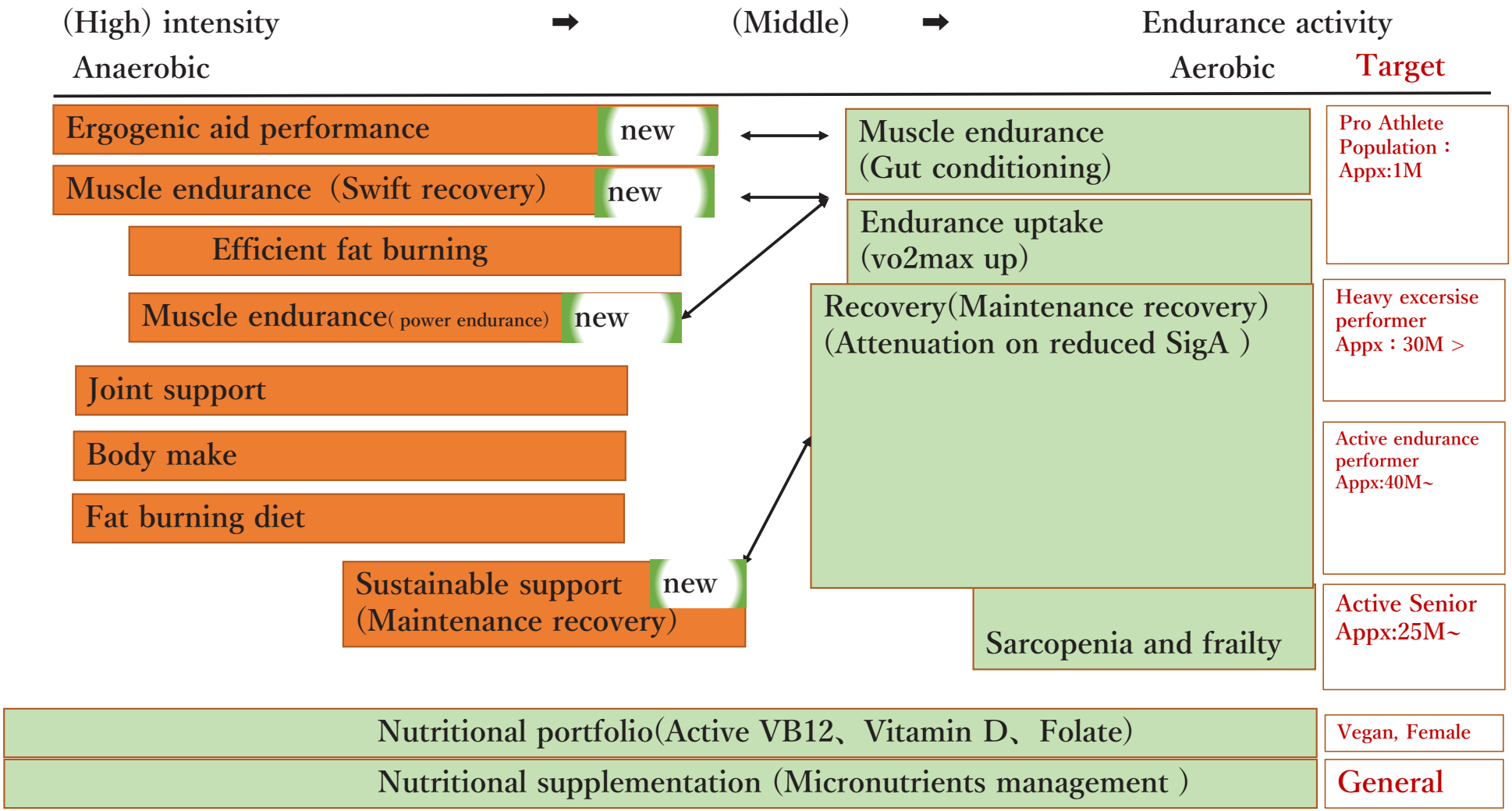
Health is Wealth™

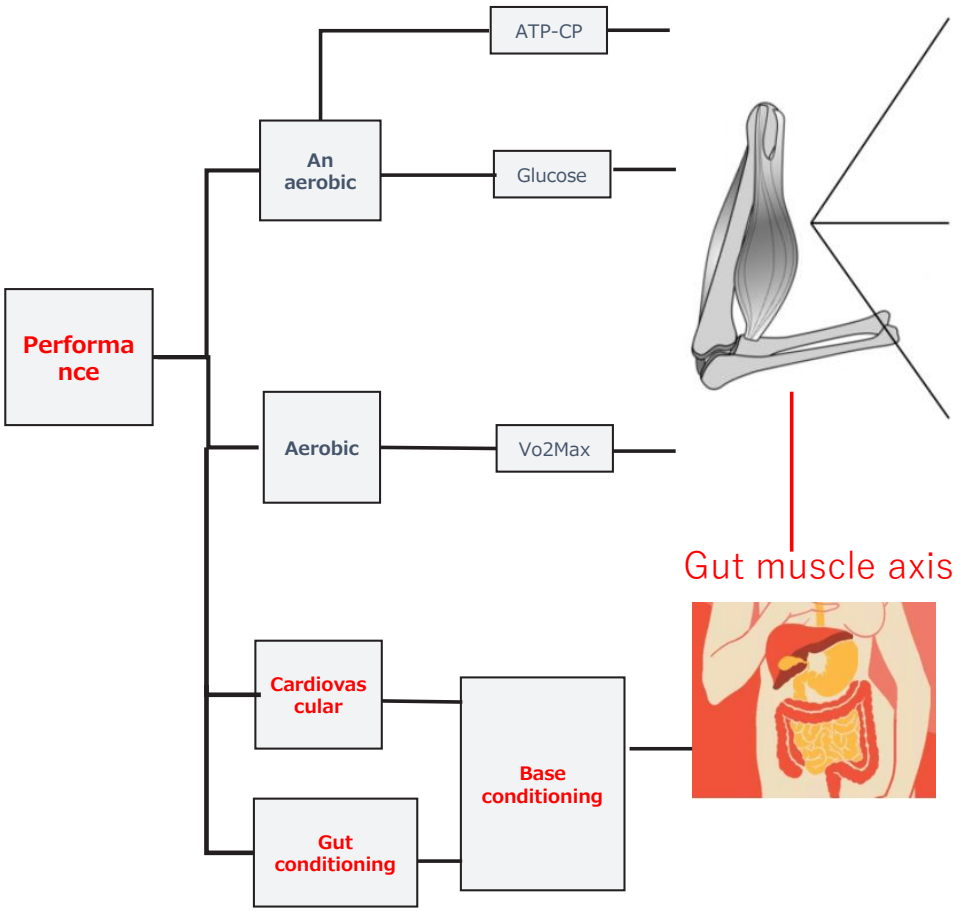
sun·chlorella

Sports Related Researches & Evidence

Primary Market Segment Targets



How The Energy System Works



ATP-CP

Substrate: Creatine phosphate

Duration of activity unit: 8 seconds

Excersise intensity: High power

Featured with Quick & high power

Anaerobic Glycolytic System

Substrate: Glucose

Duration of activity unit: 33 seconds – 60 seconds

Excersise intensity: Middle to high power

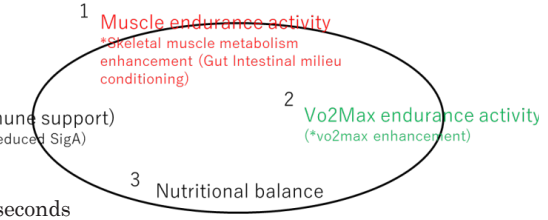
Featured with Muscle endurance

Aerobic system

Substrate: Oxygen

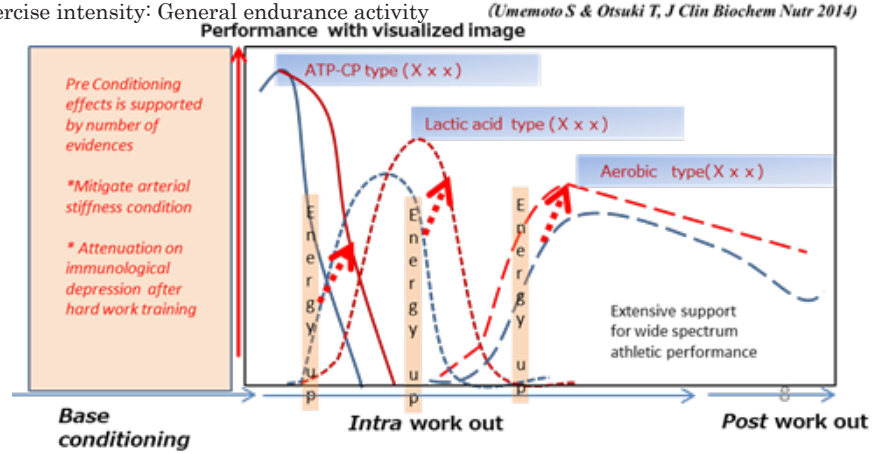
Duration of activity: long time

Exercise intensity: General endurance activity



Gut muscle axis

(Umemoto S & Otsuki T, J Clin Biochem Nutr 2014)



