

The Influences on human taking Lactic Acid Bacteria (OM-X)

— The Influences on the $\dot{V}O_2$ max of Athlete with taking Lactic Acid Bacteria (OM-X) —

Masayuki KAWAKAMI*, Iichiroh OHHIRA†, Naohiko ARAKI*,
Koji INOKIHARA*, Takashi MATSUBARA*, and Hideto IWASAKI‡

**College of Liberal Arts and Science*

Kurashiki University of Science and the Arts,

†*Research Institution of Okayama Life Science*

‡*Sanyo Gakuen University*

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I. INTRODUCTION

Athletic kinetic anemia seen in great number of athletes suggests many health problems on athletes (3, 22, 29). Athletic kinetic anemia is thought to be resulted from a variety of chemical and physical causes, and among those, many cases are iron deficiency anemia seemingly resulted from lack of iron (13, 22, 29). Most of athletes tend to force themselves in heavy training to enforce their sports ability. As a result, they suffer many biologically physical changes (10, 13, 15, 22, 29). In order to exercise heavy training, one has to develop one's body strong enough to endure heavy training. At the same time, heavy exercises lead to lack of protein in the body and affect protein syntheses and production of blood. Therefore athletes have to consider the nutrition, source of energy for sports, in their diet (8, 10, 13, 21, 22, 27, 30, 31). Training curriculums should be suited to individual physical features and designed to improve physical function effectively. In training for track and field in long distance runners, there are basically endurance training, interval & repetition training, build-up training and others. In any way of training, the aims of training by repeating are to enlarge $\dot{V}O_2$ (the volume of taking oxygen) and

improve the ability of enduring carbon dioxide at contraction of the muscles (4–16, 23, 25, 26, 33, 34). However, there is a possibility training depending on its combination will be a great burden to the body when overloaded to the athletes. Then, in order to execute trainings effectively, athletes make body conditioning which is not to overload ones' weight to their lower body, reducing %Fat (percent body fat) by changing ones' weight (8, 18–20). The "body conditioning" aims to make athlete's body suited to sports by improving and controlling one's dietary habit. This leads their diet unbalanced to low calory diet mainly with low protein (8, 10, 13, 15, 22, 24, 27, 29). Athletes' low calory diet would, not only decrease their energy when playing, but also effect tissue cell metabolism by delaying protein syntheses in the body which is a basic life metabolism and affect in many ways to body construction which is the base of life preservation (8, 10, 13, 22, 30). This affect makes great changes in function of blood corpuscles production which has an important role in life preservation (1, 22). These vicious circles can result in an increase of kinetic anemia (8, 22, 30). Moreover low calory diet irregulates nutritious absorption to the body because of unbalanced diet and, at the same time, affects on metabolic hindrance of, for example, storage of calcium in the bones (22, 30). This tendency is seen a lot in long distance or marathon runners in track and field, especially in increasing numbers for female long distance runners (8, 22, 30). Then, how do they manage their energy supply and nutrition to maintain their physical strength durable to trainings? The situation nowadays is to take supplementary medicine for nutrition that is lacking for energy or biometabolism (3, 8, 13, 22, 30). However, nutrition supply with supplementary medicine can be done temporarily but not develope fundamentally that leads direct to development of bio-function. Because mechanism of basic life metabolism that our human beings obtain is something held originally in structure of biometabolism. Therefore, even chemical medicines for lacked nutrition are supplied, it would not result in improving metabolic function fundamentally (22, 29–32).

Then, we focused on lactic acid bacteria which are believed to activate (28) tissue cells with great amount of amino acid and others. Lactic acid bacteria are one of the bacteria fundamentally existed in our body (30, 31), and they have a role to promote biometabolism more effectively. However, people of modern days are under the condition that the activity of many enterobacterial living in our body is inhibited or depressed in relation to food taken leading to the situation that enterobacterial cannot exhibit their role (30, 32). In such situation of society changes, many kinds of lactic acid bacterial products are sold under the catchphrase that the bacteria are taken alive helping activate tissue cells. However, many of them taken from the mouth would die (22, 32) about 80% to 90% before being absorbed to the body in the stomach by strong acid there.

