EXERCISE-INDUCED CALMODULIN-DEPENDENT PROTEIN KINASE (CAMK)II ACTIVATION REGULATES SATURATED AND UNSATURATED FATTY ACIDS IN RAT SKELETAL MUSCLE

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INTRODUCTION

- ELEVATED FFA ARE PREDICTIVE OF CONVERSION FROM IMPAIRED GLUCOSE TOLERANCE TO DIABETES
- FATTY ACIDS PLAY CRUCIAL ROLE IN THE PATHOGENESIS (METS)
- EXERCISE ALLEVIATES SOME OF THE METS SYMTOMS
- CAMKII REGULATES MANY BENEFICIAL CELLULAR FUNCTIONS
  - CAMKII CAN BE ACTIVATED BY EXERCISE

(BERGMAN AND ADER, 2000; ROSE *ET AL.*, 2006)

- UNSATURATED FATTY ACIDS HAVE BENEFICIAL EFFECTS ON METABOLIC SYNDROME,
  - REDUCE RISK FACTORS OF METS BY PROMOTING INSULIN SENSITIVITY, INCREASING GLYCAEMIC CONTROL, AND REGULATING HDL AND LDL LEVELS (LAURIC ACID)

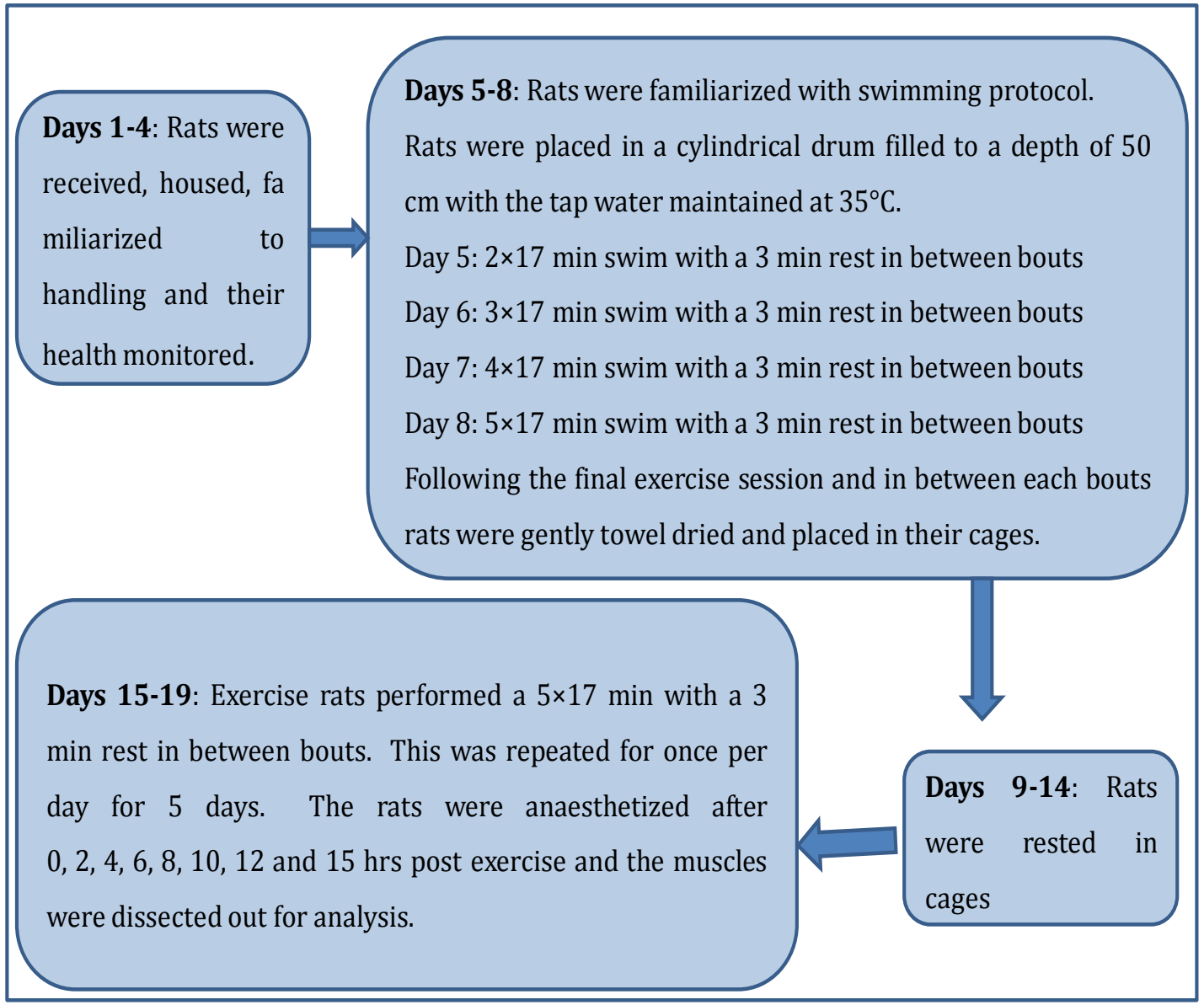
- SATURATED FATTY ACIDS ARE KEY CONTRIBUTORS TO THE INCREASE OF RISK FACTORS OF METABOLIC SYNDROME
  - PALMITIC ACID AND MYRISITIC ACID INCREASE INSULIN RESISTANCE AND LDL CHOLESTEROL LEVELS

