Did Children Eat Formula, Better Asleep?

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Abstract: Introduction: Sleep is abasic human need. Many people believe formula improve sleep of babies. Some studies showed prolonged sleep in formula fed babies. In condition formula feeding disturbs sleep about allergies and as a result and reduces quality of sleep. Mothers of formula fed think that their children eat formula, better asleep. This study was conducted primarily to investigate sleep patterns in breast-fed infants and formula-fed ones aged 6 to 12 months inhibited and secondly to evaluate the prevalence of sleep disorders among them.

Methods: This analytical study was performed using cross-sectional design. Through convenience sampling method, 53 clinically healthful breast-fed infants and 53 formula-fed infants who referred to health center were recruited for the current investigation. The questionnaires were completed observing BISQ standards. Statistical analyses were carried out using SPSS (version 18) and running t-test and chi-square.

Results: No significant statistical difference between Age, job and education of mothers and gestational age, Delivery type, Birth weight, birth height, birth head circumflex and sex, weight, age in two group. Rolling in bed were significantly less frequent in breast-fed infants compared to formula-fed ones (P.Value=0.004). Formula-fed infants mostly slept on their tummy; whereas, breast-fed infants slept on their back (P.V=0.099). Formula-fed infants unusual sound more frequently than breast-fed infants (P.V=0.001). The prevalence of sucking and rocking dependency for sleeping was higher among formula-fed infants which led to higher rate of night waking (P.Value=0.000).

Conclusion: Opposite to current believe of mothers formula fed had more difficulty in their sleep compare to milk mothers. Given that formula-fed infants experienced much more sleeping problems than breast-fed ones, breast feeding or feeding with formula closed to breast milk ingredients is recommended. Moreover, understanding sleep disorders and implementing appropriate strategies such as supplying and replacing formula milk similar to breast milk ingredients are highlighted to improve sleep patterns and consequently health among infants.

Keywords: Formula milk, Sleep disorders, Sleep pattern

Introduction

Sleep is a complex physiological and behavioral process during which one experiences reversible condition, separation from the surrounding environment, and relative non-response condition. Sleep consists of two important stages: Rapid Eye Movement (REM) Sleep and Non-Rapid Eye Movement (NREM) sleep. Children and adults begin their sleep with NREM (restful sleep), while infants usually begin their sleep with active sleep. Sleep duration is usually 60 minutes in infants and 90 minutes in adults and children (1). Children's sleep disorder is the fifth most common reason for parents to visit pediatricians and clinics. Children who wake up more than three times and have low activity are said to have sleep disorder (2). There are numerous sleep disorders. Most of them which include sleep-onset association disorder, resistance in falling asleep in infancy, parasomnia, and 24-hour rhythm disorders during adolescence are movement disorders. Others are caused by difficulty in falling asleep. Almost 25 to 40% of children suffer from sleep problems in one stage of their lives. Disrupted natural sleep can cause a variety of physical and psychological problems in children and, accordingly, parents and family. Children's sleep disorder is effective in life of families, societies, and positive role of parents. Finally, children's sleep disorder is considered a child abuse factor (3). Researchers have pointed out to various factors concerning the sleep disorder including chronic diseases, fear of sleeping, excessive intake of fluids, infantile colic, early
phase syndrome, and delayed sleep syndrome. Nutrition by powdered milk or breast milk is one of the most important factors causing sleep disorder (2). We can point out to the role of powdered milk and its impact on sleep disorder. Generally, the main topic is related to the sensitivity of children to powdered milk. Sensitivity to milk is associated with insomnia, frequent crying, shortened sleep duration, sudden waking up, and unusual sounds during sleep among powdered milk-fed infants. A study in Spain in 2012 concerning the role of breast milk and powdered milk in sleep disorder in infants showed that breast-fed children have longer duration of sleep. Melatonin in breast milk decreases the nerve excitability and improves infant’s nocturnal sleep (4).

**Method**

This is a descriptive, cross-sectional study. A total of 106 infants visiting Number 4 Health Clinic in Meybod, Yazd were enrolled as the sample using simple, random sampling. All participants met the inclusion criteria and were aged 6 months to 2 years.

**Inclusion and Exclusion Criteria**

- Infants fed by only conventional powdered milk
- Breast-fed infants
- Infants were similar concerning living places, gender, and responding to milk
- All infants were physically and psychologically healthy

Infants fed by certain powdered milk and those with less than 50% of powdered milk in their meals were excluded from the study. Infants with certain diseases or medicine intake were also excluded. Brief Infant Sleep Questionnaire (BISQ) was developed. The questionnaire variables included mother's age, job, and education, gestational age at birth, type of delivery, gender, weight, height, head circumference at birth, age of infant, sleep time, settling time, movement during sleep, number of night waking, and unusual sound at night. The reliability and validity of the questionnaire were verified. Data collection began in May 2015 and lasted for 3.5 months. The questionnaires were administered by the researcher after explaining for the parents. In case of uncertainty of parents regarding some questions, they were answered after a couple of weeks through telephone conversations. Data were analyzed using SPSS 18 and Fisher and Chi-square tests.