We focused on the vegetable fermented food with its proteolytic power is 6.25 times stronger than those bacteria of same genus and species which our cooperate researcher, Ohhira discovered in Malaysia



Fig.1 Lactic Acid Bacteria (OM-X) of OHHIRA

in 1976(6). In 1979, Ohhira succeeded in encapsulating the vegetable fermented food in result of searching an appropriate way to have the above food absorbed alive to the body with many experiments. That is the lactic acid bacteria product "OM-X" shown at Fig.1. Encapsuled OM-X are absorbed to the small intestines within 12 to 15 minutes when one has an empty stomach. That is the reason why OM-X reach to the small intestines and get absorbed to the body without being killed by strong stomach acid apart from other lactic acid bacteria products. Also, OM-X is a totalized lactic acid bacteria product not only with a great amount of amino acid and lactic acid bacteria, but also with iron, phosphorus, mineral as potassium, and a variety of vitamins(7). These vegetable fermented bacteria are considered to be taken in the body, absorbed in the small intestines, activate with enterobacterial, and exhibit its benefit in tissue cell activity. Especially, in production of red corpuscles, those contained in OM-X, iron, potassium, mineral as phosphorus, a variety of vitamins and amino acid are believed to activate totally in the body and affect changes in blood production promoting its action. Also, sodium and potassium are substances that affect muscle contraction metabolism and affect muscle contraction at playing sports(1, 2, 8, 17). Ingestion of OM-X is thought to activate physical kinetic functions athletes fundamentally possess toward physical changes caused from today's diet and therefore improve their sports ability.

This time we experimented in aim of investigating on $\dot{V}O_2\text{max}$ (the maximum amount of oxygen ingestion) after the ingestion of OM-X for male university track and field athletes specializing in long distance running.

II. METHODS

1. Subjects

Subjects are 6 male long distance runners belonging to a track and field team at K University. Their

ages are 18.9 ± 0.8 . Their performance history of track and field is three to six years since they started competition. The reason is that this test is to set on a wide range of athletes differ in their competitive ability and experience.

The physical characteristics of subjects are as shown in Table 1. Their physical measurement is performed by BODYFAT ANALYZER TBF-202 made by TANITA Corporation.

Table 1 The Physical Characteristics of Subjects

	Age (y)	H (cm)	B.W. (kg)	%Fat (%)
M	18.8	168.7	55.73	6.12
S.D	0.7	3.37	3.82	0.66

n=6

2. Procedures

In our experiment we compared two occasions, before and after of OM-X ingestion as experimental data taken before and after its ingestion.

We had subjects take lactic acid bacteria product OM-X three capsules (1.5g) a day at one has an empty stomach before sleep at night. The reason why we had them take at their stomach empty is, in case we had them take at when something is being digested in the stomach, we worried a range of live bacteria in OM-X which are live to be killed (28) by strong acid of the stomach. Moreover the reason why we appointed their OM-X ingestion before sleep at night is that we thought that absorption rate (3, 17, 22, 32) before one's sleep at night is the highest in relation to metabolism cycle of hormone metabolism absorption.

Hb (hemoglobin in blood) was measured in blood collected through earlobes before the test with FUJI DRI-CHEM EDC5500 (product of FUJI MEDICAL SYSTEMS CO.,LTD.)

$\dot{V}O_2$ max and ECG (electrocardiogram) were measured with a metabolic nutrition monitor of Morgan Medical, Ltd. (formally P.K.Morgan, Ltd.), the United Kingdoms (Benchmark exercise test system) and a kinetic load system of GE Marquett Medical System, U.S.A. (CASE 15). The way to collect breath gas was with breath by breath. Kinetic load was executed by protocol developed from Buruce protocol by the writer, Kawakami. Kinetic strength was tested with gradual loading way that increases the strength in every three minutes. We stated the $\dot{V}O_2$ max of the subjects at the amount when we had them run all-out.

