Effect of *Galohgor* Cookies Intake by Postpartum Mother on Newborn’s Growth

Ibnu Malik Bakhru Ilmi1,2, Rimbawan1, Katrin Roosita1, Zakiudin Munasir3

ABSTRACT

**Background:** Health and nutritional problems are commonly found in postpartum mothers. Prevention of vitamin A deficiency in postpartum mothers continues to be done. Utilization of local food such as *Galohgor* might be an alternative to address the nutritional needs of postpartum mothers and thus supports newborn’s growth.

**Objectives:** This study aimed to analyze the effect of *Galohgor* cookies intake by postpartum mothers on newborn’s growth.

**Methods:** This research used a quasi-experimental design with two groups including the control group (n = 9) and the intervention group (n = 9). The subjects were postpartum mothers aged 20-35 years (parity between 2 and 5) with normal delivery and had no medical indication. A total of four pieces of cookie (~ 4 g of *Galohgor* powder) were daily consumed from the 1st day to the 40th day after delivery. Anthropometric measurements (body weight, height, head circumference) were performed on day 0, 14 and 40 after delivery. Meanwhile, breast milk samples were taken on day 14 and 40 to analyze the levels of breast milk insulin-like growth factor-1 (IGF-1).

**Results:** This study showed that the newborns of the intervention group had significantly heavier weight and larger head circumference on day 14 and 40 after delivery (p <0.05). IGF-1 could be maintained by consuming *Galohgor* during postpartum period. However, this study found no differences in body length of both groups (p> 0.05).

**Conclusions:** Consumption of *Galohgor* cookies by postpartum mothers might support the newborn’s growth.

**Keywords:** *Galohgor*, growth, IGF-1, newborn, postpartum mother

*Correspondence:*
Rimbawan
Email: (rimbawan62@yahoo.com)
Departemen Gizi Masyarakat, Fakultas Ekologi Manusia, IPB University, Bogor, Indonesia
Program Studi Ilmu Gizi, Fakultas Ilmu Kesehatan, Universitas Pembangunan Nasional “Veteran”, Jakarta, Indonesia
Departemen Ilmu Kesehatan Anak, Fakultas Kedokteran, Universitas Indonesia, Jakarta, Indonesia

INTRODUCTION

Early development is a critical period that determines the future nutritional status 1. Pospartum is an important period lasted for 6 weeks after delivery when the mother and baby adapt to the new environment 2. Several health problems have been reported during postpartum, including anemia, depression, harmful beliefs and practices, oxidative stress and vitamin A deficiency 3-7. Free radicals increase after delivery and lead to oxidative stress 8. Elevated tumor necrosis factor-α (TNF-α) level was observed during the gestation and continued to increase at postpartum 9. This may affect newborn’s growth due to the negative association between TNF-α and growth hormones and the quality of milk 10. Meanwhile, vitamin A has been widely known as an antioxidant that effectively neutralizes free radicals 10.

Vitamin A is one of nutrient that is important for growth 11. Besides being conventionally functioning for vision, vitamin A plays an important role in regulating growth hormones, boosting the immune system, and regulating the expression of several genes related to growth 12,13. To meet vitamin A requirement, several countries give a high-dose vitamin A tablets (200,000 IU) to postpartum mothers. This program contributes to reduce the prevalence of vitamin A deficiency (retinol levels <20 µg / dl) among under-five children in Indonesia to be less than 5% 14. However, this program is costly, does not change an individual's eating behavior and is still at risk of deficiency in the event of stress, diarrhea, measles or other diseases 15. Furthermore, the recent study showed that 44% of breastfeeding mothers in Indonesia did not meet the estimated average requirement (EAR) of vitamin A7.

*Galohgor* is a native Sundanese herbal medicine made from 56 types of plants, including leaves, stems, fruits, nuts, herbs and spices, commonly consumed by postpartum mothers and rich in vitamin A and β-carotene 16-18. *Galohgor* has been shown to accelerate uterine recovery and lactation time, and to increase milk production in experimental animals 19. Genetically, β-carotene is believed to be responsible for galactotrophic effect of *Galohgor* by enhancing the expression of the connexin (Cx43) and β-casein (Csn2) genes 17. In addition, *Galohgor* has also been shown to improve blood glucose, visceral fat profiles and to reduce oxidative stress 20,21. Hence, *Galohgor* might give health benefits to the postpartum mothers.

