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HEADLINE

The gut-brain axis - Emergence of new human clinical studies

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The gut microbiota has been recognized to influence brain physiology and behavior through the gut-brain axis[1]. Research has shown that intestinal microbes can communicate to the brain via neural immune and metabolic routes, involving a plethora of metabolites such as volatile carboxylic acids, esters, neurotransmitters and various fatty acids produced inside the gut[1]. These have also been implicated in the programming of social behaviors in the brain, where trans-species observations suggested selection pressures have been driving this microbiota-gut-social brain axis from an evolutionary perspective[1].

Longitudinal data from human studies in this area has been lacking thus far, but a recent study by *Loughman et al.* (2020) **demonstrated a prospective association between the composition of the gut microbiota in infancy and subsequent behavioural outcomes.** In this Australian study of 201 infants from a birth cohort, a reduced abundance of *Prevotella* (a genus of bacteria analysed in the fecal microbiota) at 12 months was associated with an increased incidence of behavioural problems at two years of age, as assessed by the Child Behaviour Checklist (CBCL)[2]. Importantly, recent exposure to antibiotics was the biggest influencing factor to predict a low abundance of *Prevotella*[2].

Another newly published study has also shown for the first time the impact of 2'-fucosyllactose (2'-FL), a type of human milk oligosaccharide (HMO), on infant cognitive development, with gut-brain axis as one of the potential mechanisms involved[3]. While there has been a lack of data that investigated and identified specific human milk components that could support infant cognitive development, 2'-FL has stood out as a potential candidate among the hundreds of HMOs identified to date[3]. Animal studies have previously suggested that exposure to 2'-FL enhanced cognitive outcomes such as learning and memory during infancy[4,5].

The current study found a link between breastfeeding frequency at one month and later cognitive development in infants (n = 50), which could be explained by the level of 2'-FL consumed through human milk[3]. The daily number of breastfeeding and 2'-FL consumption at one month both predicted better infant cognitive development at 24 months based on the Bayley-III Scale assessment ($\beta = 0.34$ and $\beta = 0.59$, both $p \leq 0.01$). After adjusting for 2'-FL, a mediation analysis revealed the association for breastfeeding frequency was no longer significant, **suggesting that maternal contribution of 2'-FL in human milk and greater exposure could influence infant cognitive development** (estimation of mediation effect = 0.13, p = 0.04)[3]. **These effects may be explained by the gut-brain axis as HMOs act as prebiotics to nourish the gut microbiome, where they can possibly shape infant cognitive development through several mechanisms via the gut**[3]. To note, this effect was not observed at six months, and none of the other individual HMOs analysed at one month were found to be related to infant cognitive development scores, so early exposure of 2'-FL may be critical[3].

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References: **1.** Sherwin E et al. Science. 2019;366:587. **2.** Loughman A et al. EBioMed. 2020;52:102640. **3.** Berger PK et al. PLoS one. 2020;15(2):E0228323. **4.** Vazquez E et al. J Nutr Biochem. 2015;26(5):455-465. **5.** Oliveros E et al. J Nutr Biochem. 2016;31:20-27.

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'NUTRITION MYTH BUSTER', a brand new WNSC HK website column

"Cow's milk is the most commonly consumed diary product in the world…"

MYTH OR FACT

MYTH!

Although cow's milk has remained its dominance in the global diary industry, **around 65-72% of the world population consume dairy products from goats**[1], which is more than any other dairy sources consumed. In view of the increasing demand of this alternative dairy source, goat milk research has rapidly advanced throughout the past century from the fundamental understanding of its composition to its introduction as an ingredient in food products such as milk formulas[2].

References: 1. *Getaneh G et al. J Nutr Health Sci. 2016;3(4):401.* **2.** *Park YW. Goat Milk: Composition, characteristics. Encyclopedia of Animal Science. 2010.*

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SCAN TO BEGIN

"Delaying the introduction of foods such as eggs and peanuts would prevent a child from developing food allergies…"

"The immune system begins to develop at the moment a baby is born…"

"A mother should stop breastfeeding if she has mastitis…"

MONTHLY HEALTH FOCUS

Trans fats – Are we eating too much?

Emily Tai *PhD, Mphil, MSc, BSc (Hons)*

***Trans* fat intake** has been linked with increased risks of cardiovascular diseases through raising the ratio of LDL to HDL cholesterol[1]. Westernization of diet in Hong Kong probably increases the dietary intake of *trans* fat among the general public.

Fortunately, a recent study revealed that **lactating women in Hong Kong consumed 1.15 to 1.20 g of *trans* fat per day (0.50-0.52% total energy) which was below WHO's recommendation of < 1.0% total energy intake**[2]. Energy intake from total fat was 33%, exceeding 20 to 30% as recommended by Chinese Nutrition Society (CNS) while within the recommendation of Institute of Medicine (IOM), 20 to 35%[2]. *Trans* fat levels in human milk remained low and levels of arachidonic and docosahexaenoic acids were higher than those reported in Western countries[2].

