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# More sleep, more milk

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## ABSTRACT

Breastfeeding represents the best feed for infant, nevertheless this task is particularly challenging for mothers. Sleep time and quality are undeniably reduced in the postpartum period. No study has demonstrated the relationship between slow wave sleep and lactation. Here, we self-report a unique experimental case during which the mother registered her own sleep with SUUNTO 9 watch and quantified her milk volume, blind to sleep parameters. This case report highlighted an interesting strong correlation between stage N3 (slow wave sleep) duration and milk production. It also demonstrated that this production is linked positively to subjective sleepiness in the morning and breast tension, and negatively to the number of awakenings. These results emphasized the need of sleep preservation, especially N3 sleep during breastfeeding. Splitting nighttime infant care among parents, saving mother's sleep as much as possible during the first part of the night, could help improving lactation.

**Keywords:** lactation; slow wave sleep; breastfeeding; postpartum; motherhood

## DISCLOSURE STATEMENT

All the authors have seen and approved the manuscript. Institution where work was performed: Department of Sleep and Neurology, Beau Soleil Clinic, Montpellier, France. The authors report no conflicts of interest.

## INTRODUCTION

Breastfeeding is a natural physiological function of motherhood. It is recommended by World Health Organization during the two first years of life, because it is recognized as the best feed for infant. Maternal benefits include decreased risk of postpartum depression, breast and ovarian cancer, hypertension, cardiovascular disease, and type 2 diabetes mellitus. Infant benefits include decreased risk of atopic dermatitis, gastroenteritis, unexpected infant death syndrome and higher intellectual quotient. Nevertheless, it is one of the most challenging part of postpartum. Mothers endorse the responsibility to give a qualitatively and quantitatively sufficient milk to their infants. Breastfeeding rates are lower than recommended and more than 70% of the mothers experience breastfeeding difficulties. Perception of insufficient amount of milk and fatigue represent major risk factors for early breastfeeding cessation<sup>1</sup>. The main determinants such as mother's mood, hydration and sleep are vulnerable at the early post partum period. The aim of our case report was to measure a correlation between milk volume and the different factors suspected to influence lactation, especially sleep duration and quality.

## REPORT OF CASE

CA gave birth by vaginal delivery, without complication, on April 26, 2022 at 41 weeks and 4 days of amenorrhea of a 3.03 kg and 48 cm little girl, who received exclusive breast feeding. Every night, the mother slept alone until the first breastfeeding, the baby staying with her father, then she kept the baby (room-sharing) for the rest of the night. From June 30 until July 22, morning volume of milk from the right breast was measured systematically during the 30 minutes after the mother's morning wake up. Medela Symphony breast pump was used according to the same program during 10 minutes, including 2 minutes of stimulation and 8 minutes of expression. During the day, breastfeeding lasted 5 to 10 minutes and was alternate. During the night, it was on the left breast only, to keep the right free of feeding.

The number of feedings per 24 hours, the number of awakenings per night, the presence of the coparent and the way of sleeping (bedsharing/roomsharing) were collected in a diary. Karolinska questionnaire, thirst sensation and breast tension were reported right after morning awakening, blindly to the milk volume. Mood was monitored by the Edinburgh Postnatal Depression Scale.

SUUNTO 9 watch was worn on left wrist (except for reload time, around two hours weekly) to measure total sleep time, sleep efficiency, latency to sleep onset, deep sleep duration, wakefulness duration and daily caloric expenditure. SUUNTO 9 technology sensitivity and specificity to evaluate sleep have been previously validated<sup>2</sup>. The slow wave sleep duration quantified by SUUNTO 9 watch was validated on CA, during breastfeeding period, with a one night gold standard blind polysomnography evaluation (Compumedics). The concordance between the two methods was 91%. The milk volume was measured blind to the sleep data.

This experimental case report was self-designed and carried out by CA.

No naps were notified. No mood disorder was reported (Edinburgh Postnatal Depression Scale =0) either at the beginning or at the end of the month. Thirst sensation was present nine times out of the 20 mornings. Breast tension was quoted as absent, one time, mild, twice, moderate, ten times, intense, six times and very intense only once. The father was absent only four times. After nighttime breast feeding baby was always room sharing and was bedsharing 18 out of the 20 nights. All other clinical data are reported **Table 1**.

We looked for linear correlations using Pearson test between collected morning milk volume and all other continuous measured variables (**Table 1**). Collected milk volume was strongly positively correlated to stage N3 sleep duration (**Figure 1**), while other measures did not correlate (**Table 1**).

Because all our variables were not independent, we created, to predict milk volume a multivariate regression model, aggregating all the data (continuous data reported in **Table 1** and discontinuous described in the results). Data were z-scored and we calculated a multivariate model using Lasso method

to approximate milk volume with a minimal set of variables. The obtained model (error rate 16%,  $p=0.000328$ ) predicted the milk volume with four variables out of 14.

The main influence of our predictive model of collected milk volume came from stage N3 duration (9.9), then came the subjective sleepiness in the morning (8.4), the number of awakenings (-7.63), and the breast tension (5.64).

## **DISCUSSION**

This case report demonstrated an interesting strong correlation between stage N3 duration and milk production in the morning. It also highlighted that this production is linked positively to subjective sleepiness in the morning and breast tension and negatively to the number of awakenings.

