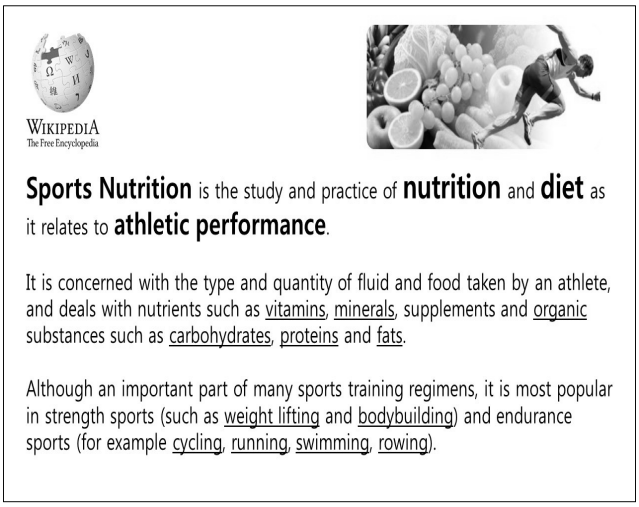
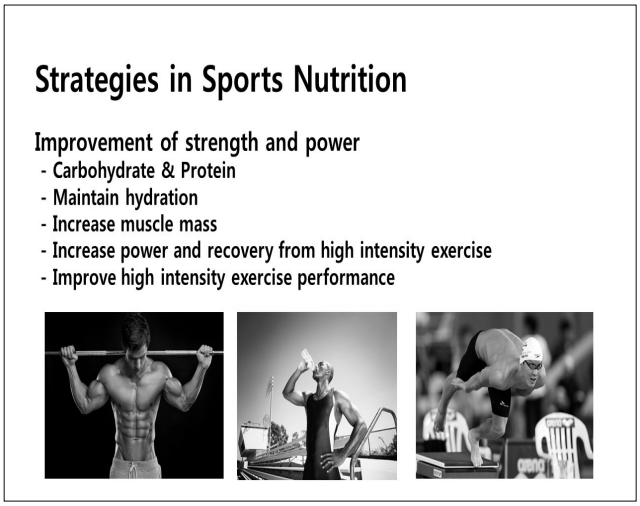
운동과 영양의 시너지 효과 규명을 위한 실험 연구

김 희 재
건국대학교





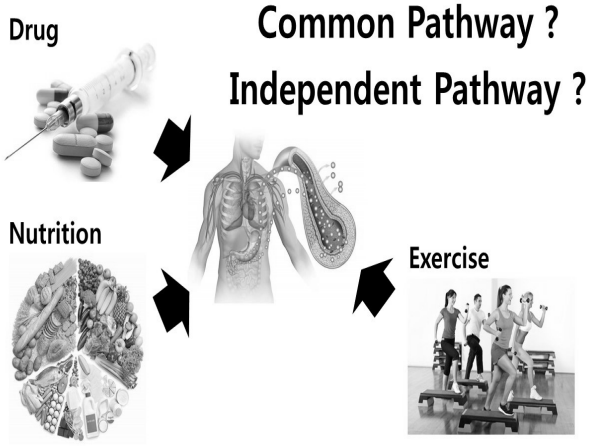
Exercise and Sports Nutrition Trends

Richard Kreider (Texas A&M University)

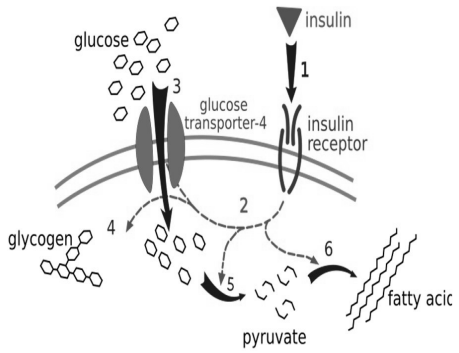
- Pre-Workout Supplements / Drinks
  - Enhance Acute Exercise
  - Improve Mental Focus / Attention
  - Reduce Catabolism
  - Convenient means to provide nutrients that can enhance training adaptations
- Identifying synergistic effects of ergogenic nutrients
- Recovery Nutrition
- Naturally derived bioactives
- Use of bioactive nutrients in functional foods
- Nutrigenomics – Individualized exercise / nutrition interventions
- **Health benefits** of exercise and sport nutrition methods

from special lecture in KSEN (2016. 8)

