

Combating Cesarean Birth Risks with Probiotic Supplementation Strategies

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Abstract

The human gut microflora is highly dependent on the mode of delivery. The increasing trend of cesarean due to poor diet, elective mode, etc. has led to the imbalance of the gut ecosystem. The gut flora and immune response connection seems to be inevitable. The cesarean delivered infants are prone to autoimmune diseases like atopic dermatitis, arthritis, respiratory disorders. The following review provides an insight of the consequences of c-section delivery on the gut flora of the infant. It also discusses the methods adopted by researchers to restore the gut microbiome of the infants devoid of the beneficial bacteria.

Keywords: Cesarean delivery; Infant gut flora; Probiotics

Introduction

Human birth follows two modes of delivery pertaining to the risks and complications involved in the delivery. The vaginal birth or natural delivery is followed by contraction of the uterus, rupture of the membranes and contact with the vaginal walls. The female vagina is known to harbor millions of bacteria. They include aerobic, anaerobic and facultative anaerobic organisms like *Enterobacter*, *Enterococcus*, *Lactobacilli*, *Bacteroides*, *Streptococci*, etc. [1]. The human gut microbiota is very crucial in the development of the newborn. These bacterial communities play an important role in the development of the immune system, smooth processing of digestive system, pathogen exclusion in the gut and deliver various other important functions. In short, the stool microbiome decides health of an individual.

Now, this microbial composition is highly dependent on the mode of delivery leading to mother-infant exchange of microbiome. During a vaginal delivery, when the child passes through the labor channel it comes in contact with the mother's vaginal bacteria. This bacterial footprint helps in natural inoculation of the baby thus helping in flourishing the neonate's gut flora. As the gut comprises of the lymphoid tissue (GALT) which holds eighty percent of the immunity, babies born devoid of gut bacteria have weak immunity. The researchers have postulated that the very first composition of gut flora plays a crucial role in providing healthy, long lasting effects in adult life

[2]. Thus, as the birth of the newborn brings happiness to parents, it also provides excitement and curiosity to a microbiologist.

Cesarean birth risks

Cesarean (C-section) delivery is an abdominal surgery which is usually performed during pregnancy complications. This surgery involves the birth in an unnatural way with the use of surgical devices, admission to intensive care and is prone to the risk of infections. Also, this mode of delivery is much expensive when compared to vaginal delivery [3]. Recent surveys have shown the sudden increase in the C-section deliveries. Women perceive cesarean as the safest and labor-free mode of delivery. Some women undergo C-section due to nervousness and fright of the labor pain during the delivery.

Urbanization, poor diet and modern lifestyle, elective delivery mode and selfish economic motives of the private institutions have led to the rise in C-section deliveries. There is a striking difference between the unnecessary C-sections conducted in the private hospitals than in government institutions [4]. The global statistic analysis has postulated that around US \$ 2.32 billion were spent by the Americans on unnecessary C-section while US \$ 432 million were spent on actually required C-sections [5]. This report is extremely astonishing as well as of deep concern. In the US and European countries, women have the right to opt for the mode of delivery. It has been found that one

in three women opt for C-section. The C-section also reduces the chance of subsequent normal delivery by 10% [6]. Available research data has proved that there is a vast difference between the gut microbiota harbored by the infants born naturally and those which have gone under the knife. Also, several C-section cases have reported the unnatural death of the mother due to symptoms like abnormal bleeding, blood pressure, weakness, etc [7]. The National Health Service of United Kingdom has reported that the death rate of women going under the knife is three times more as compared to natural delivery [8].

Consequences of cesarean birth on infants

The infant gut flora starts developing as soon as the neonate comes in contact with the vaginal channel and environmental organisms after birth. The vaginal delivery aids in direct contact with the mother's microbiota and thus helps in easy colonization of the gut with useful bacteria. In the case of C-section, this direct contact is absent and the child encounters more of environmental flora. Prior studies have shown the alarming difference between the microbiological content of babies born naturally and by C-section mode. The C-section leads to the prolonged hospital stay and short breastfeeding periods which lead to contact with pathogenic bacteria prevalent in hospital premises. The naturally born babies are instantly colonized with beneficial bacteria like *Lactobacilli*, *E.coli*, *Bifidobacteria*, *Streptococci*, *Bacteroides*, *Enterococci*, etc. The gut colonization of vaginally born infants is seen to develop successfully within 10 days of life. This is highly contrasting in the case of C-section infants. The meconium of these infants was colonized with environmental microbes that are present on the skin, hospital devices, clothes, etc. They included species of *Clostridium*, *Staphylococci*, *Propionibacteria* and *Corynebacterium species*. It was also observed that the gut colonization of these infants with lactic acid bacteria was prolonged until six months of birth. In one study, decreased *Bacteroides* were observed in C-section babies [9]. Even breastfeeding could not successfully stabilize the gut flora. Recent studies have reported the prevalence of health disorders among C-section infants.

