



CHAPTER V

DISCUSSION AND CONCLUSION

Efficiency of Lactase

In preparation of some medical food, milk was chosen as a protein source because its protein was a high quality protein.⁽¹³⁾ However, lactose, the principal sugar component in milk, is a major problem in lactose intolerance, which is being reported in many populations including Thai.⁽¹⁰⁻¹²⁾ Therefore, removing lactose from milk is one of the solution sought out for lactose intolerance.⁽²⁷⁾ Multiple trials have demonstrated the effectiveness of prehydrolyzed milk priorly treated with lactase enzyme derived from microorganism in improving absorption and tolerance.^(14,27) Commercial lactase (Lactaid) used in this study is obtained from yeast *Kluyveromyces lactis*. It was added to pasteurized low fat milk in order to reduce lactose content before this milk would be used in preparation of low lactose milk-based medical food. Decreases of lactose in pasteurized low fat milk was inversely varied with the amount lactaid. Sugars in lactase-treated milk (15 drops of Lactaid per 1 quart of milk) were determined by HPLC analysis to confirm its lactose content. Lactose was not detectable in lactase-treated milk. In addition, the physical appearance of lactase-treated milk and untreated milk were similar. Therefore, lactased-treated milk was suitable for people with any degree of lactose intolerance and medical food preparation.

Physical Properties of Spray-dried Low Lactose Milk-based

Medical Food

Optimum conditions for the spray drying process was investigated. Lecithin (0.3%) was added to stabilized oil globule in emulsion. Oxidation and thermal breakdown of medium-chain triglyceride oil have profoundly affect the palatability and acceptability of the product when heating temperature was reached or was exceeded 150°C.⁽²⁶⁾ Therefore, temperature over 150°C was not use for spray drying process. The alternative heating temperature from 130-150°C show that the solubility index and moisture content of spray-dried powder were significantly different. The lowest drying temperature investigated (130°C) gave a good fine dried product.

The bulk density of the studied spray-dried product (0.48 ± 0.02 g/ml) was in the reference region (0.5 g/ml) as suggested by ADMI.⁽³³⁾ Dissolubility of powder sprayed at 130°C was preferable because the solubility index was the lowest. When dissolved this spray-dried product in water, a good apparent colloidal stability was obtained. It can be concluded that optimal spray drying condition revealed in this study produced a satisfied product. This medical food powder efficiently dissolved in water and gave stable colloid for at least 24 hr.

Nutritional Safety of the Spray-dried Low Lactose Milk-based

Medical Food

Milk protein was the protein source in this preparation. Carbohydrate and fat were added to pasteurized low lactose milk in order to get the proper caloric distribution from protein, carbohydrate and fat (15 to 20, 45 to 55 and 30 to 35 percent, respectively).⁽²⁴⁾ Maltodextrin was selected as carbohydrate source in this formula because it was rapidly hydrolysed and rarely

caused intolerance.^(15,23) Fat added to this formula was mixture of 1 to 1 ratio of soybean oil and medium-chain triglyceride oil. This mixture provided a large amount of polyunsaturated fatty acid, especially linoleic acid and medium-chain triglyceride fatty acids, which was easily digested, absorbed and metabolized in human body.^(15,23,26) Most fat maldigestion and malabsorption conditions, and some other disorders of the lymphatic fat transport and of fat removal from the blood stream, can be completely or partially corrected by replacing dietary long-chain triglycerides with medium-chain triglycerides. Sailer and Berg stated that emulsions of long-chain triglycerides containing 25 or 50 percent medium-chain triglycerides were very useful in patients requiring intensive nutritional therapy.⁽²⁶⁾

The nutrients of studied diet (fat, protein and carbohydrate) provided caloric distribution of 35.14, 14.39 and 50.47 percent of total calories which was an appropriate proportion for enteral nutrition. (Fat, protein and carbohydrate provide 30-35, 15-20 and 45-55 percent of total calories in standard formula.)⁽²⁴⁾ The non-protein calories to nitrogen ratio was 148.79 Cal per g nitrogen. This value showed that human body can completely utilize amino acids absorbed from protein in this preparation. It is suggested that energy nutrients in this medical food provide a proper ratio. When we dissolved 21.6 g of this spray-dried product in water to make 100 ml, it provided 1 Cal/ml. The absence of lactose in this spray-dried product was very useful for lactose intolerant patients.

The reduction of lysine compared with FAO/WHO standard reference protein may be explained as follow. During the process of drying of milk, high temperature caused some destruction of lysine due to Maillard reaction, an interaction of the protein with reducing

sugars. This reaction made lysine nutritional unavailable.⁽⁴⁵⁻⁴⁸⁾ Because lysine is one of the essential amino acids for human; therefore, it should be supplemented to this spray-dried powder if consumed by human.

The protein quality of spray-dried low lactose milk-based medical food was evaluated by rats. The evaluation determined by comparing rats fed spray-dried low lactose milk-based medical food with casein reference protein and spray-dried milk-based medical food. (Untreated milk was substituted for lactosed-treated milk as protein source in preparation.) Rats fed spray-dried product were healthy. PER, CPER, NPR and RNPR values obtained by measuring the growth rate of rat⁽⁴⁹⁾ gave no statistically significant difference among casein reference group, low lactose group and lactose group. Accordingly to the values obtained by nitrogen balance method, NPU, TD and BV revealed no significant difference between low lactose group and lactose group at $p > 0.05$. It is indicated that protein in low lactose food was not different from that of regular one and lactase enzyme did not affect milk protein quality. Digestibility and utilization of protein in spray-dried low lactose milk-based medical food was good. This spray-dried product gave a high biological value.

However the implementation of this medical food to target population need more consideration because the human diet and eating pattern differ from those of experimental animals.⁽⁴⁷⁾ The acceptability in human should be concerned. The flavor and color of the product need to be modified.

