INTRODUCTION

Energy is required to perform all forms of biological function and this is provided chemically in the form of adenosine triphosphate (ATP). In skeletal muscle, resynthesis of ATP is importance for the restoration and maintenance of force-producing capabilities during and following physical activity. During exercise, skeletal muscle relies mainly on both carbohydrate (CHO) and fat oxidation to fulfil the need for chemical energy (Green *et al.*, 1991 and Romijin *et al.*, 1993). Some energy sources are located directly in skeletal muscle, whereas others are delivered to skeletal muscle via the circulation system. The primary energy substrates within muscle are glycogen and triacylglycerol. A direct relationship between muscle glycogen concentration and endurance capacity has been well accepted. Compared to muscle glycogen, less is known about the contribution to exercise expenditure from intramuscular triacylglycerols. According to the reported that depletion of intramuscular glycogen and triacylglycerol occurs during both high intensity exercise and prolonged endurance activity (Martin, 1996 and ESSen-Gustavsson and Tesch, 1990), the use of intramuscular triacylglycerol as an energy source may be more importance in both endurance and anaerobic high-intensity exercise than previously thought.

It is well accepted that improved endurance performance after exercise training occurs as a result of both physiological and metabolic adaptations. A major metabolic changes which occurs in trained muscles is to increase the contribution of fat to oxidative energy metabolism during submaximal exercise (Holloszy and Coyle, 1984 and Oldham and Sipe, 1990). It is suggested that in addition to exercise training, nutritional status and the diet manipulation prior to exercise can influence the selective use of fat as energy substrate during exercise. Many nutritional implications and the subsequent effects on physical performance have been used by endurance athletes in an attempt to promote fat oxidation. Particularly interesting are studies that have chronically adapted human subjects or rats to a high fat diet to induce enzymatic and metabolic changes that lead to increased endurance performance. Experimental documents demonstrated that chronic adaptations to high fat diet decreased resting muscle glycogen, increased muscle triacylglycerol, and promoted utilization of fat over carbohydrate as an energy substrate at rest and during exercise. Previous data regarding the effects of adaptation to high fat diet on endurance performance are mixed. Several studies showed enhance effects (Miller *et al.*, 1984; Lapachet *et al.*, 1996 and Simi *et al.*, 1991) while the study of Helge *et al.* (1996) reported impaired endurance performance. Differences in species, training status and dietary composition probably contribute to these conflicting results. In the study of Helge and colleagues (1996) dietary fat was 62% of total energy content in the diet (62% E), whereas dietary fat was 75-78 % E in the studies performed in rats (Miller *et al.*, 1984; Lapachet *et al.*, 1996 and Simi *et al.*, 1991). One of the drawbacks in promoting fat diet as an ergogenic aid is the strong relationship between high fat diet and fat body deposition (Miller *et al.*, 1984 and Oscai *et al.*, 1987). However, the optimal fat intake to induce positive adaptation in energy metabolism and endurance performance is still not known. Studies in trained athletes showed that increasing dietary fat from 15 to 42% E increased maximal oxygen consumption (VO_{2max}) and endurance capacity (Muoio *et al.*, 1994) without compromising either immune functioning (Venkatraman *et al.*, 1997) or blood lipoprotein profiles (Leddy *et al.*, 1997). These data suggest that even moderate increases in dietary fat may be beneficial for overall health and physical performance. In addition, study of Veerapun *et al.* (2002) demonstrated that trained rats fed with either high carbohydrate (79.9% E CHO) or high fat diet (74.85% E fat), followed by diet containing fat 20.14% E showed a significantly enhanced endurance performance compared with those received only high carbohydrate or high fat diet. An increase in VO_{2max} was also greatest in trained rats received a diet contained fat 20.14 % E. Although the mechanism underlying the enhanced endurance performance is still unclear, data of blood borne substrates indicated a shift of energy substrates from CHO to fat during exercise. It is therefore reasonable to hypothesize the metabolic adaptations induced by fat diet to some extent are dependent on the amount of dietary fat intake. The purpose of the present study was to investigate whether or not the diet containing moderate fat (20.14% E) could induce the metabolic adaptations in aerobically trained rats and if so, what mechanism is behind the adaptations. Furthermore, whether the metabolic adaptations with moderate fat diet enhanced endurance performance was also studied.