How The Energy System Works

System	Anaerobic		Aerobic
System	ATP-PCr	Lactic acid	Oxygen
Substrate & Material source	Pcr(Creatine)	Glucose	Carbonhydrate Lipid , Amino acid(BCAA)
Excersise	Ergogenic	High – Middle Power	Endurance activity
Durability	8 seconds	33 -60 seconds	long time ∞
Oxygen	Not used	Not used	Used
Time to develop	5 -10 seconds	40- 60 seconds	2 -3 minutes

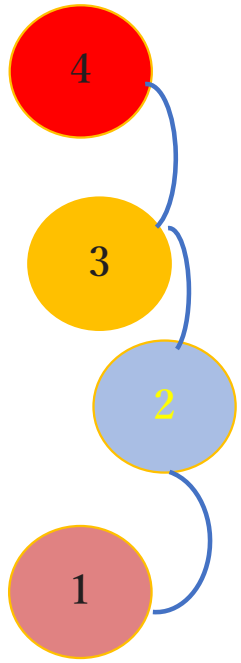
How The Energy System Works

High VO2 max level indicates ability to utilize relevant energy sources (Oxygen, ATP-CP, lactic acid)

Respiratory system
activity increases
Aerobic (VO2 max)

Cardiovascular system
activity increases
Aerobic (VO2 max)
capacity enhances

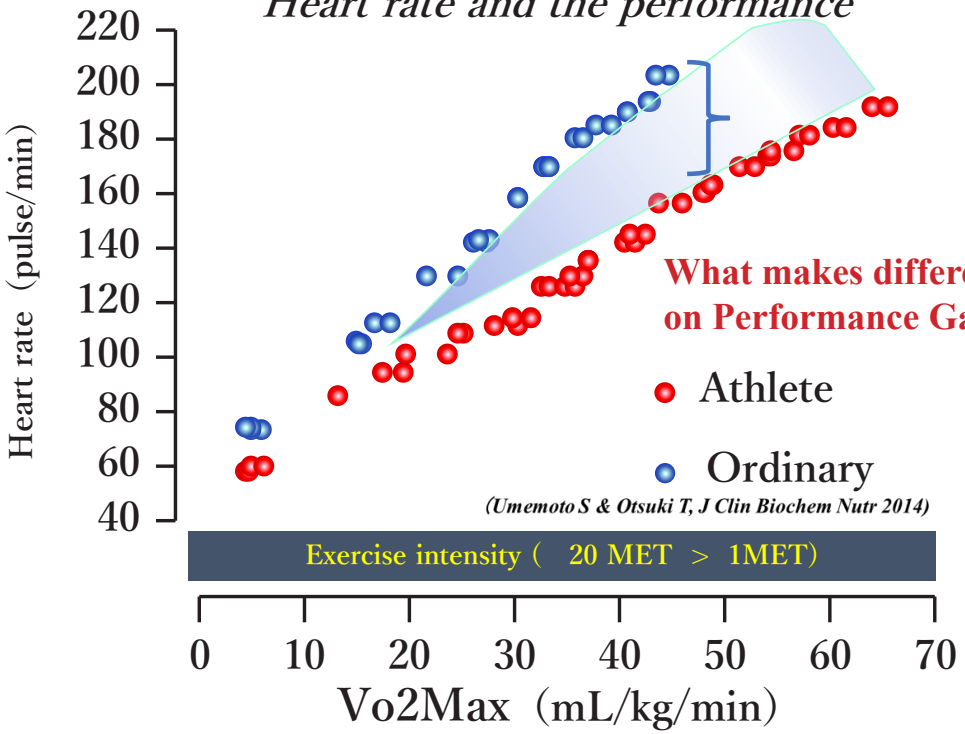
Muscular system
Activity increases
ATP ADP synthesis increases
Anaerobic