III. RESULTS

1. Before taking OM-X

Table 2 shows the body reaction on the occasion of Max (maximum kinetic load) before the ingestion of OM-X. HR (heart rate) at Max is about 2.91 times greater than that of 62.3 ± 9.1 beats/min. at rest. $\dot{V}O_2$ was about 5 times greater than that of 542 ± 179.4 ml/min. $\dot{V}CO_2$ (carbon dioxide

production) was about 8.09 times greater than that of $434 \pm 110.4 \text{ ml/min.}$ at rest. Ventilation amount was about 6.62 times greater than that of $15.03 \pm 3.67 \text{ L/min.}$ at rest. Q (cardiac output) was about 3.03 times greater than that of $6.7 \pm 1.48 \text{ L/min.}$ LA (lactic acid in blood) showed about 8.12 times greater than that of $1.13 \pm 0.26 \text{ mmol/L.}$ $\dot{V}O_2$ max before ingestion was $47.85 \pm 7.36 \text{ ml/kg.min.}$ $\dot{V}O_2$ max per weight varied greatly because of the difference of subject's sports ability. Table 3 shows the body reaction of the point crossed by $\dot{V}O_2$ and $\dot{V}CO_2$. Fig.2 shows the relation between $\dot{V}O_2$ and $\dot{V}CO_2$ at every stage during exercise. The crossing point by $\dot{V}O_2$ and CO_2 shows AT (anaerobic performance threshold) transferring from aerobic to anaerobic exercise area (3, 22, 29). Biometabolism at AT was as follows: HR, about 97.6% against Max; $\dot{V}E$, about 95.7%; $\dot{V}O_2$, about 74.7%; $\dot{V}CO_2$, about 61.4%; Q, about 82.0%; LA, about 43.1% and LA on AT was around 3 mmol/L.

Table 2 The influence during maximal exercise before taking OM-X

	M	S.D.
Heart rate (beats/min.)	181.3	11.25
Exe.Time (sec.)	637.3	77.17
Expir.flow (L/min.)	99.49	24.93
Oxygen uptake (ml/min.)	2685.67	597.52
CO ₂ production (ml/min.)	3511.5	921.16
Cardiac output (L/min.)	20.3	3.05
SaO ₂ (%)	95	1.91
Lactate (mmol/L)	9.17	4.06

n=6

Table 3 The influence on the AT before taking OM-X

	M	S.D.
Heart rate (beats/min.)	177	14.58
Exe.Time (sec.)	570	30
Expir.flow (L/min.)	63.66	11.45
Oxygen uptake (ml/min.)	2006.17	367.89
CO ₂ production (ml/min.)	2156.5	384.07
Cardiac output (L/min.)	16.65	2.12
SaO ₂ (%)	94.57	2.74
Lactate (mmol/L)	3.95	1.52

n=6

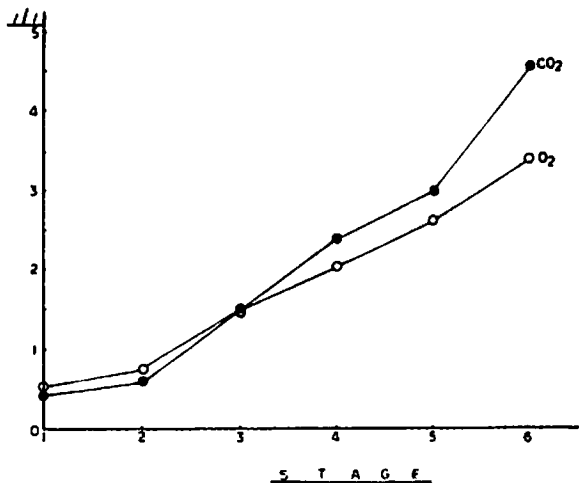


Fig.2 The relation between O₂ and CO₂ during maximal exercise before taking OM-X

Table 4 The influence during maximal exercise after taking OM-X

	M	S.D.
Heart rate (beats/min.)	183.33	5.93
Exe.Time (sec.)	677.33	81.95
Expir.flow (L/min.)	118.32	20.41
Oxygen uptake (ml/min.)	3511.17	600.39
CO ₂ production (ml/min.)	4105	975.21
Cardiac output (L/min.)	24.5	2.89
SaO ₂ (%)	95.25	0.97
Lactate (mmol/L)	9.84	3.14

n=6

Table 5 The influence on the AT after taking OM-X

	M	S.D.
Heart rate (beats/min.)	181.17	7.65
Exe.Time (sec.)	573	37
Expir.flow (L/min.)	81.71	11.33
Oxygen uptake (ml/min.)	2760.67	191.55
CO ₂ production (ml/min.)	2959	267.32
Cardiac output (L/min.)	20.81	1.01
SaO ₂ (%)	95.32	1.19
Lactate (mmol/L)	5.18	0.97

