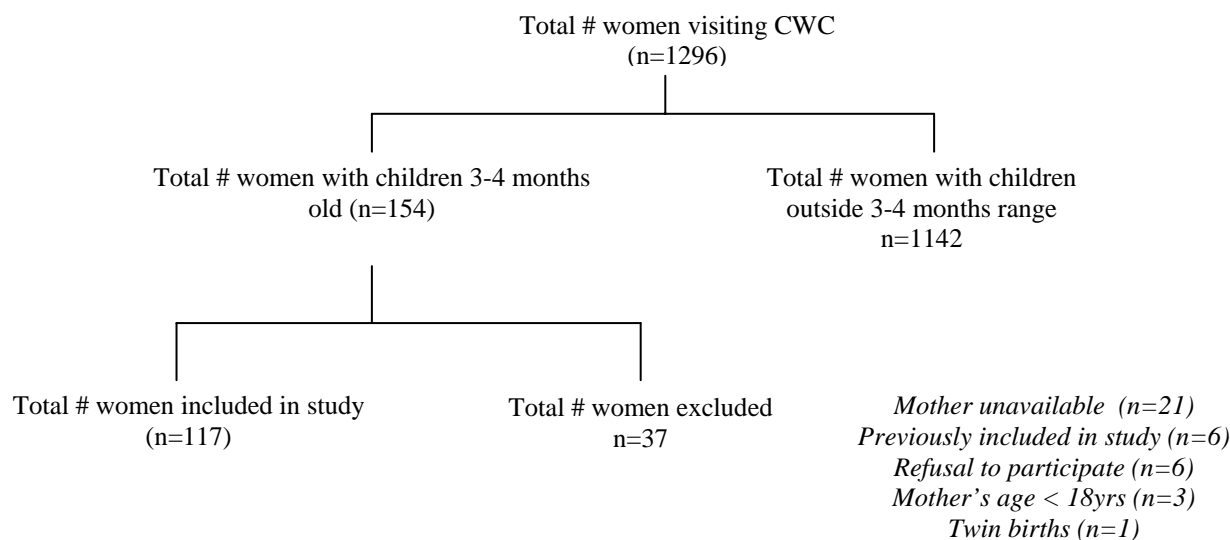


Figure 1. Recruitment for subclinical mastitis study in Ghanaian women

Table 1. Maternal background statistics (N=117).

Maternal Characteristics	Mean or %	SD	Median	Range
<b>Maternal Health Perception</b>				
<i>Excellent</i>	92.3			
<i>As Usual/Normal</i>	5.9			
<b>Maternal Age, yrs</b>	27.0	5.8	27.0	18.0 – 46.0
<b>Parity</b>	2.5	1.4	2.0	1.0 – 9.0
<b>Maternal MUAC, cm</b>	27.3	3.3	26.6	19.3 - 36.5

Table 2: Breast milk Na/K among women with and without SCM.

Na/K		Geometric mean	SD	Range
Women with unilateral SCM (N=35)	Affected side <sup>a</sup>	1.49	2.73	1.03 – 16.98
	Non-affected side <sup>b</sup>	0.65	0.23	0.06 – 0.99
Women with bilateral SCM (N=18)	Right side <sup>a</sup>	1.98	3.76	1.02 – 14.12
	Left side <sup>a</sup>	1.62	3.56	1.01 – 16.34
Women without SCM (N=64)	Right side <sup>a</sup>	0.60	0.20	0.05 – 0.98
	Left side <sup>a</sup>	0.62	0.23	0.06 – 1.00
All women (N=117)	Right side <sup>a</sup>	0.83	2.25	0.05 – 16.98
	Left side <sup>a</sup>	0.85	1.57	0.06 – 16.34

Different alphabets for same group indicates statistically significant difference at p<0.05