However, the acceptance of *Galohgor* is relatively low due to unpleasant taste, especially for those who are not accustomed. Fortunately, *Galohgor* has been developed into various products. *Galohgor* cookie is one of the developed products that commercially sold and has
been tested on patients with type 2 diabetes mellitus. The result showed Galohgor cookies reduced visceral fat, reduced malondialdehyde, and maintained liver and kidney function. Our recent study showed that Galohgor cookies reduced oxidative stress in postpartum mothers. However, its effect on early development had not been studied yet. Therefore, this study aimed to examine the effect of Galohgor cookies intake by postpartum mothers on newborn’s growth.

**METHOD**

**Materials**

Galahogor cookies were obtained from CV. Nutraseutikal Galahogor, Bogor (P-IRT No. 2063201010485-22). The cookies contained 1 g of Galahogor, while the control cookies did not contain Galahogor. The main ingredients of cookie were wheat flour, egg yolk, milk, sugar, margarine, salt, and coconut milk. A total of 50 ml of breast milk was taken using breast pump electric spectra S1 plus to analyze IGF-1 concentrations. The breast milk was kept under -80°C for analysis. The baby scale Seca 232 was used to measure both weight and length of the newborns, while non-stretchable tape was used to measure head circumference.

**Subjects**

The subjects were screened in several Community Health Centers (CHFs) in Bogor, including CHF of Pancasan, Cipaku, Kayumanis, Sempur and Warung Jambu. The subjects were mothers aged 20-35 years old (parity between 2 and 5) and had a single pregnancy. Mothers were healthy and able to communicate. Postpartum mothers with premature infant (<2500 g) and/or the labor performed by cesarean section were excluded. There were 18 subjects divided into 2 groups, the intervention group and the control group. This number was calculated using Lemeshow and colleagues formula with a confidence interval (1 - α) of 90% and power of test (1 - β) of 80%.

**Procedures of Intervention**

The present study used a quasi-experimental design. The mothers with gestational age between week 30 and 33, and visited the community health centers for prenatal care were included for screening. The informed consent was provided and signed by all subjects. The eligible subjects were divided to receive either Galahogor cookies (n=9) or control cookies (n=9). A total of 40 g of cookies were daily given for 40 days (day 1 to day 40 after birth). At baseline, the age of mothers, parity, the birth length, weight, and head circumferences were assessed. The subjects were suggested to exclusively breastfeed their infants and to eat healthy diet. The breast milk was taken at day 14 and 40. On day 14 after birth, the breast milk is relatively mature whereas the nutritional contents tend to be consistent for the next several months. The second point of sampling was determined due to probably the end stage of puerperium. To improve subject’s compliance, the cookies were given once each 5 days, the subjects were monitored using short message service every day. All study protocols have been approved by the Research Ethics Committee of IPB University, Indonesia (No.081/IT3.KEPMSM-IPB/SK/2018).

**Anthropometric Assessment**

The newborns were measured according to the standard protocols. The measurement of weight was done by removing all the child’s clothes. The baby scale measured to the nearest 5 g. Simultaneously, the length was measured by holding the newborn’s legs, positioning the head and straightening them. The crown touched the headboard to make Frankfort plane positioned vertically. The shoulders and hips were positioned to the long axis of the body. The footboard was moved against the newborn’s feet with the toe pointing upwards. There were two observers needed for the length measurement. The baby scale measured the length to the nearest 1 mm. The non-stretchable tape was applied around the head. The tape position was above the eyebrows and covered the fullest protuberance of the skull. The measurement was recorded by tightening the tape to compress the hair and skin. The non-stretchable tape measured to the nearest 1 mm.

**Breast milk IGF-1 Analysis**

The breast milk IGF was measured using the Human IGF-1 Quantikine enzyme linked immunosorbent assay (ELISA) kit (the quality of Human IGF-1 Quantikine ELISA kit is certified with ISO 13485: 2003 and EN ISO 13485: 2012). The samples were thawed before analysis. The fat of breast milk was separated using centrifugation at 30,000 for 15 m. After removing the fat layer, a total of 40 μl of sample was pipetted into the test tubes containing buffer solution. The test tubes were then added 80 μl of antibody. The samples in the tubes were subsequently assigned to the well plate. The plate was sealed and incubated at room temperature for 30 m. After incubation, the plates were washed using buffer solution. The stopping solution was pipetted and the plate was read at 450 nm.