These infants are frequently predisposed to symptoms of anesthetic neonatal depression and cases of fetal injury due to hysterectomy. Babies born by C-section suffer from gas, colic with gastrointestinal pain. They become fussy, cry excessively and also seem to surface breastfeeding complications, type 1 diabetes and respiratory distress. These infants are prone to auto-immune diseases like Crohn's disease, asthma, colon cancer, arthritis and respiratory complications due to weak immunity. Also, they cannot reflux out the toxins from the body normally [10]. Prior research has exhibited that this type of delivery contributed to 46% of childhood obesity [11]. One of the studies found that elective C-section caused an alarming rate of risk of autism in babies [12]. The origin of these symptoms is seemed to be related to the type of delivery, in turn, the composition of the gut ecosystem.

Gut microbiome restoration strategies

Several attempts have been made by the researchers to reconstitute the gut flora of C-section infants. One of them is by directly exposing and the infant's mouth to the vaginal flora swabs. But the safety of these techniques is of concern. Breast milk has found to contain *bifidobacteria*, enterococci and fewer species of lactobacilli. Prior study has revealed the presence of *Bifidobacteria* dominating the breast milk while lesser *lactobacilli* were observed. The human oligosaccharides in the breast milk supports act as probiotic and flourish the *bifidobacteria* in the gut. Hence breast milk alone could not provide the required bacterial communities of the gut ecology until six months of birth [13].

An attempt has been made to design probiotic infant formulae that will help balance the gut ecosystem. The probiotics help in increased immunity, reduced allergies, and increased IgA antibodies and reduction in inflammations [14]. These formulae contain multi-strain live organisms normally of human or animal origin. The concoction of this formulae comprises of prebiotic substrates like oligosaccharides, trehalose, lactose, that render protective function as well as nourishment to probiotic bacteria [15]. The probiotic supplementation can be given to the mother as well as the neonate. But some researches find it risky to feed formulae to the neonates. In one study, a probiotic supplementation with oligosaccharide given to the mother was found to improve the gut flora of neonate and reduction in cases of atopic dermatitis [16]. In a study, wherein pregnant mice were supplemented with LGG, reduced cytokine inflammation while increased TNF- α level were noted thus reducing the allergies in infants [17]. A Finnish cohort study revealed that probiotic supplementation with LGG in mother reduced the chances of eczema in their babies [18]. Also, it was found that supplementation of LGG during pregnancy decreased IgE antibodies to food allergens and also helped in colonization of *Bifidobacteria* [1].

LGG is also successful in treating infantile diarrhea. It also reduced the period of acute diarrhea and shedding of rotavirus during its infection. Probiotic supplementation with *bifidobacteria* has also proved to be beneficial in treating diarrhea in children. Probiotics have helped in reduction of atopic diseases by balancing the immune response of Th1 and Th2 helper cells. Increase in Th2 response leads to atopic diseases in the first year life of infants [19]. A multistrain probiotic of *L. gasseri* and *L. coryniformis* also increased immune-stimulatory response among its subjects [20].

There are some reports of *Lactobacillus* bacteraemia cases observed in infants. LGG was the main cause of bacteraemia. But, many clinical evidences have proved the efficacy of probiotics. In a randomized, double-blind trial in Turkey, the researchers found that early probiotic supplementation to the mother and infants reduced excessive crying and fussing in children [21].

In another study, 55 infants were administered with probiotic infant formula with *Bifidobacterium lactis* and *Streptococcus thermophilus*. These strains were able to reduce hospital associated diarrhea as compared with control (placebo). The percentage of infants on supplementation was only 7% whereas placebo showed 31% of diarrheal infection. The rotavirus infection and shedding periods were also significantly reduced in these infants [22]. In one RCT study, which involved groups of 20 infants on probiotic formula feeding (*S. thermophilus*, *L. helveticus*) separately were compared with 14 breastfed infants until 2mos. It was observed that all the three feeding strategies developed the gut bacteria and no significant difference was detected. Thus the studies reveal the potential of probiotic supplementation strategies [23].

Conclusion

The gut microbiota decides the health of the individual. The alarming rate of C-sections is of concern for the scientists. Women must be informed of the risks involved in C-section and they should be convinced of natural delivery. The modulation of the gut flora of C-section infants can be reconstituted with the help of probiotic intervention. Also, there is a need for awareness of breastfeeding among women as human colostrum has the beneficial prebiotics and few useful bacterial species. Exclusive breastfeeding along with probiotic formulae can help in developing the gut flora of C-section infants.

Several initiatives should be undertaken to isolate more new species belonging to gut for their probiotic properties. Careful and vigilant screening of human gut microbes for their probiotic potential may give excellent results rather using genetically modified organisms. The strains in the market must be periodically checked for their loss of activity and must be replaced soon with new potential candidates. These strains can be used as multi-strain probiotic that will render functions by balancing the gut flora. The timely prescription and dosage of probiotic in infants may help in reconstituting the gut ecology. To end with, live life longer with a healthy gut microbiome.

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