Fecal Flora of Thai Residents in Japan; Comparison between Vegetarians and an Omnivore

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The fecal bacterial flora of three healthy Thai residents in Japan were determined. Two were short-term or long-term vegetarians and one was a mixed-diet omnivore. The total bacterial counts of all these subjects were significantly lower than those of the average Japanese. The total counts and the numbers of anaerobic bacteria in the vegetarians were constant, whereas a fluctuation between the omnivore's two samplings was observed, accompanied with a decrease in bacteroidaceae, eubacteria, bifidobacteria, enterococci, and veillonellae, and an increase in *Clostridium perfringens*, lactobacilli, and staphylococci.

Key words: Fecal flora; Thai residents; vegetarian

It is suggested that fecal flora plays an important role in maintaining health and that a change of flora influences the aging process and the incidence of cancer. Although the factors affecting the composition of the human intestinal flora have yet to be determined, the factors suggested to be of importance include pH, oxygen tension, nutrient availability, colonic physiology, and bacterial interference. The diet might influence the composition and/or activity of the intestinal bacterial flora through its effect on the supply of the nutrients.

Here we studied the fecal flora of the following three healthy Thai adults: (A) a 24-year-old female with an experience of vegetarianism for 7 years, who stayed in Japan for 12 months; (B) a 27-year-old female with an experience of vegetarianism for 2 months, who stayed in Japan for 10 months; and (C) a 34-year-old omnivore male who stayed in Japan for 3 months. We used the same bacteriological techniques as described by Mitsuoka et al. (7). Fecal samplings were per-

formed twice at an interval of a week. Part of the feces freshly collected from each morning stool was put in the tube containing 9 ml of transporting medium (7) filled with 100% CO₂. The medium with the feces was kept on ice, diluted to 10⁻¹, 10⁻³, 10⁻⁵, and 10⁻⁷ in anaerobic diluent (7), and promptly cultured on each quarter of the following 13 plating media; Trypticase soy blood agar (TS), EG agar (EG), and BL agar (BL) as nonselective media, and DHL agar (DHL), PEES agar (PEES), TATAC agar (TATAC), Potato dextrose agar (P), BS agar (BS), ES agar (ES), modified LBS agar (LBS), NBGT agar (NBGT), Neomycin Nagler agar (NN), and modified VS agar (VS) as selective media. Five agar plates of TS, DHL, PEES, TATAC, and P were incubated for 24 hr at 37°C in aerobic condition, whereas PEES and P cultures were continued until 48-72 hr. Eight agar plates of BL, EG, BS, ES, LBS, NBGT, NN, and VS were incubated for 48 hr at 37°C in the glove box containing 80% N₂, 10% CO₂,

and 10% H₂. The isolates from each were classified into broad groups by cellular and colony morphology, and the numbers of each group were calculated.

The total counts of isolates, aerobes, and anaerobes, and the counts of each isolated group are shown in Table 1. The total bacterial counts in these Thai residents were 10 times lower than those of the average Japanese as described by Chida et al. (3). Although they stayed in Japan for more than 3 months, periods of more than 12 months might be needed to bring about changes in the flora as mentioned by Hill et al. (6). The difference from those of Japanese might depend on race and environment, as populations in different parts of the world have different fecal bacterial flora. The results showing that the total bacterial counts and some groups of bacteria found were similar between the vegetarians and the omnivore were consistent with those reported by

several researchers (1, 2, 5). Goldberg et al. (4) found no difference in the total counts and kind of the intestinal flora between the Seventh-Day Adventists and individuals taking a general diet. Simon et al. (8) described that the dietary consideration appeared to have surprisingly little effect on the composition of fecal flora. In the vegetarians, the considerable numbers of peptococci and clostridia-other were isolated from the short-term vegetarian, while peptococci and yeasts were not found in the long-term vegetarian. In the omnivore tested, the fluctuation between two samplings was observed in the total bacterial counts and the counts of anaerobic bacteria, that were accompanied with the striking decrease in bifidobacteria and eubacteria, the decrease in bacteroidaceae, enterococci and veillonellae, the marked increase in *C. perfringens*, and the increase in lactobacilli and staphylococci, whereas those of the two vegetarians re-

Table 1. Fecal Flora of Thai Residents in Japan.^a

Bacterial group	Sampling ^b					
	Vegetarian				Omnivore	
	A ^c		B ^d		C ^e	
	1	2	1	2	1	2
Bacteroidaceae	9.87	9.50	8.89	8.22	9.76	8.25
Eubacteria	7.19	5.26	8.58	5.26	5.13	< 2
Bifidobacteria	9.09	6.96	8.58	8.96	9.50	< 2
Peptococcaceae	< 2	< 2	8.70	8.83	< 2	< 2
Lactobacilli	3.19	3.66	5.83	2.96	< 2	4.79
Enterococci	5.94	7.87	6.20	7.74	6.26	4.83
Enterobacteriaceae	6.83	8.63	6.88	4.96	8.73	7.64
<i>Clostridium perfringens</i>	< 2	< 2	< 2	< 2	5.35	8.02
Clostridia-other	5.92	5.29	8.88	6.29	6.97	6.79
Veillonellae	5.49	5.69	5.24	< 2	5.10	< 2
Staphylococci	2.97	< 2	< 2	< 2	< 2	5.09
Bacilli	< 2	< 2	< 2	< 2	< 2	< 2
Yeasts	< 2	< 2	< 2	2.96	2.95	< 2
Total aerobes	6.98	8.70	7.74	7.74	8.74	7.64
Total anaerobes	9.94	9.50	9.45	9.24	9.95	8.46
Total counts	9.94	9.50	9.46	9.26	9.98	8.52

^a Values are expressed as log₁₀ of viable counts per gram of wet stool.

^b Samplings of 1 and 2 are performed at an interval of a week.

^c 24-year-old female with an experience of vegetarianism for 7 years, who had been in Japan for 12 months.

^d 27-year-old female with an experience of vegetarianism for 2 months, who had been in Japan for 10 months.

^e 34-year-old omnivore male who had been in Japan for 3 months.

mained constant. The dietary custom of this omnivore whereby he irregularly took unfamiliar Japanese food might reflect this striking fluctuation, whereas the vegetarians' type of food was consistent.

Further studies, performed with more subjects, which consider the intake of calorie, total protein and animal protein, and the quality and quantity of the feces, are needed. It is also necessary to identify the species of the isolates including *Bacteroides* spp. and *Bifidobacterium* spp, to investigate whether there are any differences between vegetarian's and omnivore's.

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