MET increases

What Vo2 Max means for Performance level

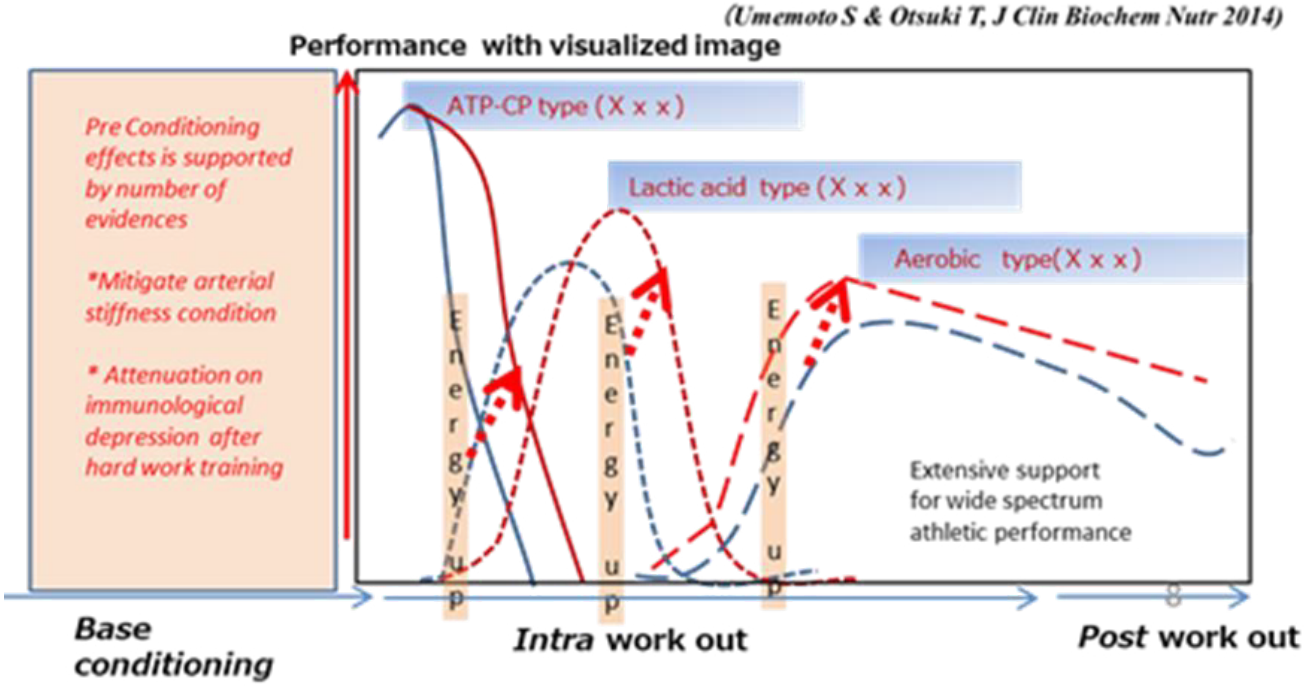
Heart rate and the performance



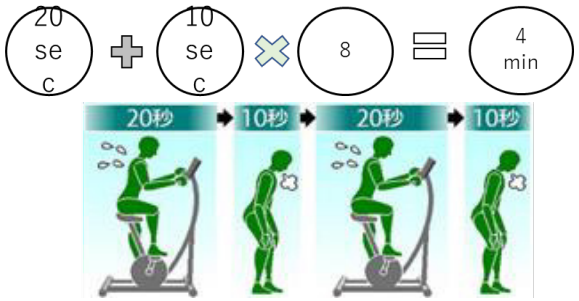
- ✓ *Performance level can be measured with heart rate, intensity (MET) and oxygen intake, each of which has a solid correlation for each.*
- ✓ *High performer athlete has higher VO2 MAX capacity that enables them to extend their limit thus, maximizing their total performance activity.*

Exercise - Hybrid System Combination

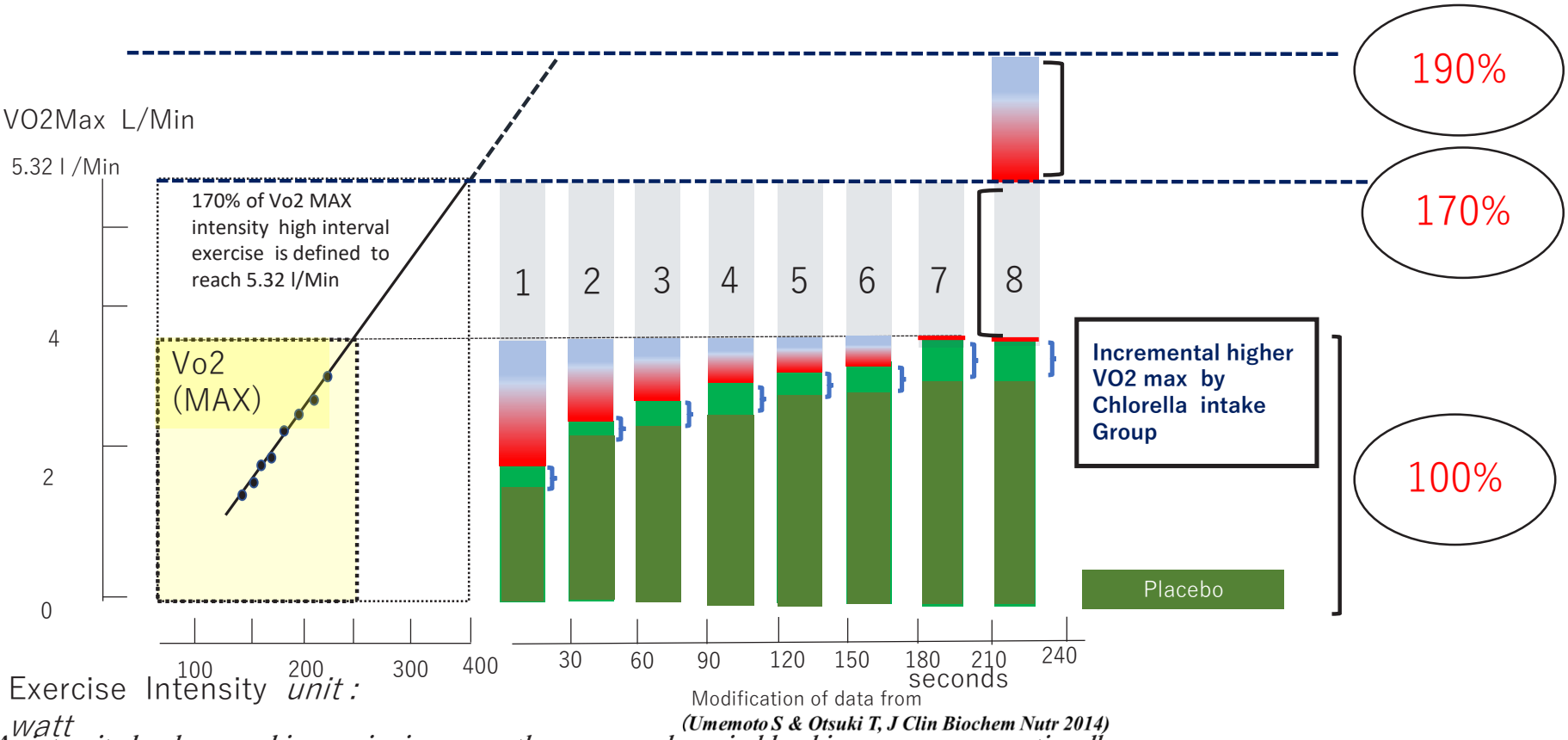
Sport/System	ATP-PC	Anaerobic Glycolytic	Aerobic
Basketball	60%	20%	20%
Hockey	50%	20%	30%
Rowing	20%	30%	50%
Running	10%	20%	70%
Skiing	33%	33%	33%



Exercise - Hybrid System Combination



With TABATA method , we employ 170% of VO2 MAX intensity level exercise to visualize the performance enhancement on both aerobic (Vo2 Max) and anaerobic system for athlete.
High Intensity Interval training(HIIT), in which VO2 intake capacity increases to VO2 MAX level in 7th interval times to complement anaerobic energy territory to fulfill its intake capacity at maximum level.
This graph shows both anaerobic and aerobic type of activity is being improved simultaneously as result of HIIT with Chlorella intake, which is approximately 10-15% more to those with placebo (No chlorella Group)