n=6

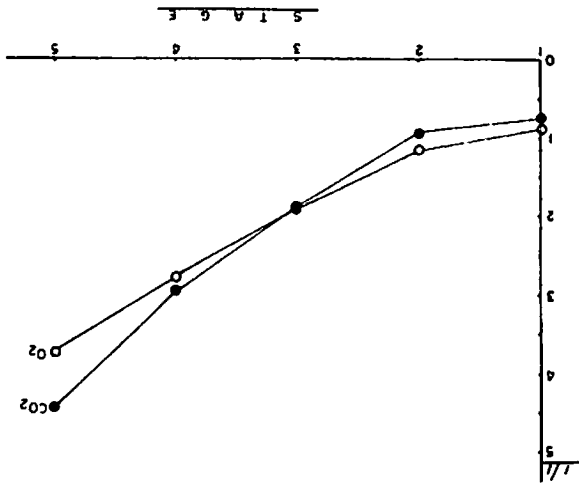


Fig.3 The relation between O₂ and CO₂ during maximal exercise after taking OM-X

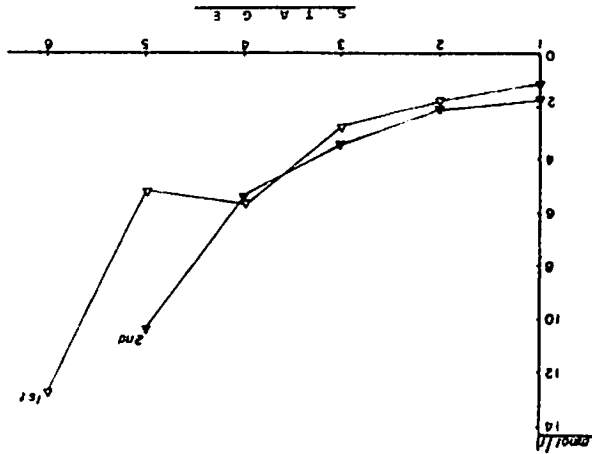


Fig.4 The relation to lactate during maximal exercise before and after taking OM-X

2. After taking OM-X

Table 4 shows the influence during maximal exercise 2 to 3 weeks after taking OM-X. HR at Max showed about 3.11 times greater than that of 59.0 ± 9.0 beats/min. at rest. $\dot{V}O_2$ was about 3.95 times greater than that of 889.83 ± 272.03 ml/min. at rest. $\dot{V}CO_2$ was about 5.35 stronger than that of 235.52 ml/min. at rest. $\dot{V}E$ was about 4.61 times greater than that of 25.64 ± 7.33 L/min. at rest. Q was about 2.6 times greater than that of 9.44 ± 1.93 L/min. at rest. LA showed about 5.56 times greater than that of 1.77 ± 0.38 mmol/L. Fig. 4 shows the relation to lactate during maximal exercise before and after taking OM-X. At this point, $\dot{V}O_{2max}$ was 62.07 ± 8.77 ml/kg.m. We found here also the difference in average deviation toward the average amount due to diversity of subjects' athletic ability. Table 5 shows the influence on the AT after taking OM-X. Fig. 3 indicates the relation between $\dot{V}O_2$ and $\dot{V}CO_2$ during maximal exercise after taking

OM-X. For AT, it is revealed that the data in after taking OM-X cross at higher point compared to the data in before taking OM-X. Biometabolism at this point was as follows : HR, about 98.8% against Max ; $\dot{V}E$, about 69.1% ; $\dot{V}O_2$, about 78.6% ; $\dot{V}CO_2$, about 72.1% ; Q, about 84.9% ; LA, about 52.6%. LA at AT showed around 4mmol/L. This concludes that after taking OM-X make muscle contraction maximal point higher than before taking OM-X.

IV. DISCUSSION

Lactic acid bacteria products, since they activate enterobacterial, recently attract public attention as health food that has good influences on various harmful influences caused from modern diet. It is said that lactic acid bacteria, especially, give influences on enterobacterial that promote resolution and absorption of nutrition in the intestinal tracts.