Data also indicated **very insufficient fiber intake among local lactating women and mean intake was 15.37 g per day, far below the recommended level of 29 g daily by IOM**[2]. In addition, daily energy intake (mean 2,069 kcal) was lower than the estimated energy requirement of 2,300 to 2,900 kcal set by CNS[2]. Postpartum period is important for improving the nutritional status of both mothers and children[3]. The International Federation of Gynecology and Obstetrics (FIGO) endorses exclusive breastfeeding for the first 6 months of life and advises appropriate supplementation of iron and folic acid during the first three months after delivery[3].

The report by Center for Food Safety (CFS) on *trans*-fat levels of various local foods (Table 1) may help to make better food choices. **Some samples showed relatively high *trans* fat contents, for example, a doughnut (47 g) and a Chinese pastry (76 g) contained ~4.7 g and ~1.7 g of *trans*-fat per 100 g, respectively**[4]. Consuming just one piece of the above would already reach a significant percentage of daily suggested intake limit (i.e. 100% and 59% of an individual with a 2,000-kcal daily intake, respectively)[4]. It is important to note that *trans* fat levels varied within a wide range among the same type of foods, and hence, reading food labels would help reducing *trans*-fat intake[4].

Summarized below more healthy eating tips and let's stay away from trans fat together!

Read food label carefully[5,6]:

- Avoid food with *trans* fat
- Avoid food that contains 'hydrogenated oils' or 'partially hydrogenated vegetable oils' in the ingredient list

Cook healthily[5,6]:

- Choose healthier oils such olive oil and canola oil
- If a buttery flavor is desired, try blending olive oil and butter and using only a small quantity of butter

When dining out[5,6]:

- Avoid commercially prepared baked food (i.e. cakes, biscuits and pastries), snack food, and processed food (including fast food)
- Avoid deep-fried foods
- Swap butter for either a margarine spread made from canola, sunflower, olive or dairy blends, or nut butter, avocado or tahini as a spread

What is "ZERO" *trans* fat?

According to the regulations, a claim of "free of *trans* fat" or "zero *trans* fat" is allowed in Hong Kong if the below conditions are met[7]:

- Solid food containing:
  - < 0.3 g of *trans* fat per 100 g of food;
  - < 1.5 g of saturated fat and *trans* fat combined per 100 g of food
  - saturated fat and *trans* fat, the sum of which contributes < 10% of energy
- Liquid food containing:
  - < 0.3 g of *trans* fat per 100 mL of food;
  - < 0.75 g of saturated fat and *trans* fatty acids combined per 100 mL of food
  - saturated fat and *trans* fat, the sum of which contributes < 10% energy

Table 1 – *Trans* fat level in tested food samples[4]

Food samples	No. of samples	Trans fat range (g/100g)
Bakery ware (e.g. cookies, wafers, crackers, pastries, doughnuts, French toast, etc.)	36	0.025 – 4.7
Ready-to-eat savoury (e.g. potato chips, tortillas, rice crackers, etc.)	16	0 – 0.26
Instant noddle and its individually packed seasoning	7 noodles & 5 packed seasonings	0 – 0.24
Soup	6	0 – 0.067
Milk products and analogues	6	0 – 0.32
Mayonnaise	2	0.31 – 0.46
Peanut butter	4	0.011 – 0.39
Chocolate spread	2	0.021 – 0.15
Chocolate	6	0.043 – 0.76

References: *1.* *Iqbal MP. Pak J Med Sci. 2014;30(1):194-197.* *2.* *Yip PS et al. Eur J Clin Nutr. 2020. doi: 10.1038/s41430-020-0604-9.* *3.* *Hanson MA et al. Int J Gynaecol Obstet. 2015;131(S4):S213-S253.* *4.* *Centre for Food Safety. Available at: https://www.cfs.gov.hk/english/programme/programme_rafs/programme_rafs_n_01_07.html. Accessed on 23Apr2020.* *5.* *Harvard T.H. Chan School of Public Health. Available at: https://www.hsph.harvard.edu/nutritionsource/2012/07/28/tips-to-lower-trans-fat-intake/. Accessed on 27Apr2020.* *6.* *Heart Foundation. Available at https://www.heartfoundation.org.au/healthy-eating/food-and-nutrition/fats-and-cholesterol/saturated-and-trans-fat. Accessed on 27Apr2020..* *7.* *Centre for Food Safety. Available at: https://www.cfs.gov.hk/english/food_leg/files/nl_technical_guidance_e.pdf. Accessed on 26Apr2020.*

