

Steatorrhea Versus Normal Stool in Neonatal and Early Infantile Period: Implications for Biliary Atresia

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Abstract: Physicochemical property of undigested milk fat is theoretically analyzed. With uniqueness of neonatal/early infantile period and fat amount, the highest estimated stiffness of stool is gel or paste level. Therefore, typical stool of breastfed, small amount either watery or “seedy” is incompatible with steatorrhea, which may be useful to diagnose biliary atresia patients.

Key Words: steatorrhea, breastfeeding, milk fat, viscosity

Biliary atresia (BA) is characterized by biliary obstruction in the neonatal period. Its clinical findings include prolonged jaundice and pale stool (1), both caused by disturbance of bilirubin metabolism. Impaired bile acid flow leads to insufficient digestion and absorption of dietary fat, which leads to coagulopathy due to vitamin K deficiency. Undigested fat turns into steatorrhea, as seen in other malabsorption disorders. We reported amount and consistency of steatorrhea as a diagnostic clue for BA (2). The stool cannot be small amount nor watery in contrast to average breastfed babies. Here, we describe additional useful information.

METHODS AND RESULTS

Fat digestion is physicochemically analyzed. Even when fat absorption is impaired, its partial digestion into fatty acid and glyceride starts by lingual and gastric lipase (3). Under body temperature in the alimentary tract, these are thin liquid. Viscosity of simple mixture of these is within the range of those of components (4), but partially digested fat can act as emulsifier to remaining undigested hydrophobic fat, and the highest possible viscosity (stiffness) of this mixture is mayonnaise level (5). Without emulsifying effect, mixture of these is less stiff. Therefore, “seedy” stool—another typical stool with breastfed (6), is incompatible with steatorrhea because the size of each seed is far smaller than that of rectum.

DISCUSSION

The average steatorrhea is described as “general appearance often readily divulges the fatty content” (7). But, neonate/

What Is Known

- Color card is used for initial screening for biliary atresia.
- No study has focused on undigested fat.

What Is New

- Theoretical consideration of un- and partially digested fat predicts appearance of its mixture.
- Steatorrhea is not compatible with normal stool of breastfed infants, regardless of its color.
- Previously unused information, stool consistency and shape, is also informative.

early infant steatorrhea looks less obvious and less oily (8,9) due to the difference in physical property of fat contained. Neonatal and early infantile period is peculiar, in that milk is the only food taken. Therefore, dietary fat consists of only milk fat, which is liquid at body temperature and solid at room temperature, whereas it also contains “oil,” which stays liquid at room temperature in later life. Although there are many other affecting factors, the amount of fat is massive and that nonabsorbed “fat” stays in bowel cavity to constitute stool. Dietary carbohydrate consists of solely lactose, which unlike starch (10) cannot form dough with fats. Milk proteins, casein and whey protein, are also unable to form solid complex with fats (11,12). Even in transient cholestasis in this period, if steatorrhea, stool is bulky and not seedy. So far, we have seen steatorrhea with greasy, pasty, mushy, or caseous appearance, regardless of its color. Another difference is that a baby wears diaper. Fat containing substance is hard to permeate to the material, which is designed to absorb aqueous urine. With formula-fed babies, situation is less directive but often similar. Many of the BA patients show within normal range weight gain at diagnosis (8,9). To compensate fat malabsorption, excessive feeding is seen (1), thus more undigested fat in stool. Taking these points into account, we have successfully picked up several BA patients.

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