This test is to investigate on the influences of lactic acid bacteria OM-X on the $\dot{V}O_{2max}$ which is believed to be an index of exercise ability for athletes. In other words, we tried to reveal the effect ingredients of OM-X have toward respiratory circulation metabolism and muscles contraction metabolism. To explicate the influences of taking OM-X on the $\dot{V}O_{2max}$ means to confirm on the Hb change of red corpuscles that deliver oxygen and carbon dioxide, and also to study on lactic acid bacteria resolution in blood and carbon dioxide resistant being influenced during muscle contraction while exercise. This type of study was done mainly on an experiment expecting to improve body functions by administrating substances or medicine that affect the subjected organs artificially as in the following methods : enforcing muscles by administering sex hormone products as steroid hormone in sports science, increasing $\dot{V}O_2$ by changing blood ingredients artificially by doping in blood, or exhibiting higher exercise ability by administering medicine that affect on erethism (8, 22). This is called doping in aim of improving athletes' exercise condition. These dopings somehow give harmful influence on the body (22). Today's athletes are over loaded in the strength of training to the utmost of the body to improve more than ones' ability even they practice effective and individually suited training as scientific trainings are progressed (2, 8, 15, 26, 34). That leads athletes to think to train ones' body tolerable to hard training, maintain and improve body function. This also leads to improve body function in respiratory circulation metabolism and muscle contraction metabolism (2, 8, 15, 34). Moreover, to execute trainings smoothly, they need to make ones' bodies to be ready to do so and lighten a burden to the body by body conditioning. Body conditioning is subjected to create the body suited to each sport and control one's weight by limiting diet. Weight control here means to reduce body weight and make the body move smoothly by decreasing unwanted %Fat for athletes. This lightens a weight burden to the lower body which works for exercise and is a theory of training body of athletes to reduce accidents by consumption energy loss or weight (2, 8, 15). However, limiting athletes' diet also limits wanted nutrition for body maintenance and leads to serious inconveniences at bio maintenance because it decreases energy

metabolism as active body and basic strength (12, 22, 29, 32). Limiting diet for athletes invites kinetic anemia and affects muscle contraction metabolism at exercise and production of bones because it lacks nutrition needed for energy in muscle contraction metabolism at exercise, nutrition needed to maintain bio tissue cells, nutrition to synthesize protein in the body and producing blood, and nutrition in relation to calcium metabolism in production of bones. Under such circumstances, athletes who repeat hard trainings need to think about how to absorb taken food effectively to the body. Also they need to resolve nutrition taken to the body effectively and synthesize as nutrition source. Food taken from the mouth are delivered through the gullet, digested in the stomach and more than 90% of them are absorbed to the body through the small intestines (22, 29, 32). Nutrition absorbed in the body is delivered from the small intestines to the liver through a portal vein, synthesized as nutrition source, preserved, and supplied to each targeted organ of the body (22). Syntheses of nutrition source are chemically exercised with various amino acid, lactic acid bacteria, and enterobacterial living in the body (30, 32). Then we have to focus on the effective way of absorption of nutrition one intakes. It is to search for the way to activate enterobacterial in relation to absorption activity of nutrition in the small intestines and the way to help act enterobacterial. The latter means to supply the necessary nutrition to have bacterial activation, which is living in the intestinal tract as enterobacterial. Or athletes should not intake substances that inhibit and block the growth and activity of enterobacterial. We see the nutrition source (30, 32) that activate enterobacterial is to replenish various lactic acid bacteria including amino acid. Because dietary changes of modern people are transferred from vegetable food to animal food in material and taste. It leads to the situation that limits and suppresses the opportunity of vigorous action of enterobacterial with contamination of food addicts (30, 32). This dietary changes alter a basic cycle in biometabolism we the human beings basically obtain and change basic function of life metabolism creatures fundamentally obtain (30, 32). These changes in life metabolism are causes of manifestation of sickness of living habit issued these days or malignant tumor or malignant new creature, and other manifestation of modern sickness thought to be caused from many metabolism hindrances (20, 27, 29). Toward this, we think it is necessary to activate each bacteria living fundamentally in the intestinal tract or in the body and promote the activity of enterobacterial which absorb energy source food for body maintenance as nutrition effectively. At the same time, we must look for the way to increase beneficial bacteria living in the intestinal tract. In other words, we should supply nutrition source that bacteria as enterobacteria can become active and give opportunities for that action (30, 32).