(MISRA *ET AL.*, 2010; RISÉRUS *ET AL.*, 2009)

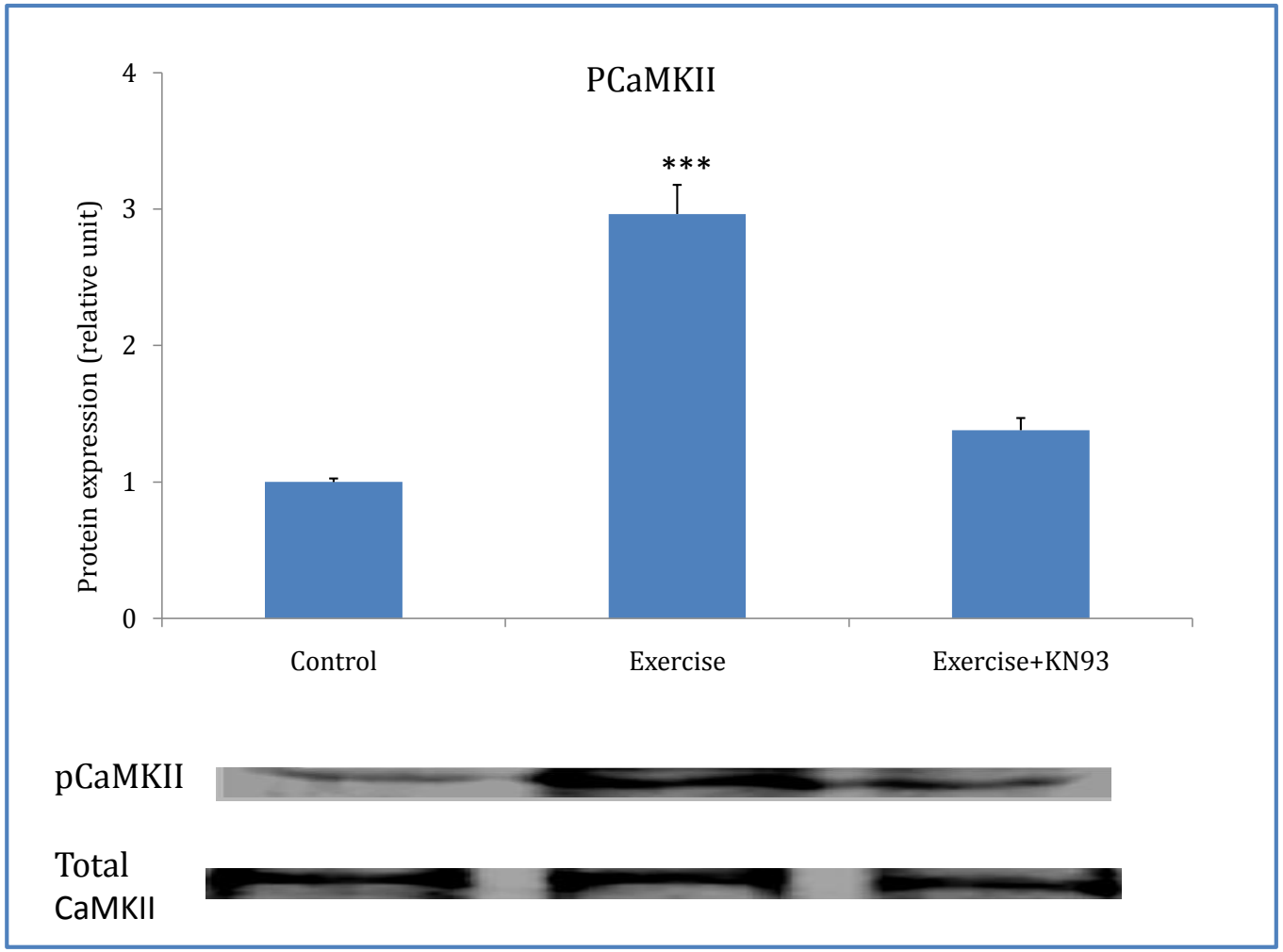
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