

AT A GLANCE

# K2 AND CARDIAC OUTPUT STUDY

ORAL CONSUMPTION OF VITAMIN K2 FOR 8 WEEKS ASSOCIATED WITH INCREASED MAXIMAL CARDIAC OUTPUT DURING EXERCISE.

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## RESEARCH SUMMARY

Menaquinones (like vitamin K2) have been shown to reduce calcium accumulation in vascular walls, induce tumor cell apoptosis, and restore the production of mitochondrial adenosine triphosphate (ATP) production. Improving ATP production has a direct implication on the contractile muscles that have high levels of mitochondria (such as cardiac muscles). In aerobically trained individuals, there is a common trend in decreasing maximal heart rate, which is a side effect of training-induced expansion of blood volume. Unfortunately, reduced maximal heart rate negatively influences the ability to maximize cardiac output. Dietary treatment with vitamin K2 can improve cardiac mitochondrial function, which may reverse training-induced reductions in maximal heart rate and/or improve stroke volume. In the current study, 8 weeks of supplementation with vitamin K2 resulted in a 12% increase in cardiac output compared to the placebo. Researchers also observed an improved cardiovascular profile of heart rate and a reduction in blood lactate levels.

## GOALS

To use a double-blind placebo controlled trial to determine the effects of 8 weeks of oral supplementation with vitamin K2 on heart rate, stroke, volume, cardiac output, oxygen consumption, blood lactate, and ventilation.

## KEY TERMINOLOGY

### CARDIAC OUTPUT

The amount of blood the heart pumps through the circulatory system in one minute.

### STROKE VOLUME

The amount of blood pumped by the left ventricle of the heart in one contraction.

### HEART RATE

The number of heart beats per unit of time, usually one minute.

### VO2 MAX

The maximum rate of oxygen consumption measured during incremental exercise; that is, exercise of increasing intensity. The name is derived from three abbreviations: "V" for volume, "O<sub>2</sub>" for oxygen, and "max" for maximum.

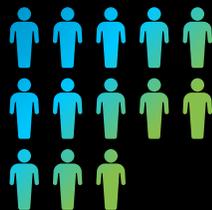
### METABOLIC CART

A device used for indirect calorimetry that measures the oxygen consumed and the carbon dioxide produced by the patient and then calculates the energy expenditure for the patient.

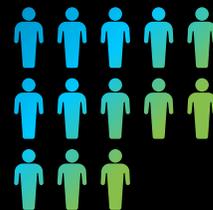
## SUBJECTS

26 aerobically trained athletes

13 MALE



13 FEMALE



## MATERIALS AND METHODS

Subjects were randomly assigned into a control (rice flour placebo) or intervention group (vitamin K2).

Both groups were directed to continue their regular exercise/physical activity habits.

Intervention group dosing was accomplished in 2 phases:

**WEEK 1-4:** loading phase of 320mcg/day of vitamin K2

**WEEKS 5-8:** maintenance phase of 160mcg/day of vitamin K2

**Experimental exercise test:**

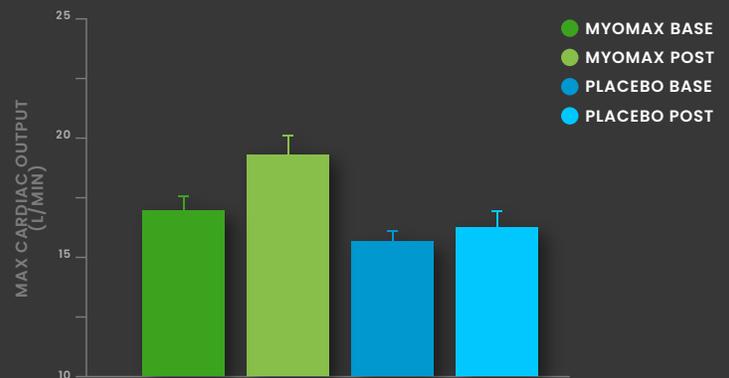
- 24 minutes of high intensity intervals to achieve a VO<sub>2</sub> peak
- Cardiovascular measurements were made continuously:
  - Heart rate, stroke volume, and cardiac output
  - Metabolic cart assessment of oxygen consumption, ventilation, and the respiratory exchange ratio during exercise.
  - Finger-stick blood samples were made to measure blood lactate.

## RESULTS

Significant 12% increase in maximal cardiac output with vitamin K2 compared to the placebo.

Small, non-significant, changes in heart rate and stroke volume were also observed. The changes could become significant with longer supplementation.

A trending reduction in blood lactate levels which aids in muscle recovery from intense exercise.



## CONCLUSIONS

Supplementation with Vitamin K2 in active individuals for 8 weeks resulted in significant cardiovascular improvements. A 12% increase in cardiac output is equivalent to an extra 900liters of oxygen pumping through your body each day.