Lactic acid bacteria product OM-X which we tested in this research is vegetable fermented food that contains 20 kinds of amino acids (of these, 8 kinds are essential amino acids), 9 kinds of vitamins, 5 kinds of minerals and 12 kinds of lactic acid bacteria in one capsule of 500 mg. Notably, the ratio of iron, potassium and sodium are very much ideal in relation to minerals for biometabolism, also, it is believed

to act beneficially for tissue cell activity and muscle contraction move(29–32). Because basic function of life metabolism in human beings is to activate oxygen taken from respiration organs and nutrition taken from digestive organs, having cells activate by maintaining tissue cells of the whole body (22, 29, 32). The basic body structure for tissue cell activity depends on the constituent parts of blood supplied from circulation organs to the body(22, 29). Blood supplies oxygen, nutrition and other substances necessary for every targeted organ or tissue cells of the body and maintain body structural cells and organs(22). Especially, ingredients necessary for blood syntheses are amino acid and vitamin which promote appropriate mineral as iron and protein syntheses(29, 32). On this experiment we determined that the amount of $\dot{V}E$, $\dot{V}V$ which is the cardiac output at a beat from the heart per minute before taking OM-X showed higher amount ($P<0.05$) than that of after taking OM-X, and Hb of red corpuscles, carrier of oxygen showed about 8.4% increase in before and after taking OM-X ($P<0.05$). These changes in the body are derived from changes in red corpuscles production and early syntheses of red corpuscles are being done. This is in the result that Hb is being increased in a very short period of time and early in consideration of existing logic(3, 8, 13, 32, 34) of red corpuscles production, and it is such an incredible phenomenon. Primarily life expectancy of red corpuscles is said to be between about 100 to 120 days, they are renewed simultaneously when about 50ml of them in blood are destroyed a day, keeping homeostasis of blood constituent parts(24, 29, 31, 32, 34). Production of red corpuscles differentiates to proerythroblast with influence of erythropoetin, a kind of hormone a stem cell of bone marrow exists in the renal, then matures to blood corpuscles as they grow(8, 22, 32). Main ingredients that relate to Hb syntheses of red blood cells are iron and protein(30). Iron absorbed in the body is sent to the liver connecting with protein namely transferrin and reserved as a substance called ferrin, or sent to bone marrow or other tissue and become an ingredient to synthesize heme protein like Hb or myoglobin(8, 30). Kinetic anemia affects on activity of blood cell production cell with lack of iron and delay of protein syntheses. We consider that we can solve it by promoting the activity of liver cells and liver function, which will raise body absorption rate of nutrition necessary for blood cell production and by promoting tissue cell metabolism by facilitating protein syntheses(28, 30). Especially, majority of iron absorbed in the body will not be excreted outside the body. They will be recycled to be charged in the reticuloendothelial system of the liver and spleen. We may say that the blood cell production will be synthesized in a rapid cycle when heme protein syntheses are promoted and reserved iron will be activated at the same time. Judging from the above, though this result differs from existing red corpuscles production and destruction metabolism theory(21, 22, 30), there is no wonder of early red corpuscle syntheses with Hb if hem protein syntheses are promoted variationally. That is, blood cell production structure or the place of blood production is different from the former cycle or place in blood production organ. Red corpuscles production of adults is majorly synthesized by red bone marrow. However, in case Hb volume is increased in a short period as in this experimental result, and in case the