Breastfeeding is a natural process which stimulates the secretion of prolactin during stage N3 sleep<sup>3</sup>. The prolactin action lasts several hours and regulates the amount of milk production. The release of oxytocin is much shorter, facilitating milk ejection<sup>4</sup>, and is associated with better mood<sup>5</sup>. Our case report shows evidence that increased stage N3 sleep may promote milk production. This is in line with the increased amount of stage N3 sleep measured in breastfeeding mothers<sup>6</sup>. One study has demonstrated that the longer their sleep duration is, the more mothers tend to breastfeed<sup>7</sup>.

Sleep amount is frequently reduced in postpartum period but this reduction is probably less important for breastfeeding mothers<sup>8</sup>. Preserving sufficient sleep quality and especially stage N3 sleep seems critical to optimize lactation. Another study has highlighted that poor sleep quality on self questionnaires was a significant predictor for lower milk volume estimated through infants weight measure<sup>9</sup>. According to the literature and our results, we can propose the following virtuous circle model : breastfeeding increases slow wave sleep, during which prolactin is secreted to produce more milk allowing breastfeeding.

Subjective sleepiness in the morning was associated with more milk. This might be indirectly linked to stage N3 sleep known to be associated with more sleep inertia<sup>10</sup>. In the same way, the number of awakenings was associated with less milk, probably because it reduces stage N3 sleep duration. Finally, breast tension was associated with milk production, already stocked up in breast at feeding time.

We have not measured prolactin in this case which could be a limitation. However, prolactin production is highly variable and does not represent a good marker for lactation<sup>11</sup>. All in all our main limitation is the unique case report justifying further studies, but the constraints linked to the protocol may prevent larger explorations.

Breastfeeding is vulnerable and here we demonstrate that stage N3 sleep preservation is determinant for milk production. The stage N3 sleep duration is higher at the beginning of the night which makes this period critical for a good lactation. Room sharing is recommended to prevent unexpected infant death syndrome, nevertheless it can alter the quality of mother's sleep. Splitting nighttime infant care among parents, saving mother's sleep as much as possible during the first part of the night could help to improve lactation.

## **ABBREVIATIONS**

CA : Cecile Aerts

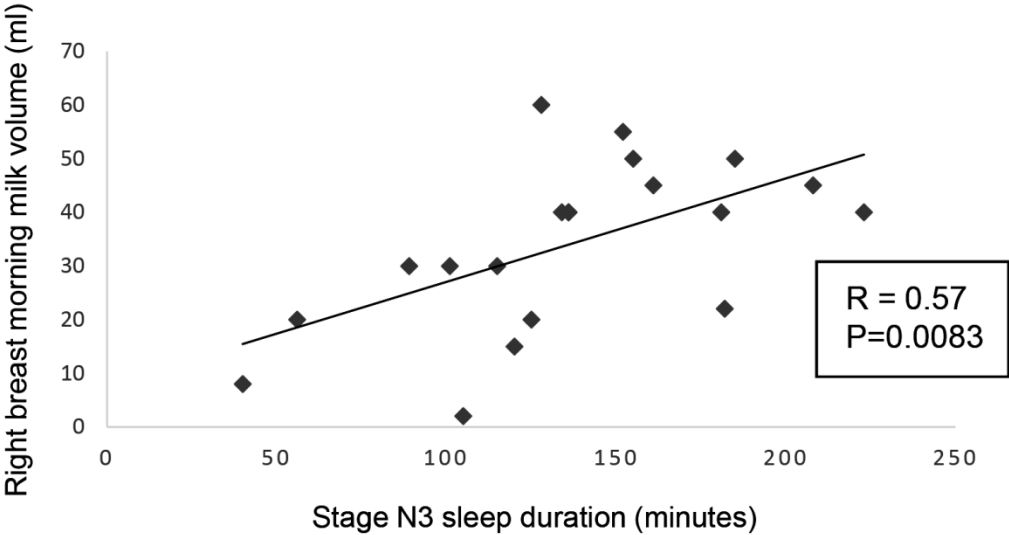
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**Figure 1**—Correlation between morning milk volume and stage N3 sleep duration.



**Table 1**—Correlations between collected morning milk volume, sleep and caloric expenditure.

<b>Variable</b>	<b>Measure</b>	<b>Pearson Correlation</b>	<b>95% CI</b>	<b>P</b>
Number of feedings per 24 hours (both sides)	10.5 (1.64)	-0.0143	-0.454, 0.4309	.95
Maternal total sleep time (minutes)	446.50 (47.86)	0.22	-0.2435, 0.6058	.34
Sleep efficiency (%)	82.05 (10.24)	0.2118	-0.2546, 0.5982	.37
Latency to sleep onset (minutes)	6.75 (10.96)	0.06	-0.3924, 0.49	.80
Stage N3 sleep duration (minutes)	136.6 (46.69)	0.57	0.1744, 0.81	.0083
Wakefulness duration (minutes)	52.5 (32.61)	0.11	-0.3484, 0.5278	.64
Latency to first breast feeding awakening (minutes)	147.45 (58.08)	0.26	-0.2208, 0.6207	.30
Number of awakenings	3.2 (1.24)	-0.08	-0.5042, 0.3763	.74
Measure of subjective sleepiness at morning awakening (Karolinska)	4.3 (1.59)	0.36	-0.1026, 0.6899	.12
Caloric expenditure (Kcal)	1861 (189.48)	0.05	-0.4015, 0.4818	.83

Data are mean (standard deviation).