**Results**

The infants in two groups were not statistically different concerning the mother's age, job, and education, gestational age at birth, type of delivery, gender, weight, height, head circumference at birth, and age of infant. Powdered milk-fed infants had later onset of sleep and used to sleep later for one hour (PV=0.001). They required more time for sleeping at early evening (PV=0.001). 41.5% of powdered milk-fed infants and 9.4% of breast milk-fed infants woke up more than three times during night for feeding. 71.7% of powdered milk-fed infants and 9.4% of breast milk-fed infants woke up between one to three times during night for feeding. 7.5% and 15.1% of powdered milk-fed infants and breast milk-fed infants did not wake up at all for feeding. 7.55% of powdered milk-fed infants and 3.8% of breast milk-fed infants were constantly sucking. In general, powdered milk-fed infants woke up more for feeding during night (PV=0.000). Powdered milk-fed infants moved more while sleeping and used to leave their bed as 52.8% of powdered milk-fed infants and 22.6% of breast milk-fed infants woke up somewhere apart from the initial sleeping location. 24.5% of powdered milk-fed infants and 43.4% of breast milk-fed infants woke up in the initial sleeping location. 13.2% of powdered milk-fed infants and 9.4% of breast milk-fed infants were not found in their beds (PV=0.004). 39.6% of powdered milk-fed infants and 17% of breast milk-fed infants slept on their stomach. Back sleepers were 9.4% of powdered milk-fed infants and 28.3% of breast milk-fed infants. 28.3% of powdered milk-fed infants and 30.2% of breast milk-fed infants fell asleep in a non-fixed position (PV=0.019). Powdered milk-fed infants had more unusual sounds during sleeping as 28.3% of powdered milk-fed infants and 3.8% of breast milk-fed infants had very high sounds and four powdered milk-fed infants and one breast milk-fed infant frequently made unusual sounds during the sleep. 47.2 % of breast milk-fed infants and 35.8% of powdered milk-fed infants did not make any sound. 47.2% of powdered milk-fed infants and 28.3% of breast milk-fed infants made low sounds during sleep (PV=0.001).
Tables

Table 1: Sleep Time and Essential Sleep Duration for Early Evening

<table>
<thead>
<tr>
<th></th>
<th>Sleep Time for Early Evening</th>
<th>Essential Sleep Duration (Minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdered milk-fed Infant</td>
<td>11.39±1.2</td>
<td>25.85±10.5</td>
</tr>
<tr>
<td>Breast-fed Infant</td>
<td>10.36±0.56</td>
<td>19.25±8.4</td>
</tr>
</tbody>
</table>

According to the table and T-test, a significant relationship was found between the two groups concerning the sleep time (PV=0.000) and mean duration of sleep in early evening (PV=0.001).

Table 2: Number of Waking for Feeding

<table>
<thead>
<tr>
<th></th>
<th>No waking</th>
<th>1-3 times</th>
<th>More than 3 times</th>
<th>Always Sucking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdered milk-fed Infant</td>
<td>7.5%</td>
<td>43.4%</td>
<td>41.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Breast-fed Infant</td>
<td>15.1%</td>
<td>71.7%</td>
<td>9.4%</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

According to the table and Fisher test (PV=0.000), a significant relationship was found between two groups.

Table 3: Movement during Sleeping

<table>
<thead>
<tr>
<th></th>
<th>No Movement</th>
<th>More than 50% in Initial Location</th>
<th>Less than 50% in Initial Location</th>
<th>Not in the Initial Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdered milk-fed Infant</td>
<td>9.4%</td>
<td>24.5%</td>
<td>52.8%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Breast-fed Infant</td>
<td>24.5%</td>
<td>43.4%</td>
<td>22.6%</td>
<td>9.4%</td>
</tr>
</tbody>
</table>

According to the Fisher test and table (PV=0.004), most powdered milk-fed infants moved during sleep and were found somewhere else than the initial location.

Table 4: Waking up Condition

<table>
<thead>
<tr>
<th></th>
<th>Back</th>
<th>On Stomach</th>
<th>On Side</th>
<th>Non-Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdered milk-fed Infant</td>
<td>9.4%</td>
<td>39.6%</td>
<td>22.6%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Breast-fed Infant</td>
<td>28.3%</td>
<td>17%</td>
<td>24.5%</td>
<td>30.2%</td>
</tr>
</tbody>
</table>

According to table 4 and Fisher test (PV=0.019), a significant difference was found in sleeping condition in two groups.

Table 5: Unusual Sounds during Sleep

<table>
<thead>
<tr>
<th></th>
<th>No Sound</th>
<th>Low</th>
<th>High</th>
<th>Frequent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdered milk-fed Infant</td>
<td>35.8%</td>
<td>28.3%</td>
<td>28.3%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Breast-fed Infant</td>
<td>47.2%</td>
<td>47.2%</td>
<td>3.8%</td>
<td>1.95%</td>
</tr>
</tbody>
</table>

According to table 5 and Fisher test (PV=0.001), a significant different was found between two groups.