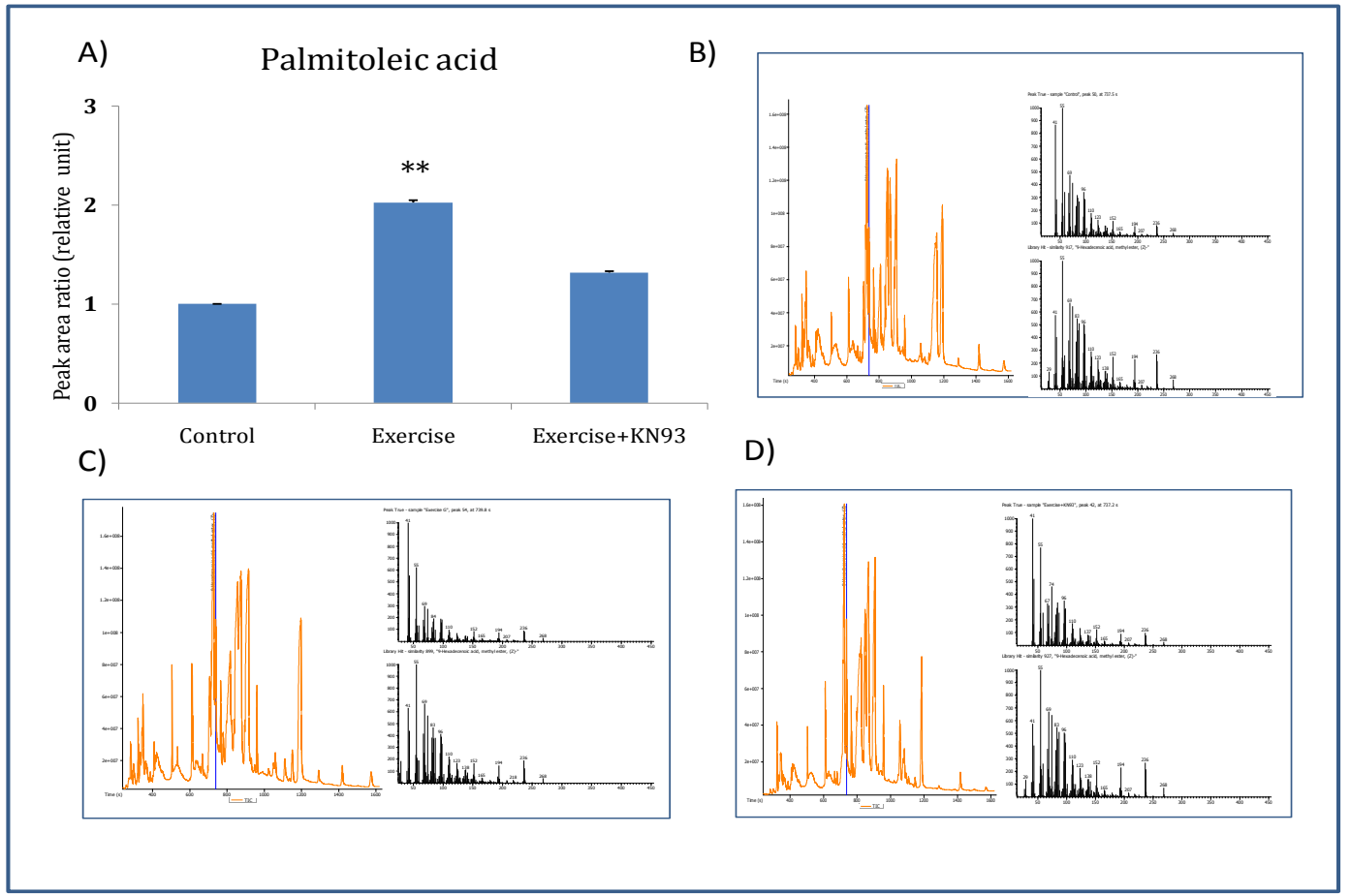
- EXERCISE-INDUCED CAMKII ACTIVATION REGULATES SYNTHESIS AND DEGRADATION OF SATURATED AND UNSATURATED FATTY ACIDS?