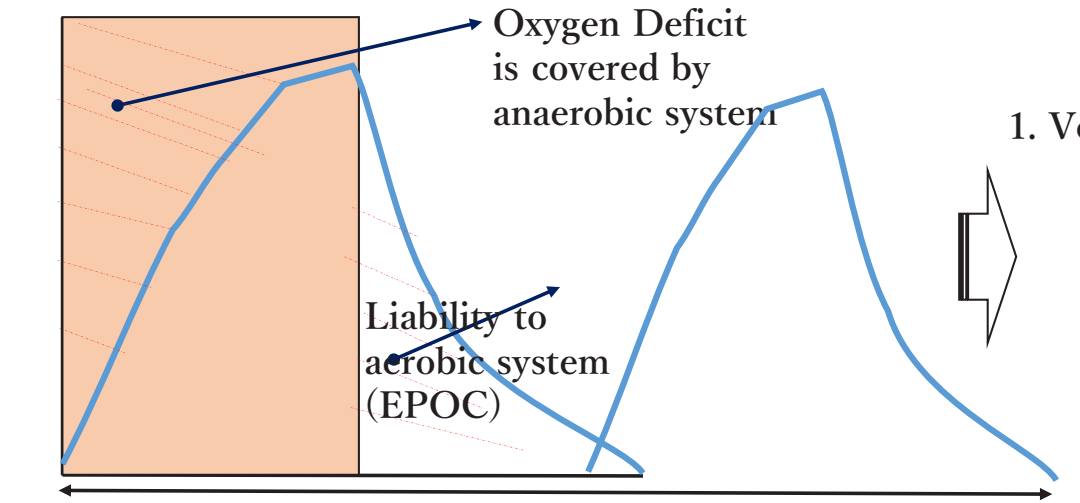


Modification of data from
(Umemoto S & Otsuki T, J Clin Biochem Nutr 2014)

As intensity level on aerobic exercise increases, the oxygen volume in blood increases as proportionally.
The value of Vo2Max means peak maximum oxygen intake ,which is identified as key performance indicator especially for endurance activity.

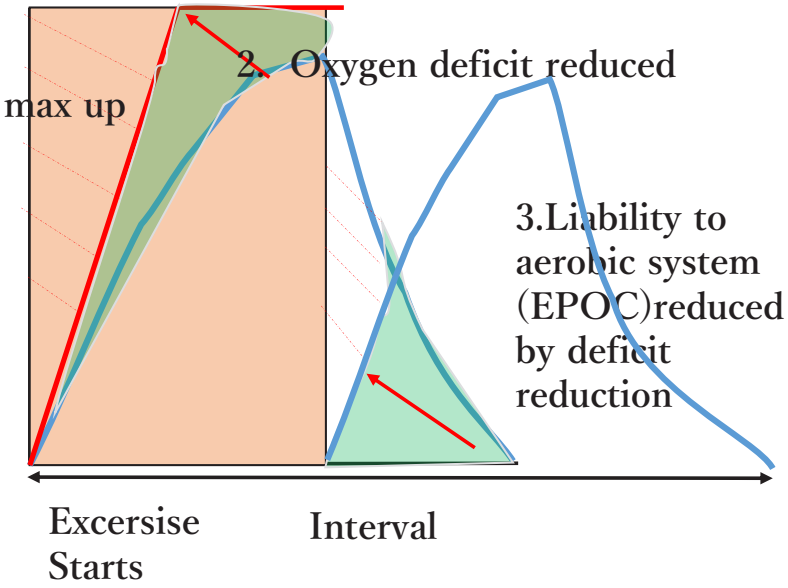
Importance of Vo2 Maximum Enhancement for Performance

Required Oxygen(Vo2) demand to achieve workout



EPOC will be more than oxygen deficit due to resource such as creatine and glucose previously wasted takes time for reloading

1. Vo2 max up



Source:
2020 edition Medical science International,ltd

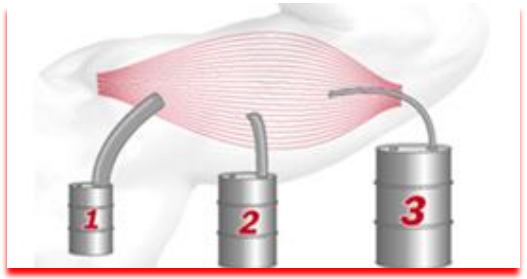
Proposal for Energy Portfolio Management

Hypothesis on mechanism:
Enhancement of VO2 max uptake is directly impacting the enhancement of ATP PCR Glycoritic activity through modulation of metabolic response in skeletal muscles.

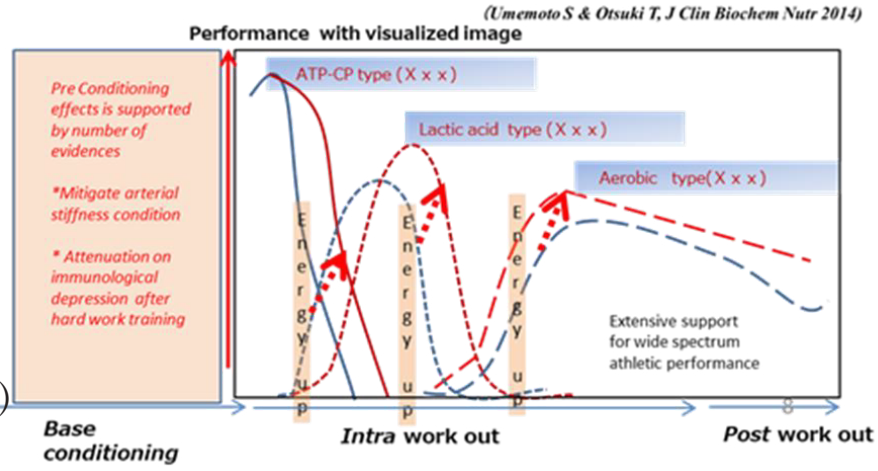
-NEW - Sun chlorella proposal "Gut muscle axis"
suggests a correlative functioning proof that SCFAs mediates metabolic crosstalk between intestinal microbiota and skeletal muscles through chlorella's functional factor to supplement specific SCFA deficiency

(ATP-CP ➡ lactic acid system ➡ aerobic system)

Anaerobic and aerobic systems work together



(ATP-CP ➡ lactic acid system ➡ aerobic system)



Sun Chlorella's Proposal: Gut-Muscle Axis 2

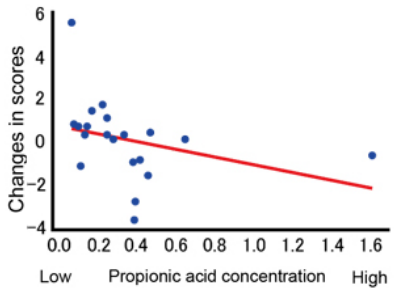


Figure 1.Relationship between propionic acid concentrations and changes in scores

