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## Physiological effects of alkaline ionized water:

Effects on metabolites produced by intestinal fermentation

by Takashi Hayakawa, Chicky Tushiya, Hisanori Onoda, Hisayo Ohkouchi, Harul~to Tsuge (Gifu University, Faculty of Engineering, Dept. of Food Science)

We have found that long-term ingestion of alkaline ionized water (alkaline ionized water) reduces cecal fermentation in rats that were given highly fermentable commercial diet (MF: Oriental Yeast Co., Ltd.). In this experiment, rats were fed MF and test water (tap water, alkaline ionized water with pH at 9 and 10) for about 3 months. Feces were collected on the 57th day, and the rats were dissected on the 88th day. The amount of ammonium in fresh feces and cecal contents as well as fecal free-glucose tended to drop down for the alkaline ionized water group. In most cases, the amount of free-amino acids in cecal contents did not differ significantly except for cysteine (decreased in alkaline ionized water with pH at 10) and isoleucine (increased in alkaline ionized water with pH at 10).

Purpose of tests

Alkaline ionized water electrolyzers have been approved for manufacturing in 1965 by the Ministry of Health and Welfare as medical equipment to produce medical substances. Alkaline ionized water (alkaline ionized water) produced by this equipment is known to be effective against gastrointestinal fermentation, chronic diarrhea, indigestion and hyperchylia as well as for controlling gastric acid.\*1 This is mainly based on efficacy of the official calcium hydroxide. \*2 By giving alkaline ionized water to rats for a comparatively long time under the condition of extremely high level of intestinal fermentation, we have demonstrated that alkaline ionized water intake is effective for inhibition of intestinal fermentation when its level is high based on some test results where alkaline ionized water worked against cecal hypertrophy and for reduction in the amount of short-chain fatty acid that is the main product of fermentation.\*3 We have reported that this is caused by the synergy between calcium level generally contained in alkaline ionized water (about 50ppm) and the value of pH, and that frequency of detecting some anaerobic bacteria tends to be higher in alkaline ionized water groups than the other, although the bacteria count in the intestine does not have significant difference. Based on these results, we made a judgment that effect of taking alkaline ionized water supports part of inhibition mechanism against abnormal intestinal fermentation, which is one of the claims of efficacy that have been attributed to alkaline ionized water electrolyzers. \*4 On the other hand, under the dietary condition of low intestinal fermentation, alkaline ionized water uptake does not seem to inhibit fermentation that leads us to believe that effect of alkaline ionized water uptake is characteristic of hyper-fermentation state. Metabolites produced by intestinal fermentation include indole and skatole in addition to organic acids such as short-chain fatty acid and lactic acid as well as toxic metabolites such as ammonium, phenol and p-cresol. We do not know how alkaline ionized water uptake would affect the production of these materials. In this experiment, we have tested on ammonium production as explained in the following sections.

## Testing methods

Four-week-old male Wistar/ST Clean rats were purchased from Japan SLC Co., Ltd. and were divided into 3 groups of 8 each after preliminary breeding. Alkaline ionized water of pH 9 and 10 was produced by an electrolyzer Mineone ROYAL NDX3 1 OH by Omco Co., Ltd. This model produces alkaline ionized water by electrolyzing water with calcium lactate added. On the last day of testing, the rats were dissected under Nembutal anesthesia to take blood from the heart by a heparin-treated syringe. As to their organs, the small intestines, cecum and colon plus rectum were taken out from each of them. The cecum was weighed and cleaned with physiological saline after its contents were removed, and the tissue weight was measured after wiping out moisture. Part of cecal contents was measured its pH, and the rest was used to assay ammonium concentration. The amount of ammonium contained in fresh feces and cecal contents was measured by the Nessler method after collecting it in the extracted samples using Conway's micro-diffusion container. Fecal free-glucose was assayed by the oxygen method after extraction by hot water. Analysis of free amino acids contained in cecal contents was conducted by the Waters PicoTag amino acid analysis system.

## Test results and analyses

No difference was found in the rats' weight gain, water and feed intake and feeding efficiency, nor was any particular distinction in appearance identified. The length of the small intestines and colon plus rectum tended to decline in alkaline ionized water groups. pH value of cecal contents was higher and the amount of fecal free-glucose tended to be lower in alkaline ionized water groups than the control group. Since there was no difference in fecal discharge itself, the amount of free-glucose discharged per day was at a low level. The amount of discharged free-glucose in feces is greater when intestinal fermentation is more intensive, which indicates that intestinal fermentation is more inhibited in alkaline ionized water groups than the control group. Ammonium concentration in cecal contents tends to drop down in alkaline ionized water groups (Fig. 1). This trend was most distinctive in case of fresh feces of one of alkaline ionized water groups with pH 10 (Fig.2) Alkaline ionized water uptake was found to be inhibitory against ammonium production. In order to study dynamics of amino acids in large intestines, we examined free amino acids in the cecal contents to find out that cysteine level is low in alkaline ionized water groups whereas isoleucine level is high in one of alkaline ionized water groups with pH 10, although no significant difference was identified for other amino acids.

## Bibliography

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