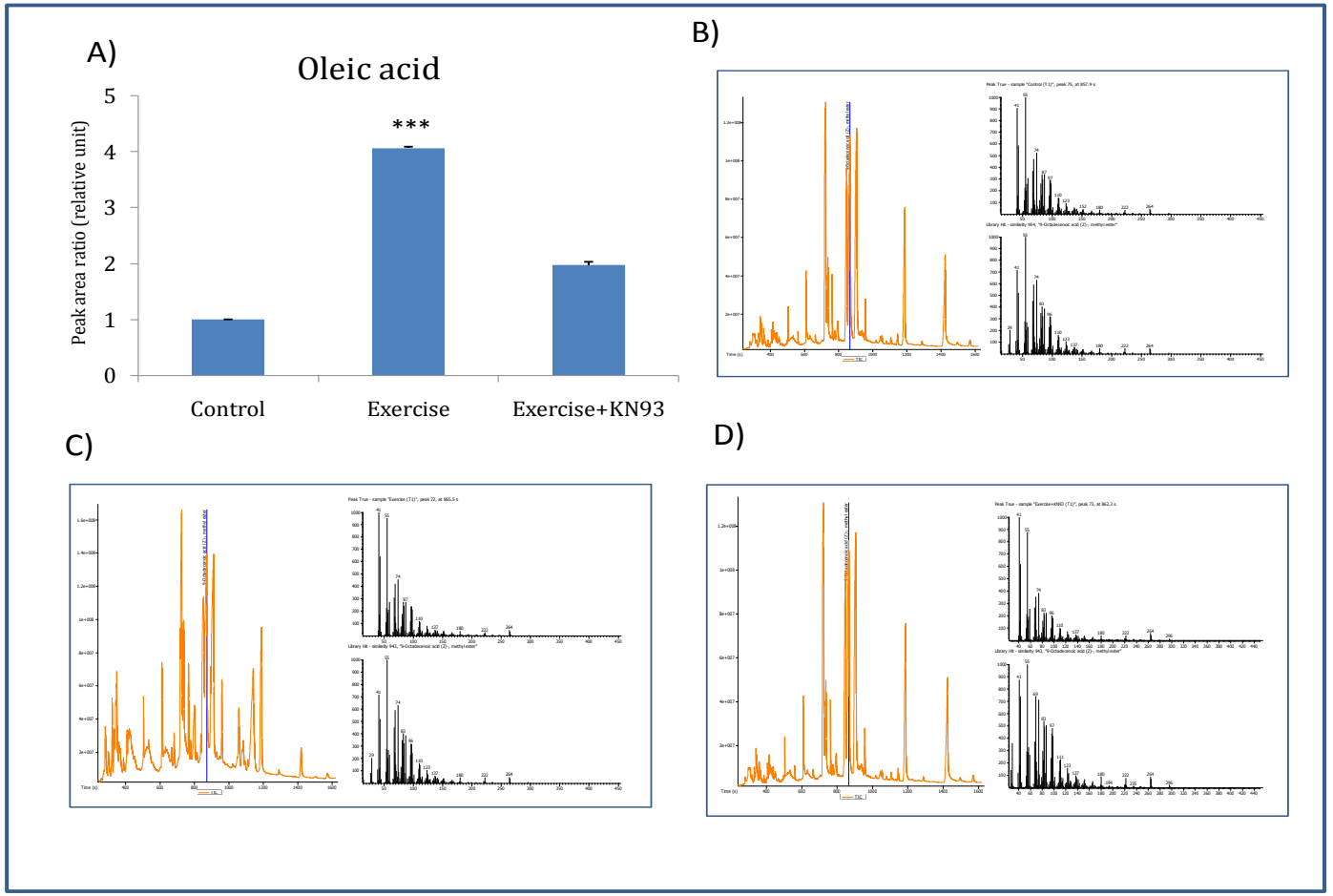
METHODS

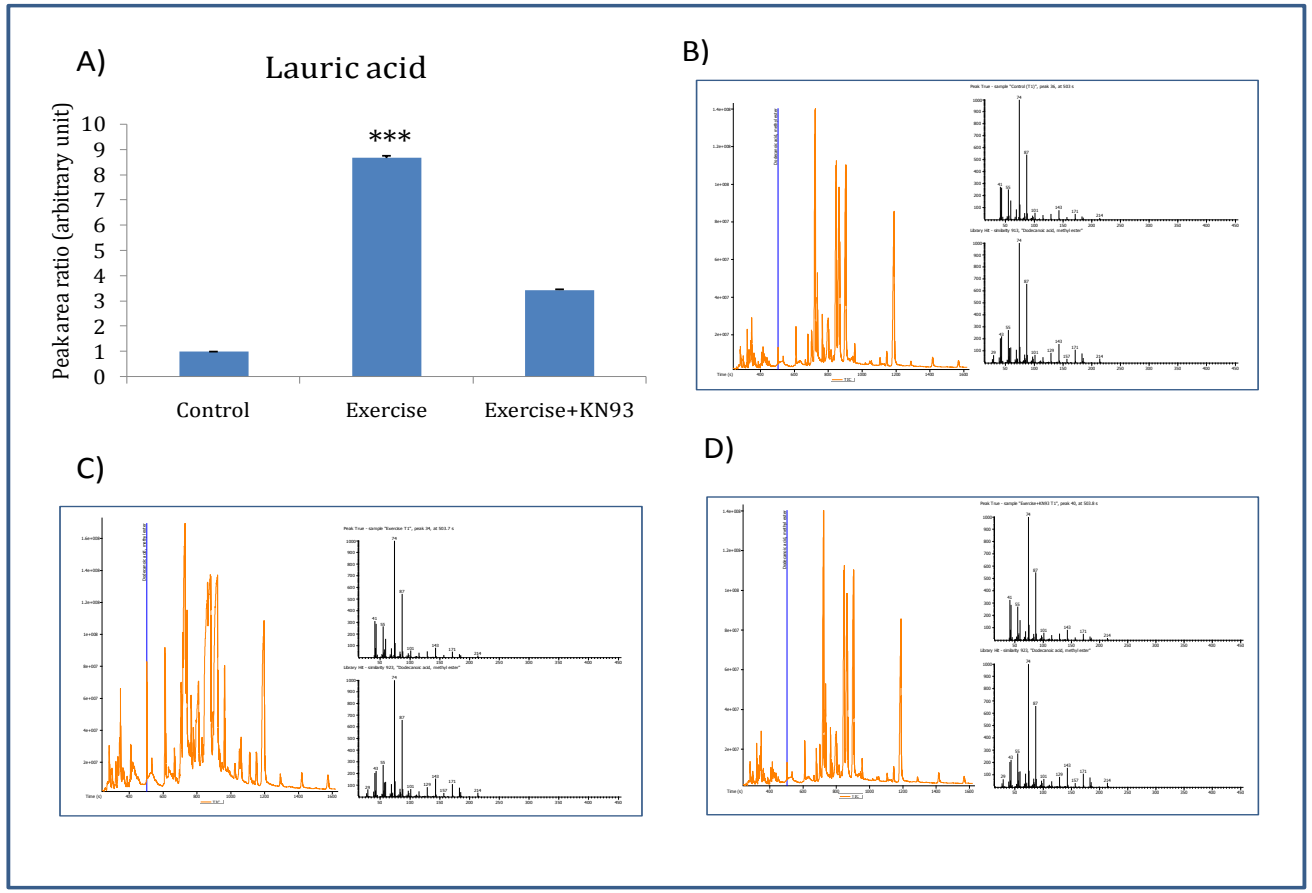

Days 1-4: Rats were received, housed, fa miliarized to handling and their health monitored.
Days 5-8: Rats were familiarized with swimming protocol. Rats were placed in a cylindrical drum filled to a depth of 50 cm with the tap water maintained at 35°C.
Day 5: 2×17 min swim with a 3 min rest in between bouts
Day 6: 3×17 min swim with a 3 min rest in between bouts
Day 7: 4×17 min swim with a 3 min rest in between bouts
Day 8: 5×17 min swim with a 3 min rest in between bouts
Following the final exercise session and in between each bouts rats were gently towel dried and placed in their cages.
Days 9-14: Rats were rested in cages
Days 15-19: Exercise rats performed a 5×17 min with a 3 min rest in between bouts. This was repeated for once per day for 5 days. The rats were anaesthetized after 0, 2, 4, 6, 8, 10, 12 and 15 hrs post exercise and the muscles were dissected out for analysis.