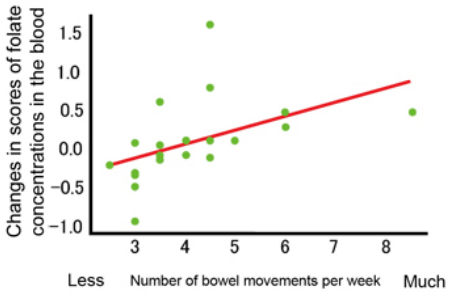
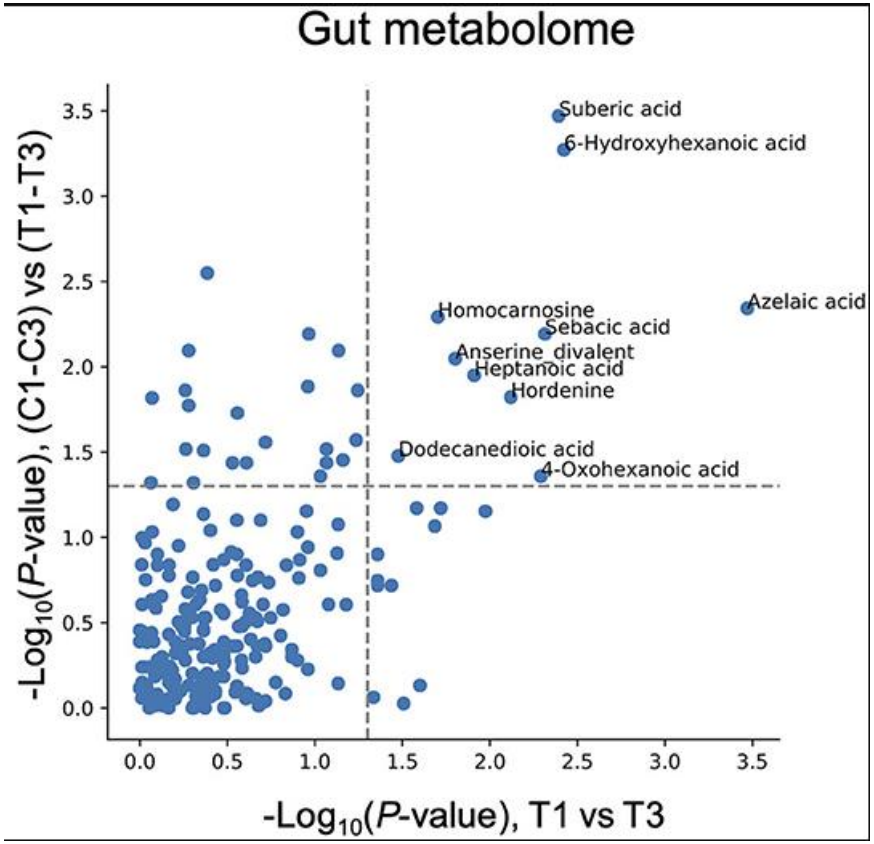


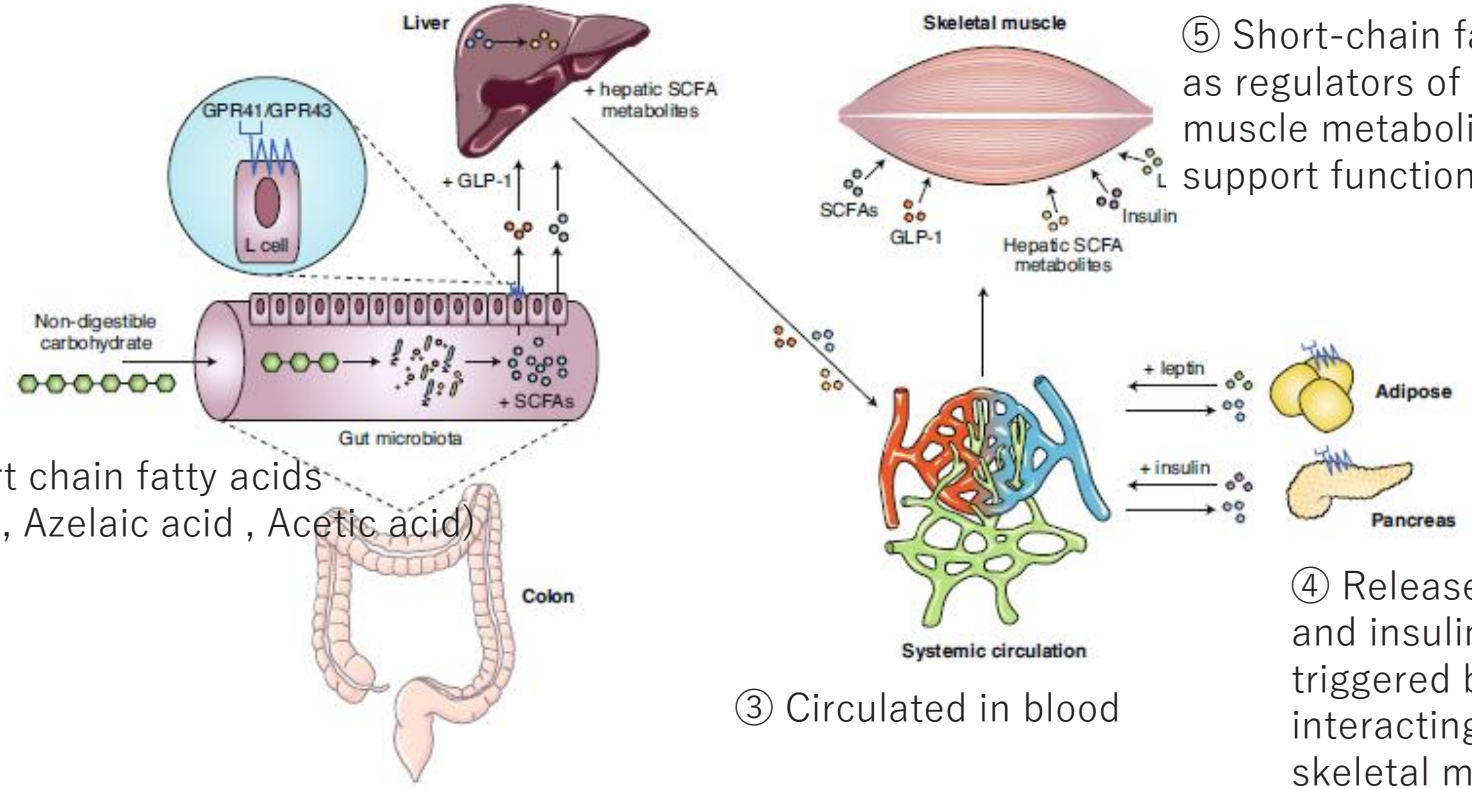
Figure 2.Relationship between the number of bowel movements and changes in scores of folate concentrations in the blood

Gut muscle axis proposal:
We believe that the underlying mechanism contributed by short-chain fatty acids as potential regulators of skeletal muscle metabolism and function (cited: nature published paper) can be applied as a new sales story for performance enhancement.