**Data Analysis**

Data were presented in mean ± standard deviation (SD). The differences between groups was tested using independent t-test, while the differences between day 14 and 40 of intervention was tested using paired t-test. P-value < 0.05 was considered to be significant.

**RESULTS AND DISCUSSION**

The characteristics of subjects and their newborns were equally distributed at baseline assessment (Table 1). The subjects were around 30 years and were multiparous mothers with parity between 2 and 3. Both groups had the average newborn’s birth weight, length, and head circumference more than 3 kg, 48 cm, 32 cm respectively. All anthropometric measurements showed positive changes between the measurement at day 14 and day 40 for both groups. The weight of newborns differed significantly at day 14 and day 40 between the control and intervention groups. The same
pattern did also appear in head circumference. However, the length did not differ at those points. The newborns in intervention group seemed to have heavier weight and larger head than the control group (Table 2). The result of breast milk analysis showed that IGF-1 concentrations were found to be significantly different between the control and intervention groups only at day 40. IGF concentration significantly decreased in the control group, whereas it could be maintained in the intervention group during postpartum (Table 3).

Table 1. Characteristics of Subjects at Baseline

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Control (n=9)</th>
<th>Intervention (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
</tr>
<tr>
<td>Age (year)</td>
<td>30.33±4.000</td>
<td>31.22±5.286</td>
</tr>
<tr>
<td>Parity</td>
<td>2.56±0.726</td>
<td>2.78±0.667</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>3.017±0.292</td>
<td>3.311±0.322</td>
</tr>
<tr>
<td>Birth length (cm)</td>
<td>48.667±1.870</td>
<td>50.111±1.900</td>
</tr>
<tr>
<td>Birth circumference (cm)</td>
<td>32.277±0.971</td>
<td>33.333±1.391</td>
</tr>
</tbody>
</table>

Galahgor has long been used by postpartum mothers in the Sundanese community. Several studies have scientifically proven the benefits of galahgor for postpartum mothers. This study supports those scientific evidences whereas Galahgor cookies appeared to be able to support the growth of newborns. Even though the body length differences were not statistically significant, the value was relatively higher in the intervention group than the control group. This was thought to be caused by body length is a function of long-term health and nutritional experiences. Supporting growth effect of Galahgor was believed due to increased levels of breast milk IGF-1 which absorbed intact by infants in early life. Oxidative stress often occurs especially after delivery. Noor et al. showed TNF-α increased in postpartum caused by increased oxygen consumption and the apnea during uterine contractions. Unfortunately, TNF-α concentration is negatively associated with IGF-1 production. According to Lang et al., TNF-α might interfere with signal transduction and synthesis of growth hormone (GH) receptors thus giving rise to resistance. Growth hormone resistance causes the inhibition of IGF-1 synthesis. Also, the inhibition of GH receptors inhibits the capacity of cells to bind to GH. TNF-α inhibits sp1 and sp3 bond which are transcription factors for growth hormone genes. In addition, TNF-α also enhances the expression of SOSC-3 and CIS which play an antagonistic effect to the growth hormone signaling pathways.

Table 2. Weight, Length and Head Circumference of Newborns at Day 14 and 40

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control (n=9)</th>
<th>Intervention (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 14*</td>
<td>3.198±0.311</td>
<td>3.680±0.335</td>
</tr>
<tr>
<td>Day 40*</td>
<td>4.095±0.426</td>
<td>4.648±0.350</td>
</tr>
<tr>
<td>Changes</td>
<td>+0.896±0.243 **</td>
<td>+0.968±0.185**</td>
</tr>
<tr>
<td>Length (cm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 14</td>
<td>51.144±1.664</td>
<td>52.322±1.980</td>
</tr>
<tr>
<td>Day 40</td>
<td>53.633±1.335</td>
<td>54.277±1.801</td>
</tr>
<tr>
<td>Changes</td>
<td>+2.488±2.406 **</td>
<td>+1.955±1.558**</td>
</tr>
<tr>
<td>Head Circumference (cm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 14*</td>
<td>33.811±1.550</td>
<td>35.655±1.377</td>
</tr>
<tr>
<td>Day 40*</td>
<td>38.422±0.359</td>
<td>39.611±1.176</td>
</tr>
<tr>
<td>Changes</td>
<td>+4.611±1.446 **</td>
<td>+3.955±0.918**</td>
</tr>
</tbody>
</table>