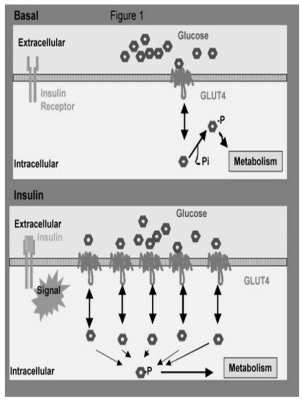
Common Pathway ? Independent Pathway ?



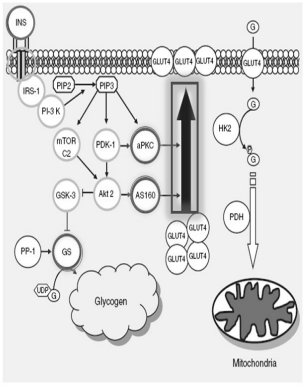
GLUT4 and insulin signaling



GLUT4 and insulin signaling



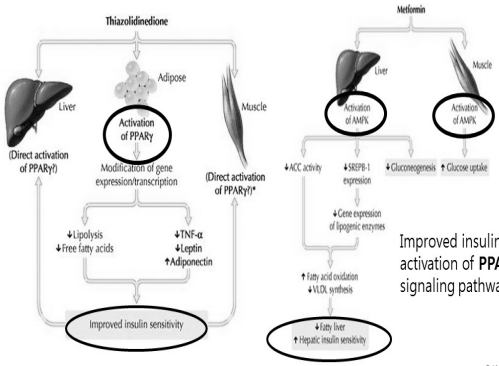
Regulation of GLUT4 expression by exercise



Insulin signaling to GLUT4 translocation and stimulation of glucose uptake after prior exercise
(*Christian Frøsig and Erik A. Richter1, 2009)*

Exercise effect is <u>independent</u> of the insulin signaling pathway

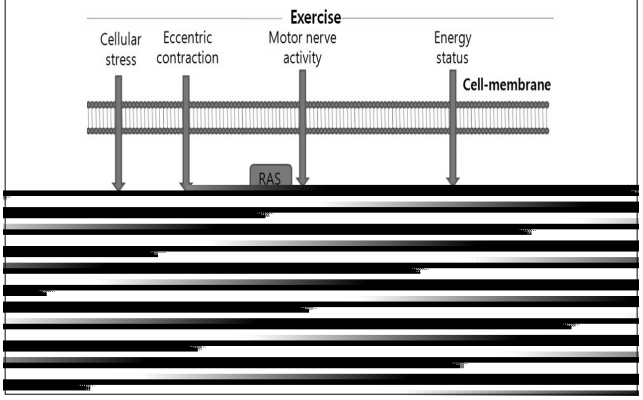
Target signaling of drug for type 2 DM (TZD & Metformin)



Improved insulin sensitivity by activation of **PPAR** and **AMPK** signaling pathway

C.K.Ashok Kumar et al. 2008

Results of Exercise Training in Insulin Signaling



Oh et al. Journal of the International Society of Sports Nutrition 2013, 10:21
http://www.jissn.com/content/10/1/21

RESEARCH ARTICLE Open Access

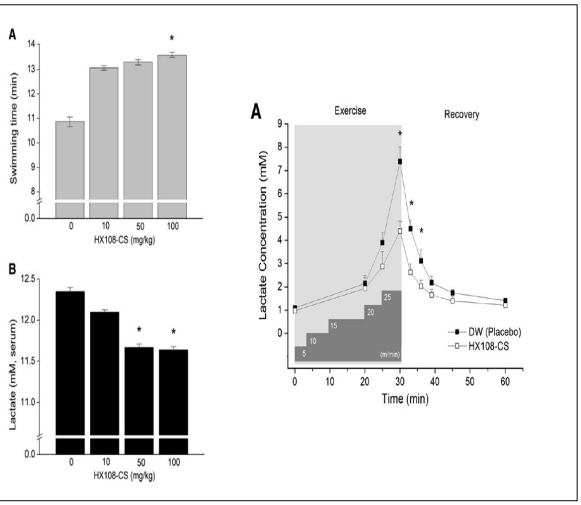
Effect of HX108-CS supplementation on exercise capacity and lactate accumulation after high-intensity exercise