Sun Chlorella's Proposal: Gut-Muscle Axis 2

② Hepatic SCFA Metabolized



⑤ Short-chain fatty acids as regulators of skeletal muscle metabolism and support functioning

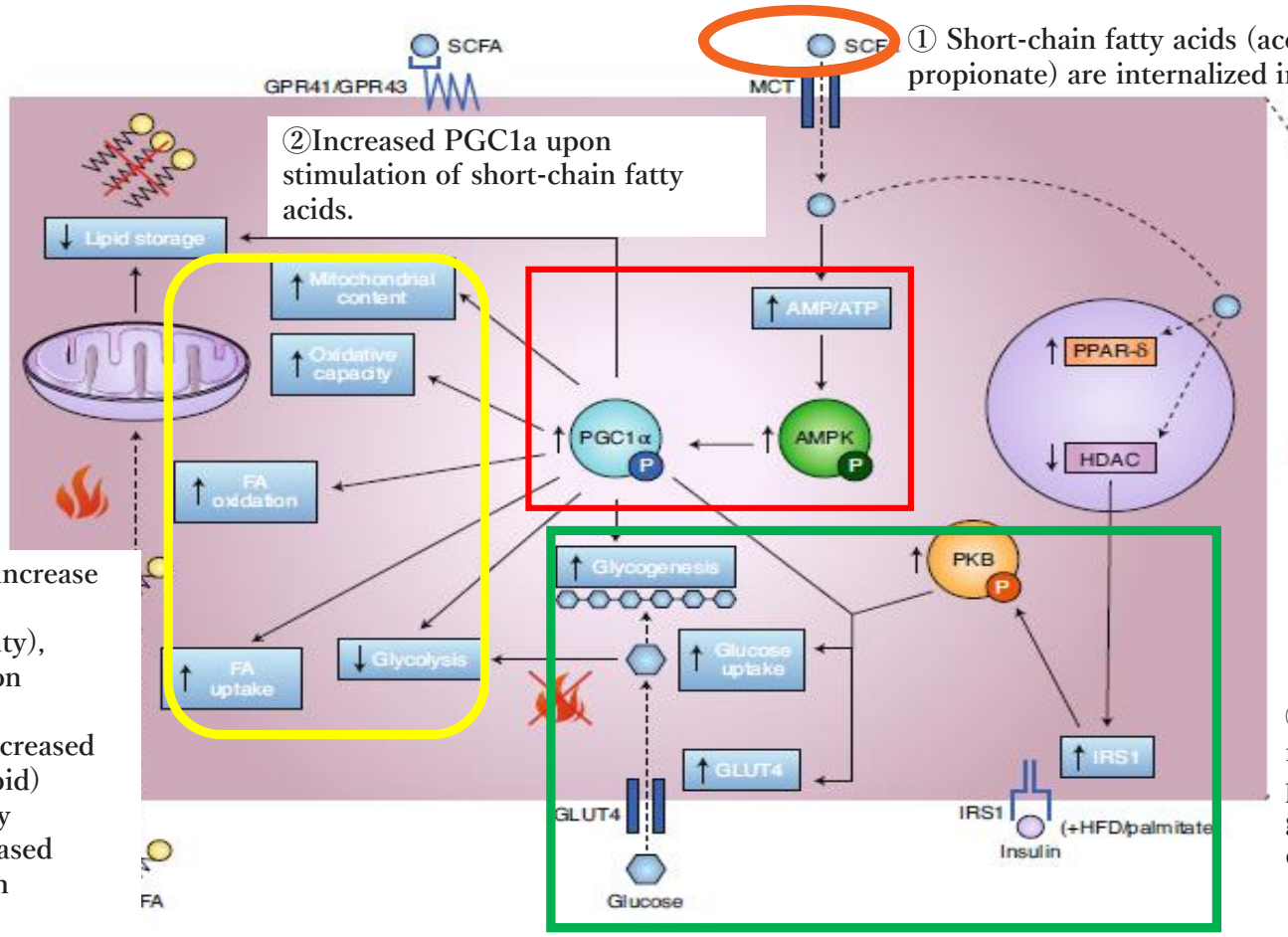
① SCFA Short chain fatty acids
(Propionic acid, Azelaic acid , Acetic acid)

③ Circulated in blood

④ Release of leptin and insulin is triggered by SCFA interacting with skeletal muscle

Fig. 3 | The contribution of short-chain fatty acids to the gut–muscle axis. Non-digestible carbohydrate is fermented by the gut microbiota, thus producing SCFAs. SCFAs trigger the release of GLP-1 (colon), leptin (adipose) and insulin (pancreas). These hormones, alongside SCFAs, enter the systemic circulation, interact with skeletal muscle and subsequently influence lipid, carbohydrate and protein metabolism.

The Effects of Short-Chain Fatty Acids on Metabolic Signaling Pathways in Skeletal Muscle



① Short-chain fatty acids (acetate, butyl acid, and propionate) are internalized into the cell.

②Increased PGC1a upon stimulation of short-chain fatty acids.

③Mitochondrial increase (increased energy production capacity), increased oxidation tolerance (fatigue tolerance), and increased free fatty acid (lipid) uptake and energy conversion (increased energy production efficiency).

⑤Skeletal muscle

④As a result, the insulin receptor increases, which promotes glucose uptake and glycogen synthesis, a storage of glucose loading.

Fig. 2 | The effects of short-chain fatty acids on metabolic signalling pathways in skeletal muscle. SCFAs influence skeletal muscle glucose and lipid

The Effects of Short-Chain Fatty Acids on Metabolic Signaling Pathways in Skeletal Muscle

#1 Research
MCT1,MCT4 (uptake of short-chain fatty acids) and PGC-1a (volatilization of each function), and the significantly increased PGC-1 α, as impacts on metabolic lineages.

#2 Research
Increased GLUT4 transporter (Glucose intake)

