Profil Human Milk Oligosaccharides dan Polimorfisme FUT2 pada Ibu di Indonesia: Kajian pada Hubungan Genotipe- Fenotipe Sekretor Ibu dan Profil Asam Lemak Rantai Pendek Berdasarkan Pasangan Genotipe Ibu-Bayi = Profile of Human Milk Oligosaccharide and FUT2 Polymorphism in Indonesian Mothers: Review on Secretor Genotype-Phenotype Association and Profile of Short Chain Fatty Acids Based on the Genotype of Mother-Infant Dyad

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Abstrak

Human milk oligosaccharides (HMO) adalah karbohidrat yang terdiri dari 3–10 monosakarida dan tidak dapat dicerna oleh manusia. Fungsi HMO adalah prebiotik untuk mikrobiota usus. Metabolit yang dihasilkan mikrobiota adalah asam lemak rantai pendek (short chain fatty acid/SCFA). Sintesis HMO ditentukan oleh enzim fukosiltransferase 2 (FUT2) dan fukosiltransferase 3 (FUT3), yang disandi gen FUT2 dan FUT3. Polimorfisme gen FUT2 menyebabkan perbedaan HMO pada ASI. Ibu dengan kadar 2'fukosillaktosa (2'FL) 50 mg/L disebut ibu sekretor. Proporsi ibu sekretor bervariasi, karena polimorfisme gen FUT2 berbeda antar ras. Proporsi sekretor di Eropa > 80%, namun belum ada data di Indonesia. Penelitian ini bertujuan menganalisis proporsi sekretor dan polimorfisme gen FUT2, serta profil SCFA berdasarkan pasangan genotipe ibu-bayi.

Penelitian menggunakan desain potong lintang, dilakukan di RSIA Bunda selama bulan Desember 2021–Juli 2022. Subjek penelitian adalah ibu berusia minimal 18 tahun, menyusui eksklusif, dan sehat. Ibu dengan ras Kaukasia di atas 2 generasi dieksklusi. Bayi dari ibu yang memenuhi kriteria inklusi automatis menjadi subjek penelitian dan dieksklusi bila bayi pernah mendapat antibiotik. Pemeriksaan HMO dilakukan saat bayi berusia 2–5 minggu, sedangkan SCFA feses bayi saat usia 4 minggu. Sekuensing coding region FUT2 dilakukan pada ibu dan bayi.

Sebanyak 120 pasangan ibu-bayi memenuhi kriteria inklusi dengan proporsi ibu fenotipe sekretor 65,8% dan genotipe sekretor 65,8%. Hubungan antara genotipe FUT2 dan kadar 2'FL bermakna. Penelitian ini menemukan varian baru c.851C>G yang bersifat merusak berdasarkan prediksi in silico. Berdasarkan genotipe FUT2, diusulkan nilai ambang baru 2'FL 425,9 mg/L dengan nilai sensitivitas 98,7% dan spesifisitas 100%. Tidak terdapat hubungan antara proporsi relatif asetat, propionat, butirat dan genotipe ibu, genotipe bayi, maupun pasangan genotipe ibu-bayi.

.....Human milk oligosaccharides (HMO) are complex carbohydrates consisting of 3–10 monosaccharides which is undigestible to human. HMO acts as a prebiotic for gut microbiota, which produce short chain fatty acid (SCFA). The synthesis of HMO is determined by the activity of fucosyltransferase 2 (FUT2) and fucosyltransferase 3 (FUT3) enzymes, which are encoded by the FUT2 and FUT3 genes. Polymorphisms of the FUT2 gene result in different secretor status. Mothers with 2'-fucosyllactose (2'FL) level of 50 mg/L are referred to as secretor. The proportion of secretor varies worldwide due to FUT2 polymorphisms among races. The proportion of secretor in Europe is generally > 80%, but there is no data on secretor status in Indonesia. Thus, baseline data about secretor phenotype and genotype status in Indonesia is needed. This study aimed to analyze the proportion of secretor and FUT2 gene polymorphism in Indonesia, as well as the

stool SCFA profile based on the mother-infant dyad genotype.
This was a cross-sectional study conducted at Bunda Mother and Child Hospital from December 2021 to July 2022. The study subjects were healthy mothers aged at least 18 years, exclusively breastfeeding. Mothers with Caucasion ancestor from two generations above were excluded. Infants from eligible mothers were automatically included as study subjects but excluded if they had history of antibiotic administration. Breastmilk samples were obtained at infant's age 2–5 weeks old, while infant's stool at 4 weeks old. Sequencing of the entire coding region of FUT2 was performed for mothers and infants.
A total of 120 mother-infant dyads met the eligibility criteria. The proportion of secretor mother was 65.8%. Secretor genotypes were found in 65.8% of mothers. There was a significant association between secretor genotype and 2'FL level. A novel variant was identified, c.851C>G, which showed deleterious effect based on in silico analysis. A new threshold value of 425.9 mg/L for 2'FL is proposed, with 98.7% sensitivity and 100% specificity. There was no significant relationship between the relative proportion of acetate, propionate, butyrate, and valerate among the mother-infant's genotype dyads.