Advances in HMO research – 2'-Fucosyllactose and Lacto-N-neotetraose

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Human milk oligosaccharides (HMOs) can be generally classified into three categories based on their molecular structures[1]:

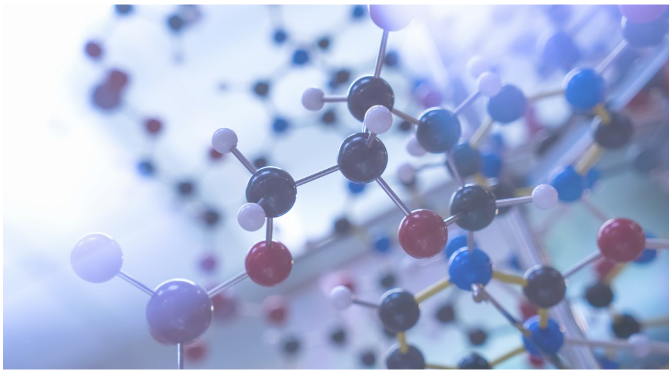
- **Fucosylated HMOs** (35–50% of total HMOs), e.g. 2'-fucosyllactose (2'-FL)
- **Non-fucosylated neutral HMOs** (42–55%), e.g. Lacto-N-neotetraose (LNnT)
- **Sialylated HMOs** (12–14%), e.g. 3'-sialyllactose (3'-SL) and 6'-sialyllactose (6'-SL)

Among the hundreds identified to date, **2'-fucosyllactose (2'-FL) has been long recognized as the top prominent HMO, comprising nearly 30% of total HMOs** in mature milk samples of secretor mothers[2], thus evidently differentiating it from all other HMO types. On the other hand, **a recent longitudinal research has identified Lacto-N-tetroase & Lacto-N-neotetraose (LNT&LNnT) as the most abundant neutral HMOs** in milk samples of Chinese mothers[3]. Expanding preclinical and clinical data have brought the two, both individually and synergistically, to the fore of HMO research:

After confirming the safety and tolerance of HMO supplementation (1.0 g/L of 2'-FL and 0.5 g/L of LNnT) to a standard infant milk formula in 2017[4], *Berger B et al.* (2020)[5] further analyzed fecal samples from the healthy infant subjects (total $n = 156$) and identified distinct fecal community types (FCTs) as defined by their respective dominant taxa. **At 3-month timepoint, test group fed with HMO supplementation ($n = 58$) had a higher number of subjects with FCT BiH for *Bifidobacteriaceae* at higher abundance (the predominant FCT found in breastfed infants) as compared to FCT Bi for *Bifidobacteriaceae*. FCT BiH at 3-month timepoint was also associated with a less likelihood to require antibiotics up to 12 months (OR = 0.4, $p = 0.033$) as compared to their FCT counterparts.** Further associations of HMO supplementation with a lower microbiota diversity ($p < 0.05$), higher relative abundance of *Bifidobacterium* ($p < 0.01$), lower *Escherichia* ($p < 0.01$) and lower unclassified *Peptostreptococcaeceae* ($p < 0.05$), altogether concluded the influence of HMOs in shifting the microbial profile closer to breastfed infants.

In addition, other studies with animal, *ex vivo* and *in silico* models have brought insights to the potentially protective effects of 2'-FL intake against *Escherichia coli* colonization via the increased expressions of *MUC2* and other mucins alike[6] as well as the prevention of necrotizing enterocolitis (NEC) via toll-like receptor 4 signaling (TLR4) inhibition[7]. Immunological properties of LNnT has also been demonstrated particularly via the rate of collagen deposition and gene expressions involved in type 2 immunity responses during wound healing process[8].

Whilst research continues to authenticate the role of specific HMOs in the growth and development of neonates, **it is crucial to acknowledge that their functional properties are described to be structure-specific, hence, HMOs should never be confused with other classes of non-digestible carbohydrates with significantly distinctive structures that are absent in human milk[9], for instance, galacto-oligosaccharides (GOS) and fructo-oligosaccharide (FOS).**



References: 1. Totten S et al. J Proteome Res. 2012;11(12):6124-33. 2. Vandenplas Y et al. Nutrients. 2018;10:1161. 3. Wang M et al. Nutrients. 2020;12:826. 4. Puccio G et al. JPGN. 2017;64(4):624-631. 5. Berger B et al. mBio. 2020;11:e03196-19. 6. Wang Y et al. Nutrients. 2020;12:1284. 7. Sodhi C et al. Pediatr Res. 2020;doi:10.1038/s41390-020-0852-3. 8. Farhadihosseinabadi B et al. Sci Rep. 2020;10:997. 9. Bode L et al. Adv Nutr. 2012;3:383S-391S.