

운동과 영양의 시너지 효과 규명을 위한 실험 연구

김 희 재

건국대학교

Nutrition ?

Exercise ?

Sports Nutrition ?



Sports Nutrition is the study and practice of **nutrition** and **diet** as it relates to **athletic performance**.

It is concerned with the type and quantity of fluid and food taken by an athlete, and deals with nutrients such as vitamins, minerals, supplements and organic substances such as carbohydrates, proteins and fats.

Although an important part of many sports training regimens, it is most popular in strength sports (such as weight lifting and bodybuilding) and endurance sports (for example cycling, running, swimming, rowing).

Strategies in Sports Nutrition

Improvement of strength and power

- Carbohydrate & Protein
- Maintain hydration
- Increase muscle mass
- Increase power and recovery from high intensity exercise
- Improve high intensity exercise performance



Role of sports nutrition only for the athletic performance?



Obesity



Diabetes



Cancer & Cachexia



Sarcopenia & Frailty

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)

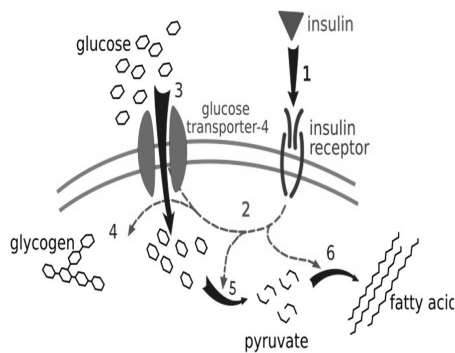
Drug

Common Pathway ?
Independent Pathway ?

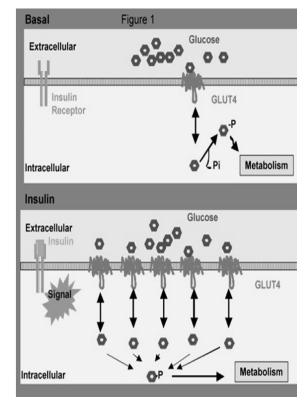
Nutrition

Exercise

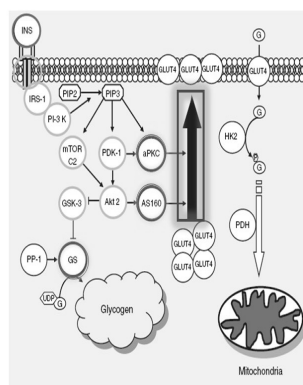
GLUT4 and insulin signaling



GLUT4 and insulin signaling



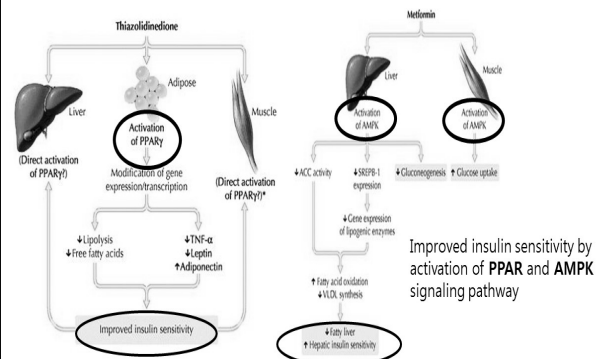
Regulation of GLUT4 expression by exercise



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

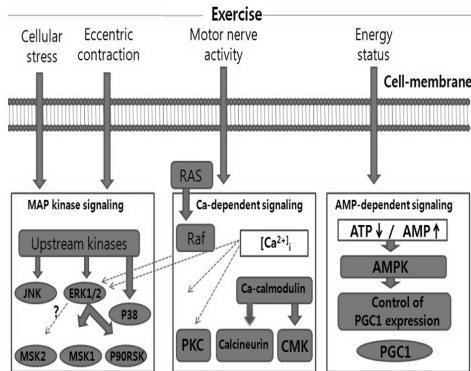
Exercise effect is independent of the insulin signaling pathway