circumstance allows to promote heme protein syntheses, it is likely that there is an early blood synthesis in organs like the liver and spleen, other than in the red bone marrow (28, 30). Because we have a result of blood cells production in the liver and spleen in the fetal period or in the infant and early childhood period (22, 29). Therefore, we note that production of blood is promoted in organs other than the bone marrow under the condition that there exists a circumstance in the body that acts beneficially to the red corpuscle syntheses for adults, too (22, 29–32). We may say that it is because a line of ingredients OM-X holds and enterobacterial living in the body act each other in promotion of syntheses of red blood corpuscles (30). The reason to it is that ingredients of OM-X, iron, mineral like phosphorus and potassium and many kinds of vitamins affect active promotion on bacteria, enterobacterial, and boost syntheses of heme protein which is the base of Hb production of red corpuscles. Then, each kind of amino acid and lactic acid bacteria activate bacteria in the body and blood cell syntheses are promoted (8, 22). We can judge its synthetic mechanism as follows: ingredients of OM-X and each kinds of bacteria living in the body act each other to promote absorption of nutrition by the intestinal tract, and they are sent to the liver by a portal vein, early production of red corpuscles are made because syntheses of blood cells are promoted. Increasing volume of Hb is the most influential matter to $\dot{V}O_2\text{max}$ and improve athletic ability as aerobic exercise (8, 15). Also, the increase of $\dot{V}O_2\text{max}$ improve oxygen supply ability and tolerance ability of carbon dioxide at muscle contraction because resolving function of lactic acid in the blood is being promoted (6, 13). Strengthening of tolerance ability of carbon dioxide at muscle means the continuing possibility of muscle contraction at higher athletic strength (8, 13–15). Substances that help muscle contraction are seen potassium and sodium which control oxygen supply and muscle contraction, and appropriate ratio of mineral as phosphorus (30). For potassium, 899mg/100g of them is included in the ingredients of OM-X which we used here. We believe that affects beneficially to helping muscle contraction (30). 178mg/100g of phosphorus and 58.6mg/100g of sodium are extremely contained in appropriate ratio, we may suggest that they affect beneficially to the syntheses of adenosine triphosphate, ATP, which allows muscle acts automatically (8, 22, 30). We find it as the result of improvement of athletic ability which aerobic exercise ability is widened in relation to an increase of AT, as high as up to about 600ml/min. after taking OM-X at exercise (8). This is also of the result that it affects to the tolerance of carbon dioxide which decide the maximum point of muscle contraction exercise. Moreover, we may say that as production volume of LA at AT shows higher amount in after taking OM-X than before and as $\dot{V}O_2\text{max}$ also shows great number, the tolerance of carbon dioxide is clearly accelerated at muscle contraction exercise (8). These changes of biofunction at exercise are derived from the changes of Hb volume in red corpuscles in the component of blood. It is considered that ingredients of OM-X relate in great deal the increase of $\dot{V}O_2\text{max}$ and the promoting act of resolving LA at exercise. The ingredients of OM-X are amino acid, lactic acid bacteria, mineral and vitamin. These work beneficially to blood production act in the body because they act totally with enterobacterial,

conform with each kinds of bacteria in the intestinal tract, and promote protein syntheses cells construct. As the result, Hb syntheses of red corpuscles are promoted, and blood cells are produced early. And ingredients of OM-X also contain vitamin B₁₂ (0.07μg/100g), folic acid (4μg/100g), and vitamin E. We think these also affect (28) early blood production at the same time.

All these things make it clear that intake of lactic acid bacteria OM-X increases $\dot{V}O_{2max}$, the index of athletic ability to athletes(8). We may say that ingredients of OM-X, lactic acid bacteria, amino acid and mineral affect red corpuscle production and lead to early blood production(28). Also, we can recognize that this mechanism has a big key to the bacteria activity in enterobacterial (30).

This experiment was resulted in administering 1.5g of OM-X to athletes of different weight. Our next themes we plan to solve step by step are the relation between the volume of OM-X intake and body type, difference in sexes, or the relation between intake period and diet, and the role and mechanism of lactic acid bacteria product OM-X intake to the body. We believe that this is to investigate changes of biometabolism occurred from modern diet and habit of living and to study the basic working of life metabolism.

V. SUMMARY

This experiment was tested in aim to study the influences on the $\dot{V}O_2$ of athlete taking lactic acid bacteria product OM-X. It was made clear that $\dot{V}O_{2max}$ has a dramatic increase after taking OM-X. We hereby report we see other changes in bio-function during exercises loaded.

The major results obtained are as follows :

- 1) The numerical volume of Hb increases about 8.4% (g/dl) after taking OM-X (p<0.05)
- 2) After taking OM-X, the AT point under $\dot{V}O_{2max}$ exercise test indicates about 600ml/min. higher point than before. (p<0.05)
- 3) The numerical volume of LA at Max does not indicate significant differences between before taking OM-X and after.
- 4) The numerical volume of $\dot{V}O_{2max}$ per weight increases about 29.7% after taking OM-X. (p<0.05)
- 5) These results lead to the identification that the intake of lactic acid bacteria product OM-X has significant influences on the $\dot{V}O_{2max}$ of long distance runners in track and field. We may say that a variety of ingredients in OM-X act totally to enterobacterial in the body and promote Hb syntheses of red corpuscles. We may also say that early increase of Hb promotes resolving ability of lactic acid in blood while exercising, improves tolerance of carbon dioxide, and enables to maintain muscle contraction exercise in stronger strength.

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