Seung-Lyul Oh[1], Hyukki Chang[2], Hee-Jae Kim[1], Yong-An Kim[1], Dong-Sik Kim[3], Seong-Hyun Ho[3], Seon-Hee Kim[3] and Wook Song[1,4*]

Abstract

Background: In the present study, we determined the effects of HX108-CS (mixed extract of *Schisandra chinensis* and *Chaenomeles sinensis*) supplementation on lactate accumulation and endurance capacity. Furthermore, we examined CK (creatine kinase), LDH (lactate dehydrogenase) activity to determine whether the HX108-CS affected markers of skeletal muscle injury *in vivo* and *in vitro*.

Methods: Exercise capacity was measured by an exhaustive swimming test using ICR mice divided into four groups; one group received distilled water (DW) (Control group, n = 10), and the other groups received three different dosages of HX108-CS (10, 50 and 100 mg/kg, n = 10 per group) solution in water orally. Then, for the time-dependent measurements of blood lactate, CK, and LDH, Sprague-Dawley rats were divided into two groups

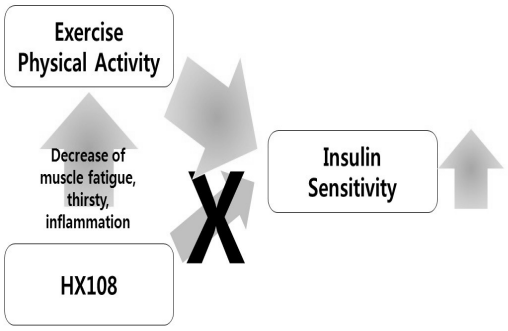


2 weeks of supplementation

HX108-CS (100 mg/kg)

Decrease of fasting blood glucose concentration !

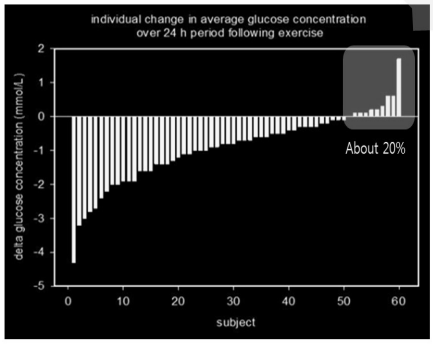
Why ?



Combined treatment of exercise and nutrition ?

Individual response to exercise

Genetic?
Environmental?



Synergistic effect of exercise and nutrition !

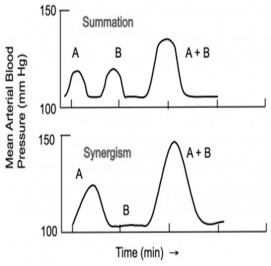
Synergic effect VS. Additive effect

Synergic effect

The interaction of two or more agents or forces so that their **combined effect is greater than the sum** of their individual effects.

Additive effect

An effect in which two substances or actions used in combination produce a **total effect the same as the sum** of the individual effects.



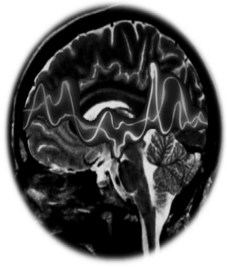
Study question ?

Is exercise **safe** for seizure patients?

- Type of exercise
- Intensity of exercise
- Interaction with drug or nutrition

What is seizure ?

"**Seizure**" is a general term that refers to a sudden malfunction in the brain that causes someone to **collapse**, **convulse**, or have another temporary disturbance of normal brain function, often with a loss or change in **consciousness**.