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

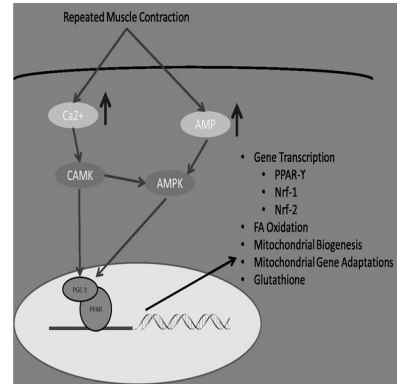


C.K.Ashok Kumar et al. 2008

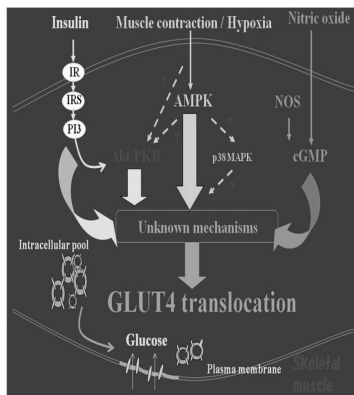
Results of Exercise Training in Insulin Signaling



Results of Exercise Training in Insulin Signaling



evolutionaryhealthperspective.wordpress.com 2013



www.med.nagoya-u.ac.jp

Exercise as a potent stimulator for enhanced insulin sensitivity via various mechanisms

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

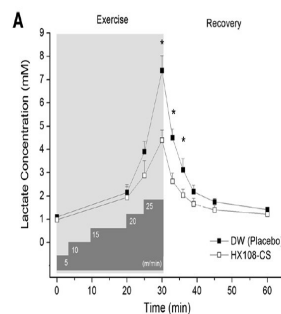
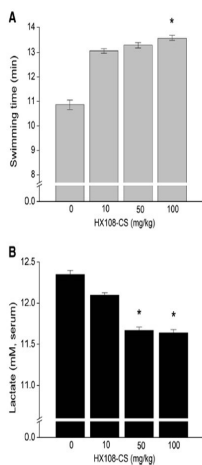
Effect of HX108-CS supplementation on exercise capacity and lactate accumulation after high-intensity exercise

Seung-Lyul Oh¹, Hyukki Chang², Hee-Jae Kim¹, Yong-An Kim¹, Dong-Sik Kim¹, Seong-Hyun Ho², Seon-Hee Kim¹ and Wook Song^{1*}

Abstract

Background: In the present study, we determined the effects of HX108-CS (mixed extract of *Schisandra chinensis* and *Chenopodium shensi*) 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 measurement of blood lactate (CK and LDH), serum and tissue were collected into two groups.



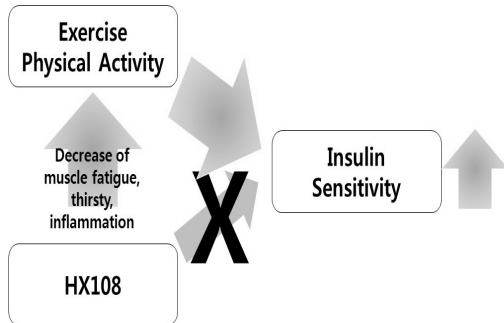
2 weeks of supplementation



HX108-CS (100 mg/kg)

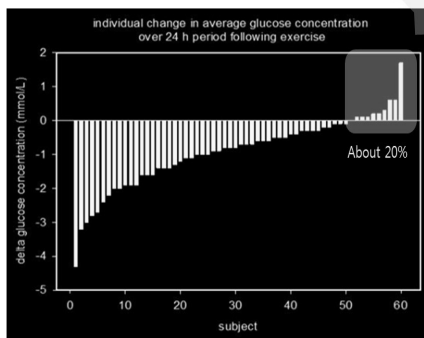
Decrease of fasting blood glucose concentration !

Why ?



Combined treatment of exercise and nutrition ?

Individual response to exercise



Synergistic effect of exercise and nutrition !

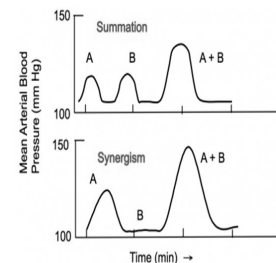
Synergic effect VS. Additive effect

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.



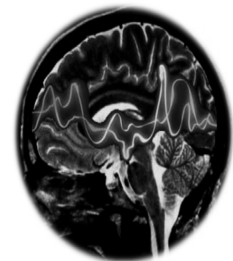
Study question ?

Is exercise **safe** for seizure patients?

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

What is seizure ?

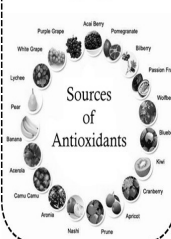
"**Seizure**" is a general term that refers to a sudden malfunction in the brain that causes someone to **collapse, convulse**, or have another temporary disturbance of normal brain function, often with a loss or change in **consciousness**.