Discussion

Sleep is a biological rhythm and a high-level of physiological process influenced by social and cultural issues (5). Sleep causes the secretion of growth hormone, the development of children, and weight gain and growth which is of great importance at early age (6). Sleeplessness is the most common behavioral problem in children (7). If children's sleep disorder is not treated, it causes some complications such as disturbance in attention, concentration, memory, and learning and behavioral disorders (8). High percentage of sleep disorder can be treated in milk-fed infants (9). The study had some limitations including lack of parental awareness of sleep problems concerning the infants' sleep, movement and unusual sounds during sleep dependent on the quality of parents' sleep, parental training prior to the study, and inaccurate reporting by parents. Mothers sometimes begin using powdered milk due to low breast milk or frequent waking of infants for feeding. Yet, powdered milk declines the quality of infant's sleep. In a study in 1992, the number of waking was more in breast-fed infants, while powdered milk-fed infants had lower quality of sleep. Breast-fed infants were more likely to be fed and they spent longer duration of feeding than powdered milk-fed infants. No difference was found at the onset of nocturnal sleep between two groups (10).
Melatonin in breast milk improves the quality of sleep.

The study by Lee (2000) compared the behaviors of 188 breast-fed and powdered milk-fed infants. Breast-fed infants used to frequently wake up during the nights and had shorter duration of feeding (11). Frequent movement during sleep is one of reported problems in our study.

In the study by Mozafari et al. (2013) in Qom, Iran, a total of 200 children aged 2-12 were investigated concerning the sleep behavioral and movement disorders. 46.3% of children younger than 7 years old and 53.3% of children older than 7 years old had frequent movement during sleep (12). Age was different in these two groups. Yet, high prevalence of such disorder shows the importance.

The study by Cubro (2007) on 30 infants aged 4-20 weeks showed that adding Nucleotides and Tryptophan to conventional powdered milk causes a significant increase in real sleep time, a decrease in the frequency of movement in sleep, and the number of waking (13). In addition to the age, cultural and ethnic differences were different between the two groups. According to Cohen, breast milk has a certain amount of melatonin not found in powdered milk (4). In our study, we concluded that lack of breast milk can be replaced by using other types of milk similar to breast milk or adding certain materials to powdered milk in order to decrease the sleep disorder in powdered milk-fed infants.

In the study by Franco (2005), 16 infants aged 6-16 months were swaddled during nights. As the movement declined, NREM and the quality of sleep increased (14). Yet, nutrition was not taken into account in this study. Frequent movements which are higher in powdered milk-fed infants showed that their quality and depth of sleep is lower in breast-fed infants. Naturally, when sleep cycle changes from NREM (deep) to REM (light), individuals move. If powdered milk-fed infants move more, it means that they experience a restless sleep and their deep sleep is shorter than breast-fed infants. In this study, powdered milk-fed infants used to sleep on their stomach and in non-fixed positions.

In the study by Hajime Togari et al. (2000), 1626 1.5-month-old breast-fed infants were investigated concerning the position of sleep. They were more likely to sleep on their stomachs. 87% of infants moved from back sleep to stomach sleep not influenced by parents’ movement (15). The study, however, did not investigate the relationship between nutrition and sleep position. New findings show that powdered milk-fed infants displayed more unusual sounds during sleep and breast-fed infants had no or low unusual sounds. Studies concerning unusual sounds during sleep were not found to be taken into account. Most studies in this regard are associated with adults. For example, the study by Pour Afkari (2004) investigated sleep abnormalities. The study reported 26.4% sleep talking, also known as Somniloquy (16). Unusual sounds in powdered milk-fed infants are associated with the fact that sounds are a manifestation of sleep disorder in adults known as Somniloquy.

The study by Mozafari showed that 62.1% of younger-than-7 and 37.2% of older-than-7 children suffer from sleep talking in the form of moans, whispers, etc. (17). The study by Hawley reported that nocturnal waking was 49.4% in 12-month infants and 45.9% in 24-month infants for once or more than once. The effect of nutrition was not studied, though. The study by Kahn (1988) showed that stopping powdered milk feeding for 7 weeks decreased the nocturnal waking by almost 40%. Accordingly, sleep duration increased. The study showed that powdered milk worsens the sleep (19). Melatonin in breast milk plays a key role in decreasing the nerve excitability and improving children's nocturnal sleep (4).

Conclusion

Mothers begin feeding their infants with powdered milk assuming that it would help them sleep better. Our study showed that powdered milk is the chief cause of sleep problems in powdered milk-fed infants. The role of allergy to powdered milk was not studied, though. The findings included delayed onset sleep in powdered milk-fed infants, frequent waking, higher movement during nocturnal sleep, restless sleep, and unusual sounds during sleep seen more in powdered milk-fed infants than in breast milk-fed infants which is associated with the lack of melatonin in powdered milk. The materials in breast milk can affect the sleeping habits. Similar to the study by Cubro, adding Nucleotides and Tryptophan to conventional powdered milk improves sleep disorders in powdered milk-fed infants. Adding some materials to the conventional powdered milk in order to have a similar compound to breast milk and melatonin as a sleep regulatory agent can decrease the sleep disorders in powdered milk-fed infants.

Section 3. chapter15: Normal Sleep and Pediatric sleep disorders. P 47.


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