* The difference between groups is significant at the 0.05 level
** The difference between day 14 and 40 in the group is significant at the 0.05 level

Galahgor is a potential source of antioxidants. This biological activity reduces oxidative stress and increases IGF-1 expression. It can be seen from the other parts of this study that reported by Ma’rifah et al. and showed that Galahgor cookies reduced malondialdehyde levels in postpartum mothers. The high β-carotene content in Galahgor was thought to underlie the mechanism. The supplementation of β-carotene has been reported to reduce oxidative stress, elevate glutathione level in lead-exposed workers. The same results were found by Lee et al. who found protein oxidation and DNA damage decreased after administration of β-carotene of 9 mg for four weeks in the active smokers. This finding is supported by observational research which showed that there was a negative correlation between β-carotene intake and oxidized low-density lipoprotein (ox-LDL). In addition, retinoic acid participates in development of the nervous system. Retinoic acid has two main roles including in the patterning and differentiation of neurons. In terms of patterning, retinoic acid contributes to the patterning of neural plate and neural tube. Disruption of retinoic acid intake causes defective neural tube closure and results in neural tube defects.
signaling causes imperfect development of hindbrain and anterior spinal cord. Induction of nerve cell differentiation by retinoic acid may occur due to the activation of several genes throughout affecting transcription factors, signaling molecules, structural proteins, enzymes and receptors\textsuperscript{37}.

### Table 3. IGF-1 Concentrations in Breast milk at Day 14 and 40 after Delivery

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control (n=9)</th>
<th>Intervention (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 14</td>
<td>Mean±SD</td>
<td>Mean±SD</td>
</tr>
<tr>
<td>0.416±0.097</td>
<td>0.353±0.014</td>
<td></td>
</tr>
<tr>
<td>Day 40*</td>
<td>0.321±0.028</td>
<td>0.360±0.043</td>
</tr>
<tr>
<td>Changes</td>
<td>-0.095±0.112**</td>
<td>+0.018±0.056</td>
</tr>
</tbody>
</table>

* The difference between groups is significant at the 0.05 level

** The difference between day 14 and 40 in the group is significant at the 0.05 level

β-carotene is a pro-vitamin A which plays an important role to meet vitamin A requirement of pregnant and postpartum women\textsuperscript{19}. An active vitamin A, retinoic acid, plays an important role in switch on the transcription of several genes\textsuperscript{38}. A low vitamin A diet is associated with low IGF-1 gene expression. Research was conducted by Fu et al.\textsuperscript{40} by providing a vitamin A deficient diet to quails aged one day. A vitamin A deficient diet reduced 22% of serum IGF levels, 21-52% of IGF-1 mRNAs in the testes, lungs, liver, and heart and caused growth retardation.

Human IGF-1 is positively associated with baby’s growth. Kon et al.\textsuperscript{41} found that there was a significant relationship between breast milk IGF-1 levels and the weight gain for 3-month-old infants. IGF-1 triggers proliferation, migration and inhibiting cell apoptosis\textsuperscript{42}. The mechanism of action of IGF-1 is similar to the mechanism of insulin. IGF-1 binds to its receptors on the membrane and then induces autophosphorylation in a number of cell proteins including the insulin receptor substrate (IRSs) group. IRS is a docking protein that can activate a number of signaling pathways, such as phosphatidylinositol 3-kinase (PI3K), Akt, Ras / Raf, and Rac. PI3K and Akt activation protect cells from potential loss of mitochondrial membrane and cytochrome c. This action inhibits caspase-3 activation which inhibits apoptosis.

There are several strengths of the present study, including relatively long period of intervention and high level of compliance. In addition, the clinical trial regarding the effect of foods on breast milk IGF-1 concentrations and newborn’s growth at postpartum is still limited. However, the present study did not control food intake of subjects, thus daily intake of postpartum mothers may affect the results. Therefore, the future study needs to control food intake of postpartum mothers and investigate IGF-1 levels in baby to confirm whether newborn’s growth is affected by IGF-1 status.

### CONCLUSION

Galahgor cookies intake by postpartum mothers could support newborn’s growth. Newborns of postpartum mothers who consumed Galohgor cookies had heavier weight and larger head circumferences. Galohgor cookies were also able to maintain breast milk IGF-1 concentration during postpartum period.

ACKNOWLEDGEMENT

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