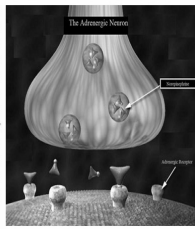
Literature review

Potential mechanisms for regulation of seizure activity

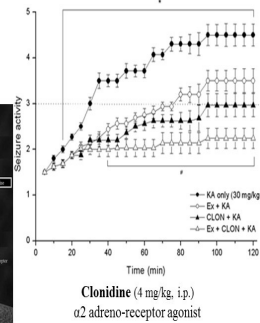
Antioxidant



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)



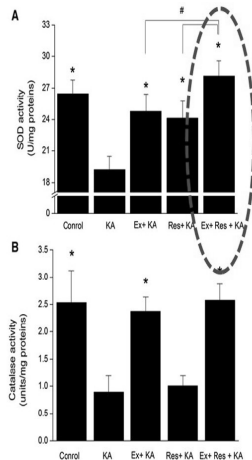
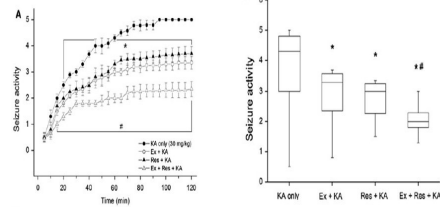
Neurochem Res
DOI 10.1007/s10644-012-0897-8

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)

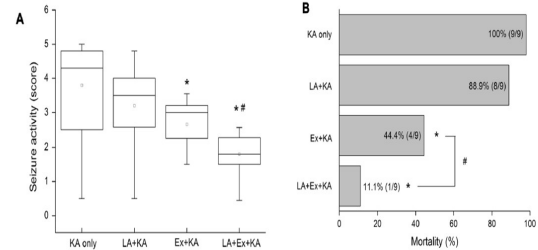


Neurochem Res
DOI 10.1007/s10644-014-1350-y

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/s10644-015-1789-5



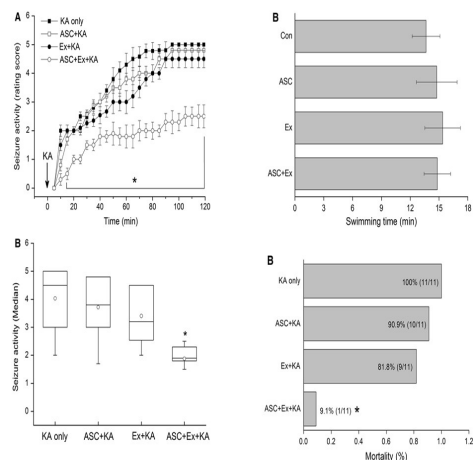
ORIGINAL PAPER

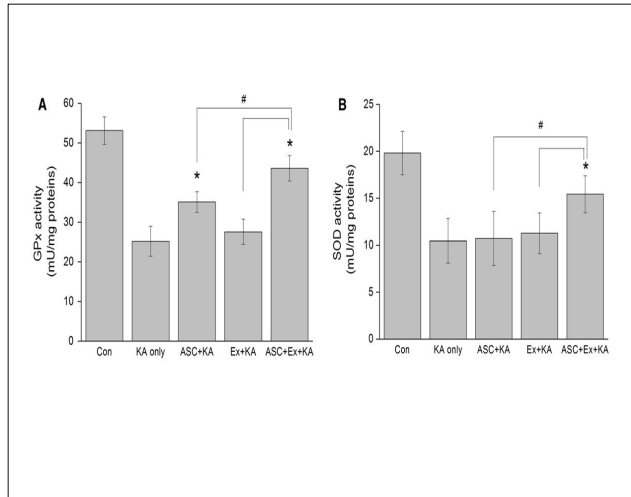
Combined Low-Intensity Exercise and Ascorbic Acid Attenuates Kainic Acid-Induced Seizure and Oxidative Stress in Mice

Hee-jae Kim¹ · Wook Song^{1,2} · Eun Hee Jin³ · Jongkyu Kim⁴ · Yoonseok Chun⁵ · Eung Nam An¹ · Sok Park⁶

ASC : 200 mg/kg body weight

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





Consideration for the experiment design !

- ✓ **Exercise type** (resistance exercise or endurance exercise)
- ✓ **Exercise duration** (Acute exercise or Training)
- ✓ **Exercise intensity** (High intensity or moderate intensity)
- ✓ **Nutritional timing** (Pre-exercise or Post-exercise)
- ✓ **Interaction between Exercise and Nutrition**
(Common or Independent pathway)



*Take
home message