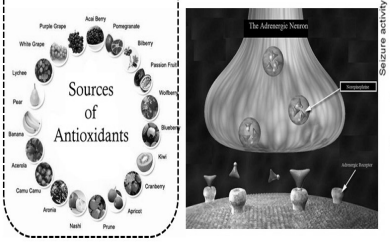


Literature review

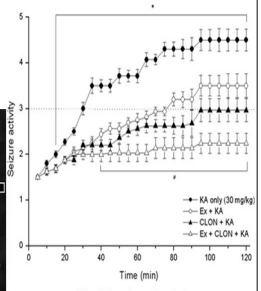
Potential mechanisms for regulation of seizure activity

Antioxidant

Adrenergic response



Inhibitory effect of **clonidine** on kainic acid-induced seizure activity in regularly exercised mice.
Hee-jae Kim, Sok Park et al., (JENB. 2011 15(2):87-93)



Clonidine (4 mg/kg, i.p.)
α2 adreno-receptor agonist

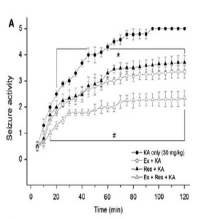
Neurochem Res
DOI 10.1007/s11064-012-0897-8

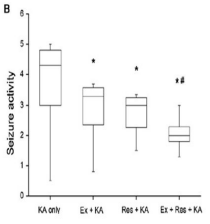
ORIGINAL PAPER

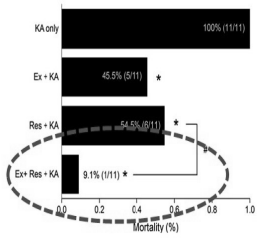
The Synergic Effect of Regular Exercise and Resveratrol on Kainate-Induced Oxidative Stress and Seizure Activity in Mice

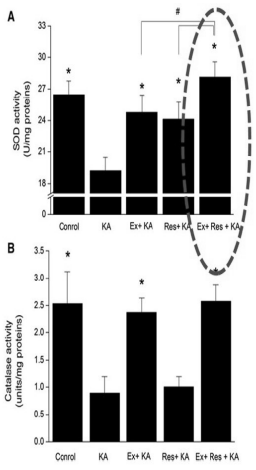
Hee-jae Kim · Il-Kon Kim · Wook Song · Jin Lee · Sok Park

Resveratrol (40 mg/kg, 6 weeks)







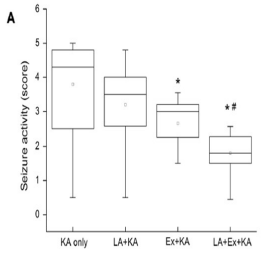


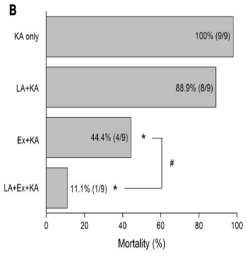
Neurochem Res
DOI 10.1007/s11064-014-1350-y

ORIGINAL PAPER

Synergic Effect of Exercise and Lipoic Acid on Protection Against Kainic Acid Induced Seizure Activity and Oxidative Stress in Mice

Hee-jae Kim · Wook Song · Jin-Soo Kim · Eun Hee Jin · Moon-Seok Kwon · Sok Park





To find the "exercise intensity" and "dose of agents"

There is a need to find an efficient treatment regimen that includes ASC and low-intensity exercise to diminish the risk of overtraining and nutritional treatment by attenuating oxidative stress

Neurochem Res (2016) 41:1035–1041
DOI 10.1007/s11064-015-1789-5

CrossMark

ORIGINAL PAPER

Combined Low-Intensity Exercise and Ascorbic Acid Attenuates Kainic Acid-Induced Seizure and Oxidative Stress in Mice

Hee-jae Kim[1] · Wook Song[1,2] · Eun Hee Jin[3] · Jongkyu Kim[4] · Yoonseok Chun[5] · Eung Nam An[5] · Sok Park[4]

ASC : 200 mg/kg body weight

Swimming training: period lasted 8 weeks and consisted of 30-min sessions