식이섭취 형태와 일회성 운동이 골격근 내 PPAR Isoforms 유전자 발현에 미치는 영향

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Abstract

Lim, Y.J., Lee, J.K., Kim, J.K., Moon, H.W., Park, S.H., Lee, J.S. The influence of dietary feeding type and acute exercise on gene expression of PPAR isoforms in skeletal muscle. *Exercise Science*. 17(4): 401-412, 2008. We determined the interactions of dietary alterations and acute swimming exercise on gene expression of peroxisome proliferator-activated receptor(PPAR) α , β/δ , and γ in red vastus lateralis muscle. Total 32 Sprague-Dawley rats were allocated one of two dietary conditions: either standard chow diet(CHOW, $n=16$) or high fat diet(FAT, $n=16$). Rats in each dietary condition were further divided into either exercise(EXE, $n=8$) or non-exercise(CON, $n=8$) group. All rats in exercise group were performed 3 hr(30min x 6bouts) acute swim exercise. Major findings of this study were that there was no significant difference in body weight(BW) between CHOW and FAT. There was a significant increase in blood glucose and insulin concentration after 8wk high fat diet compared to standard chow diet. Although high fat diet did not show any significant changes in blood lactate, it significantly increased free fatty acid level at rest(FFA, $p<.05$). Swimming for 3hr significantly decreased of blood glucose and insulin concentration($p<.05$), and significantly increased of lactate and FFA($p<.05$). While there was no significant difference in PPAR α and β/δ gene expression, PPAR γ gene expression was significantly decreased after 8wk high fat feeding. After 3 hr swim exercise, PPAR α and β/δ expression was significantly increased($p<.05$), but the degree of increase in PPAR γ gene expression did not reach statistical significance($p=.059$). Based on these results we concluded while high fat feeding predominantly affect in PPAR γ gene expression, prolonged acute swim exercise affect mostly of PPAR α , and β/δ gene expression. These results suggest that both different types of diet and long lasting acute exercise would have important role in regulating fatty acid metabolism, but these isoforms would also have unresolved unique cellular signaling cascade to exert their independent roles in skeletal muscle.

초 록

임영조, 이장규, 김정규, 문희원, 박승한, 이종삼. 식이섭취 형태와 일회성 운동이 골격근내 PPAR isoforms 유전자 발현에 미치는 영향. *운동과학*, 제17권 제4호. 401-412, 2008. 본 연구는 식이섭취의 변화와 장시간의 수영 운동 시 슛트 쥐 외측광근에서 일어나는 PPAR 이성체들의 상호작용을 밝히고자 수행되었다. 총 32마리의 Sprague-Dawley 쥐를 정상식이 섭취군과 고지방 섭취군으로 배정(각 16마리)하였으며 각각의 식이섭취군을 다시 수영 운동 수행군($n=8$)과 비운동 수행군($n=8$)으로 무선 배정하였다. 운동 수행군으로 배정된 쥐들은 일회성의 3시간 수영운동을 수행하였다. 8주간 지속된 식이섭취 후 체중의 변화를 관찰한 결과 정상 식이군과 고지방 식이군 간의 유의한 차는 나타나지 않았다. 고지방 식이 후 휴식 시 글루코스, 유리지방산, 및 인슐린 농도의 상승을 나타냈으나 젖산 농도의 유의한 변화는 나타나지 않았다. 3시간의 수영 운동으로 혈중 글루코스와 인슐린 농도가 유의하게 감소($p<.05$)하였으나 유리지방산과 젖산의 혈중 농도는 유의한 상승($p<.05$)을 보였다. 고지방 식이 섭취 후 적색의 외측광근 내 PPAR α 와 β/δ 의 유전자 발현량에 유의한 차이를 나타내지 않은 반면 PPAR γ 의 유전자 발현은 유의하게 감소했다. 수영 운동 후 모든 PPAR 이성체의 유전자 발현이 뚜렷이 증가하는 경향을 보였으나 통계적으로 PPAR α 와 β/δ 에서만 유의한 차($p<.05$)를 나타내었다. 이러한 결과를 종합해볼 때 장기간의 고지방 식이 섭취로 PPAR 이성체에 발휘되는 효과와 일회성의 운동을 통해 PPAR 이성체에 발휘되는 효과가 서로 다르게 나타남을 알 수 있었으며 이는 식이섭취의 변화와 운동 모두가 아직까지 알려지지 않은 세포 내 서로 다른 경로를 통해 PPAR 이성체들의 기능 발휘를 위해 중요한 역할을 수행한다는 것을 암시하는 것이라 하겠다.

Key words : swim exercise, messenger RNA, dietary manipulation, fatty acid metabolism

주요어 : 수영운동, 식이섭취 변화, 유전자 발현, 지방산 대사

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논문투고일 : 2008. 06. 30

심사일 : 2008. 10. 13

심사완료일 : 2008. 11. 03