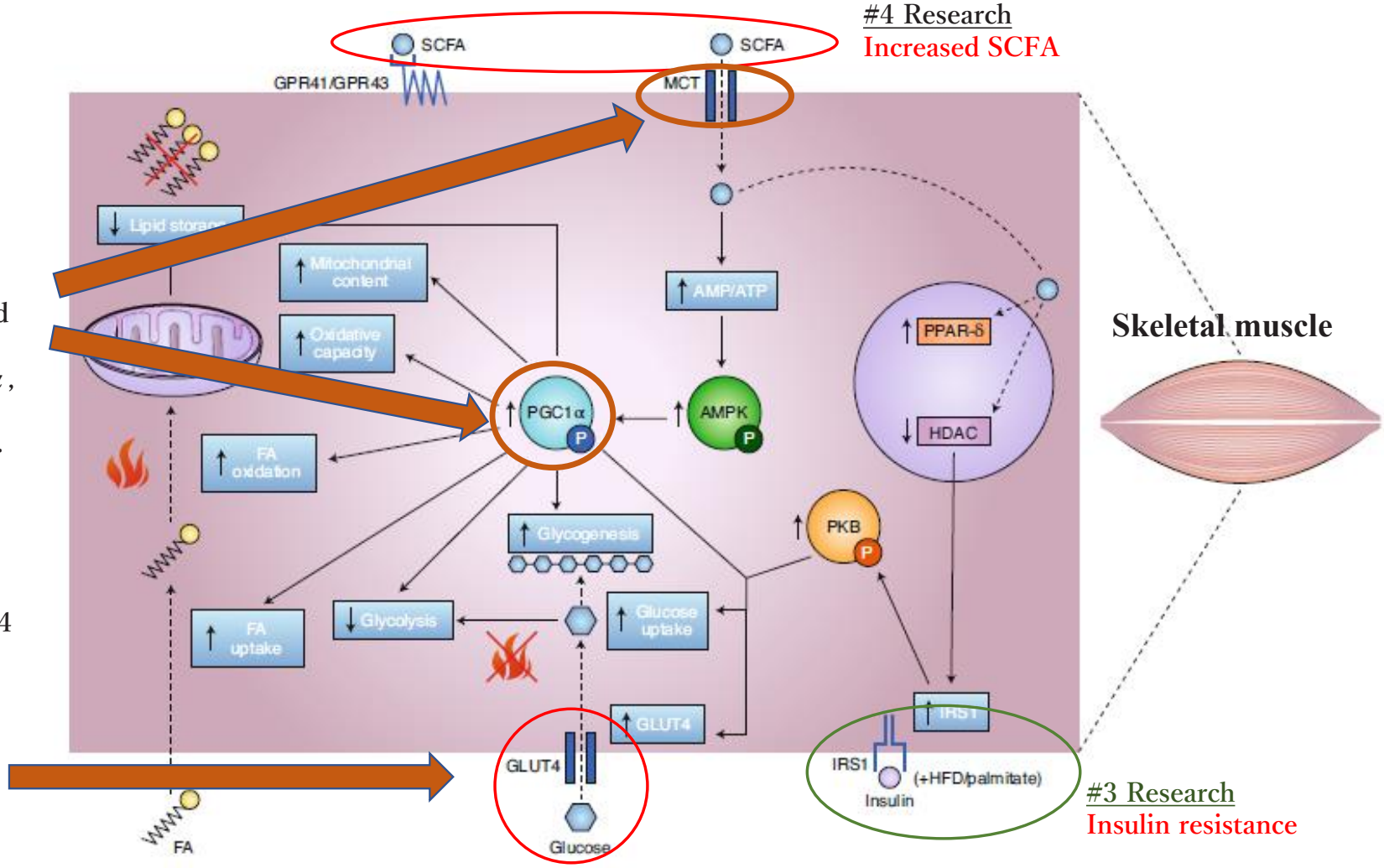
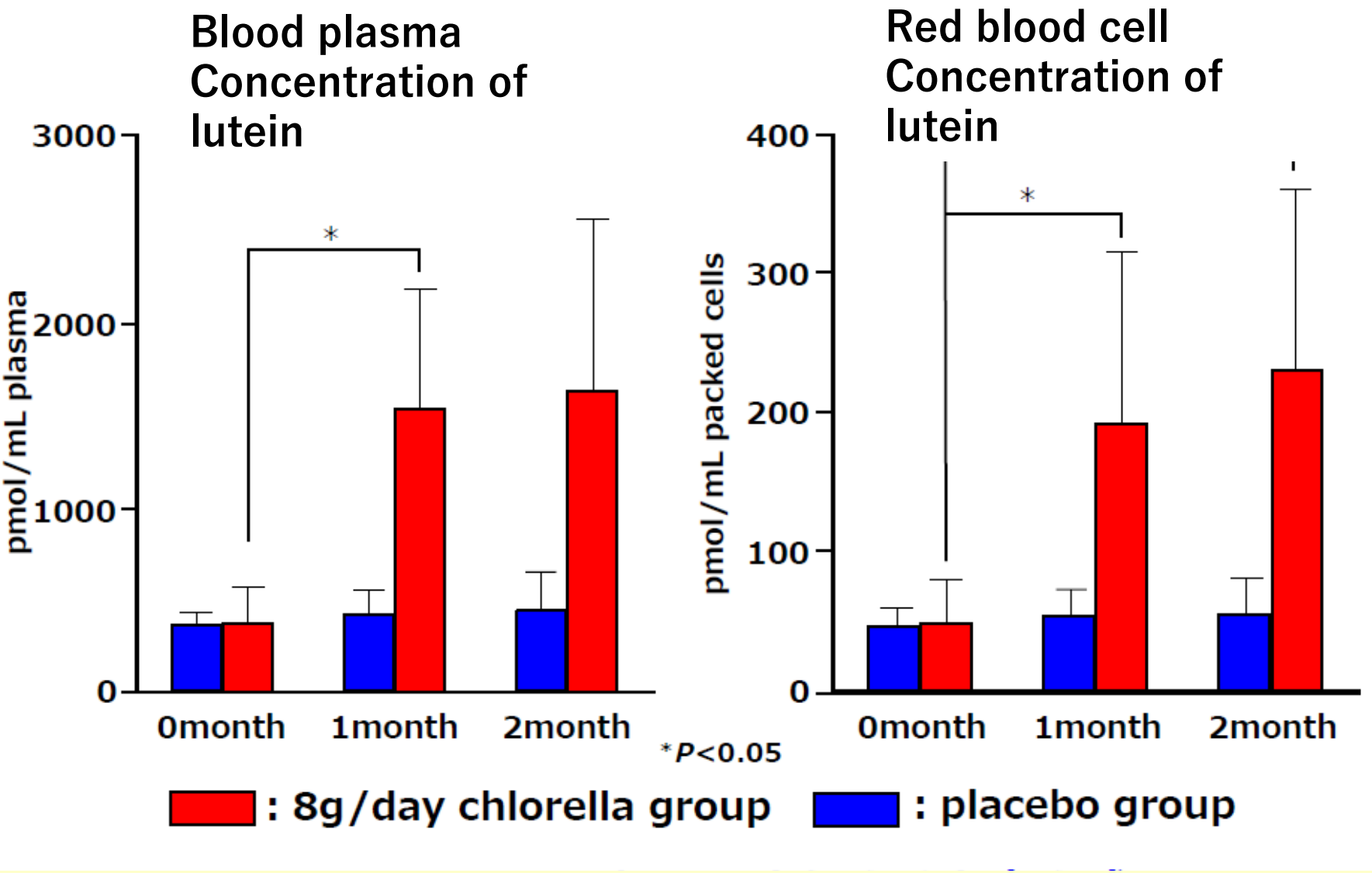


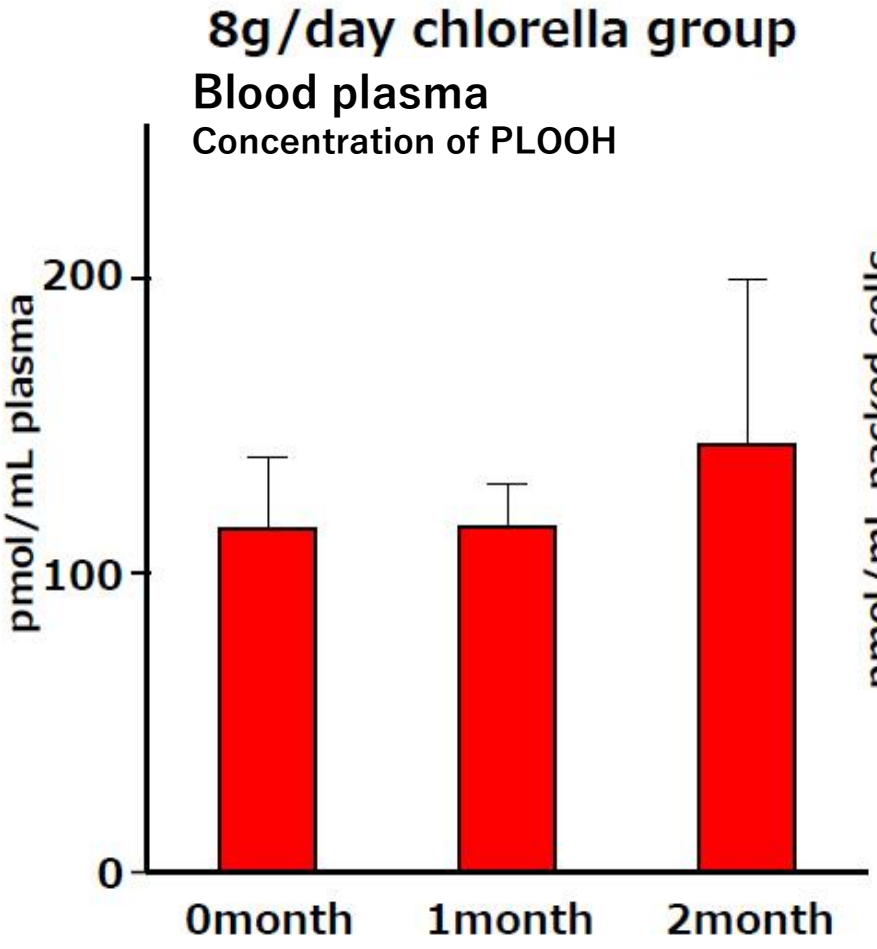
Fig. 2 | The effects of short-chain fatty acids on metabolic signalling pathways in skeletal muscle. SCFAs influence skeletal muscle glucose and lipid