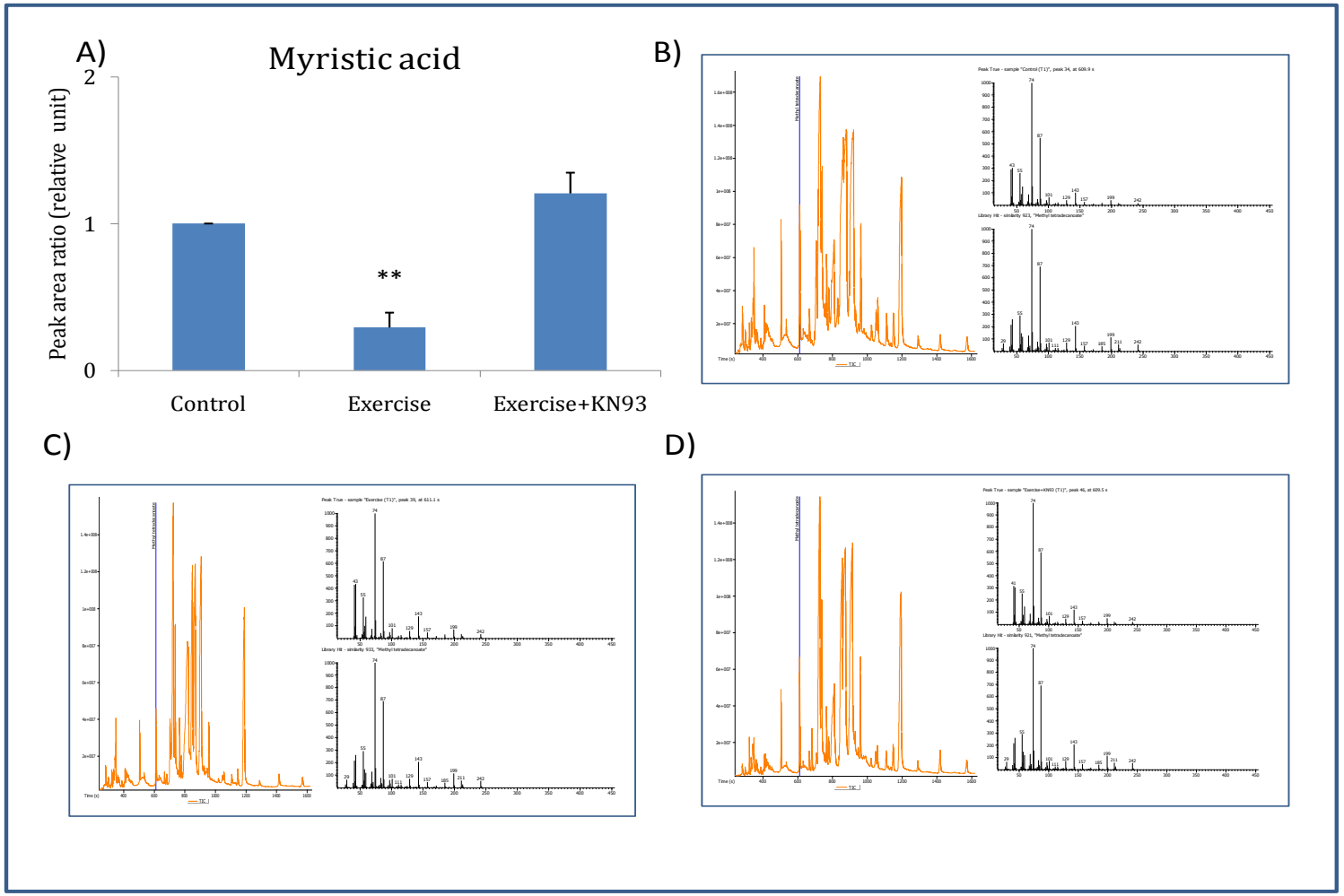
RESULTS

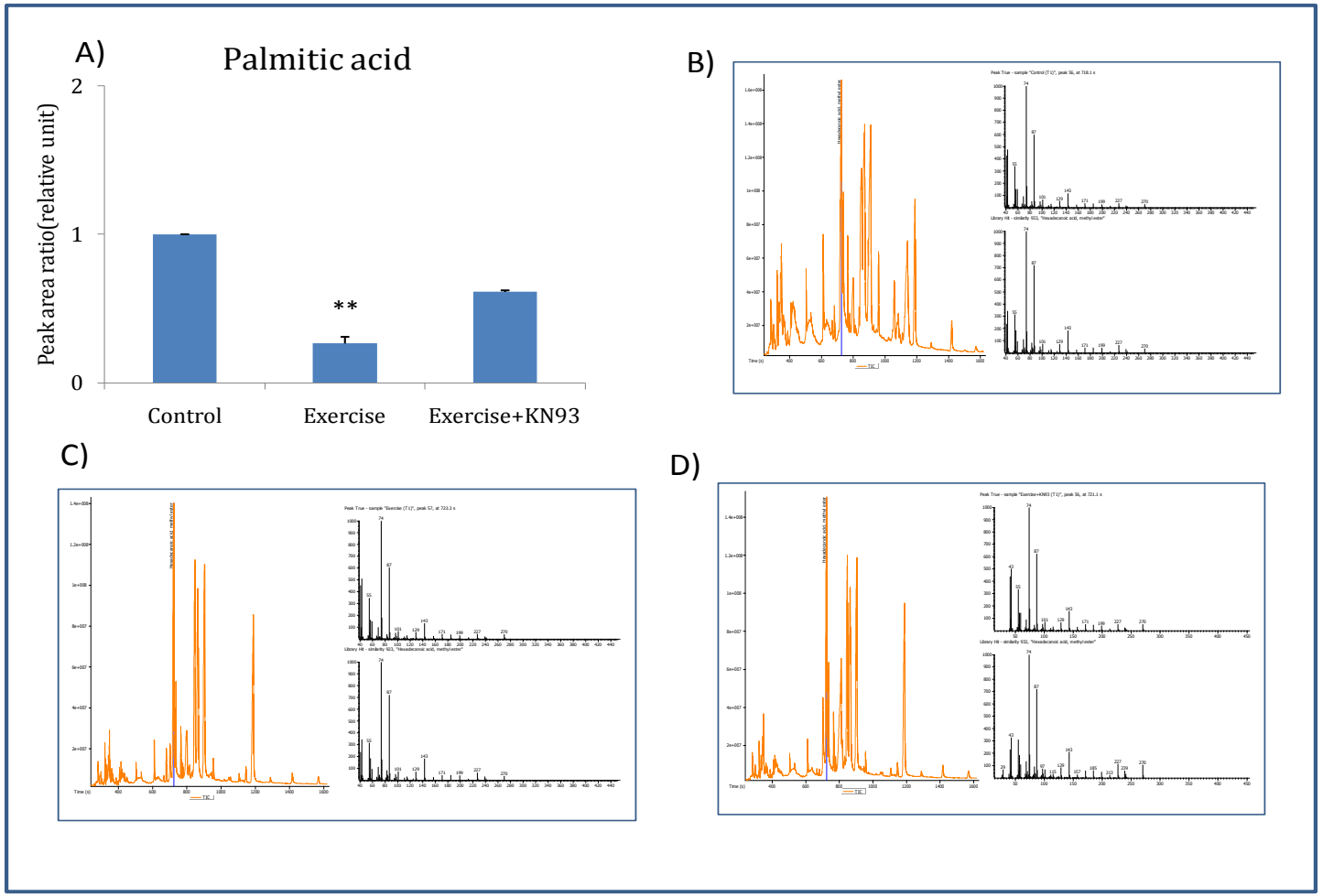

PCaMKII
***
Protein expression (relative unit)
4
3
2
1
0
Control
Exercise
Exercise+KN93
pCaMKII
Total CaMKII


A)
Palmitoleic acid
Peak area ratio (relative unit)
3
2
1
0
**
Control
Exercise
Exercise+KN93
B)
C)
D)


A)
Oleic acid
***
Peak area ratio (relative unit)
0
1
2
3
4
5
Control
Exercise
Exercise+KN93
B)
C)
D)


A)
Lauric acid
Peak area ratio (arbitrary unit)
10
9
8
7
6
5
4
3
2
1
0
***
Control
Exercise
Exercise+KN93
B)
C)
D)


A)
Myristic acid
Peak area ratio (relative unit)
2
1
0
**
Control
Exercise
Exercise+KN93
B)
C)
D)


A)
Palmitic acid
Peak area ratio(relative unit)
2
1
0
**
Control
Exercise
Exercise+KN93
B)
C)
D)

CONCLUSIONS

- CAMKII ACTIVATION BY EXERCISE REGULATES SATURATED AND UNSATURATED FATTY ACIDS
- CAMKII SELECTIVELY INCREASES THOSE LIPIDS BENEFICIAL TO HUMAN HEALTH AND DECREASES THOSE LIPIDS SHOWN TO HAVE A NEGATIVE EFFECT ON TYPE 2 DIABETES AND METABOLIC SYNDROME.