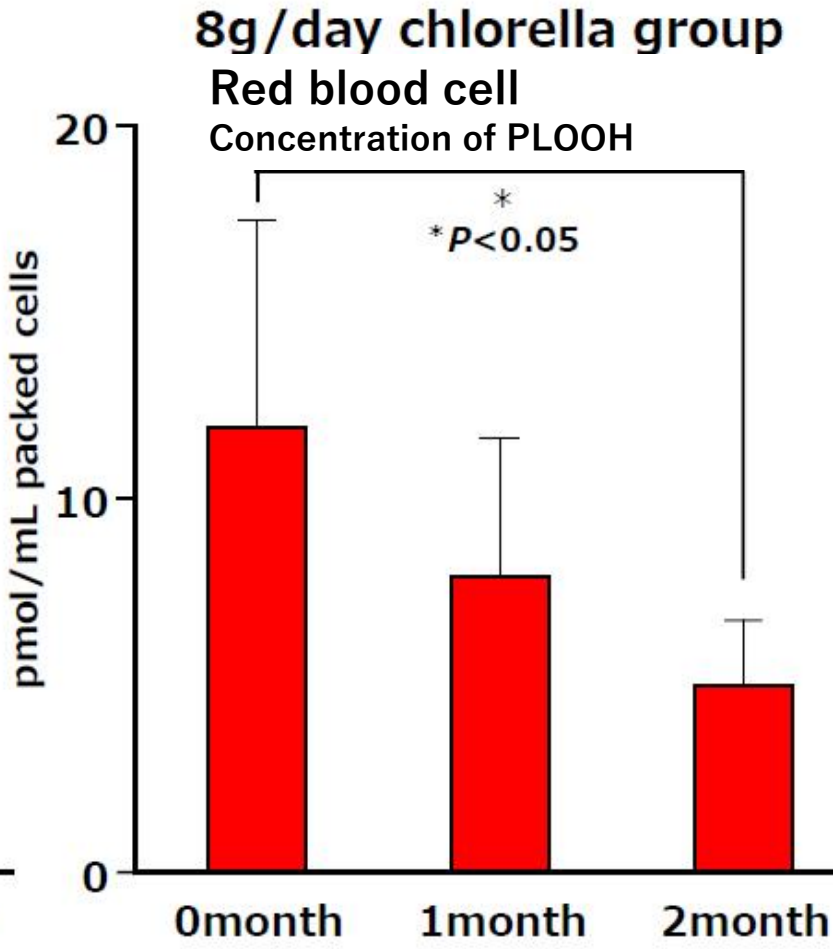
Clinical Result: Blood Plasma & Blood Cell Lutein Concentration



8 g/day ingestion chlorella enhances concentration of lutein in blood at significant level

Clinical Result: Blood Plasma & Blood PLOOH Concentration)

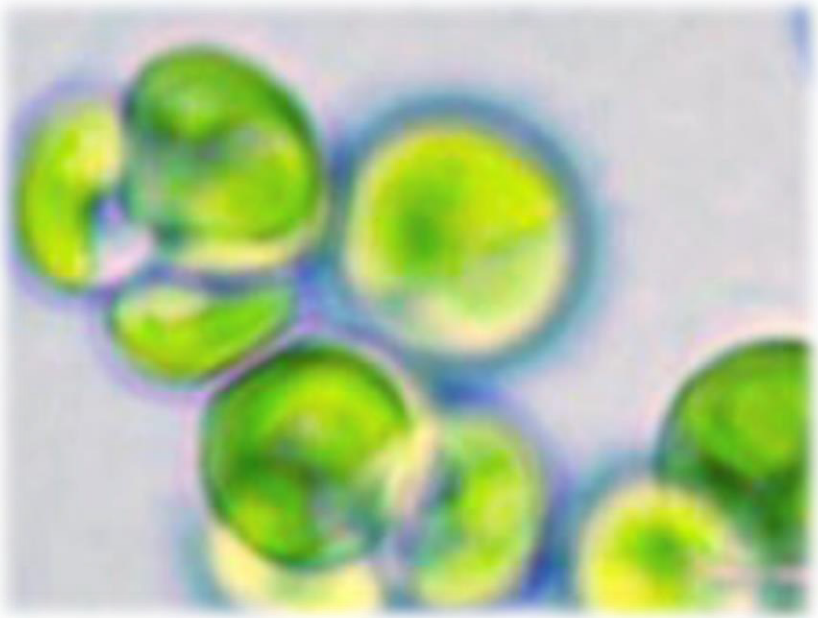




8 g/day ingestion chlorella enhances the antioxidant level of red blood cell

Conclusion

Lutein in chlorella is absorbed
erythrocyte membrane
oxygen



100%
Plant based whole foods

Clinical Evidences for Physiological Excersise Enhancement

Support Category	Theme	Evidence	Functional factors
Muscle endurance support	Chlorella as potential modsurator for metabolic signalling enhancement on skeltal muscle	Chlorella intake increases SCFA enetring systemic circulation interacting with skeltal muscle ATP creation.physiological evidence showing MCT1,MCT4,PGC1 α level increased.	MCT1、MCT4、PGC1 α / Relevant indicators for enhancement of anaerobic and aerobic system.
Vo2Max /Muscle endurance support	Vo2Max level up	HIIT and Chlorella combination maximizes the Vo2 MaX level	Resulting data shows overrall enhancement on cardiovasscular system affecting both aerobic and anaerobic
Vo2Max endurance supoort	The Antioxidant Effect of Chlorella on Erythrocyte Membrane Phospholipids	Inhibiting the accumulation of PLOOH in the erythrocyte membrane	Erythrocyte antioxidant with blood circulation ehnacement
Muscle endurance support	Insulin pathway activation	Gene expression analysis in subjects taking chlorella : Comparison between groups of subjects with high risks of lifestyle-related diseases and healthy subjects	The effects of chlorella on gene expressions changes examined on gene expressions in the peripheral blood before to identify activation insulin path way
Muscle endurance support(Gut muscle axis)	The Nutritional Efficacy of Chlorella Supplementation Designs on the Individual Gut Environment	The intake of chlorella increased the fecal concentration of "azelaic acid," which has been reported to improve blood glucose levels. In addition, among individuals with low fecal concentrations of propionic acid increase SCFA discriminatively.	Intestinal flora conditioning/SCFA/Probiotics
Recovery support	Immune support	Chlorella intake attenuates reduced salivary antioxidant capacity	SigA