Examination of quality of life improvement effect of Laughter Yoga

--Demonstration of the mental and physical health benefit by the stress reduction--

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Abstract
In this study, we demonstrated it about usefulness of “the private training” in “Laughter Yoga” for the purpose of improving quality of life objectively. The object was woman of 40-70 generations, 31 people in total, and the average age was 66.9 years old. I divided a target person into two groups of A group (I carry out private training) and the B group (I do not carry out private training) and weighed it. As a result, it was recognized that the following effects were provided by performing “Laughter Yoga” program continuously. 1) Is health maintenance, an increase effect by the protective efficacy of a heart, the vascular disease by a sustained light exercise effect and the maintenance effect of the arterial elasticity, 2) relaxation effects and the mental and physical stabilization promotion, 3) temperature rises and a temperature maintenance effect, the reinforcement effect of 4) breathing functions and the respiratory illness prevention, an improvement effect, 5) stress relaxation effects (inspect it by salivary α-amylase activity level). Therefore, the training of "laughter yoga" is a very useful challenge from the viewpoint of not only those who suffer from mental and physical disorders such as anxiety neurosis, panic disorder and depression, those who have chronic diseases such as respiratory system diseases such as chronic bronchitis and bronchial asthma, hypertension, arrhythmia due to tachycardia, etc., and rehabilitation such as cerebral infarction, etc. and health promotion and maintenance, but also mental health, and it contributes to the improvement in the quality of life.

Key Words: Laughter Yoga, quality of life, stress reduction, mental and physical health, salivary α-amylase activity

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I. Introduction

"When you were born, the people around you would have been laughing and you would have been crying. So, live such a life that you laugh and others cry when you die." This is a teaching passed down to Native Americans. A baby's first job is "crying" (opening emotions). In addition, the baby begins to laugh after 2-3 months of life (social smile). It can be said that "crying and laughter" is the first step in communication formation and the basis of human life. In the rest of life, people are friends with their emotions, express each emotion as “crying and laughter,” and live their lives. "Joy and Happiness" leads to "laughter", and if "anger and sadness" included in emotions rises and expands, "crying" tries to relieve the emotions and open the heart. However, if emotional suppression continues through repeated patience, the emotion of "anger and sadness" expands while being covered and accumulates in the heart as stress with nowhere to go.

The "laughter yoga" introduced in the next section is a unique "laughter" health method that was devised by an Indian physician in 1995 and incorporated the yoga breathing method. It started with only five people in a park in Mumbai and quickly spread to the world[1)]. Currently, more than 10,000 groups in over 100 countries perform regular "laughter yoga" activities, and it is used in various fields such as educational institutions, companies, facilities for the disabled, and facilities for the elderly, centered around laughter clubs. If it becomes possible to relieve the burden of "anger and sorrow" that is amplifying stress by practicing this health method, resulting that the element of "laughter" originally possessed

by human beings is naturally extracted and the element of "joy and happiness" is amplified, it will lead to a better daily life. In recent years, personal computers and smartphones have become common and communication may have become so weak, and "laughter" is likely to be lost, we need to reconsider "laughter" itself and at the same time to seek an approach to improve the quality of life by improving our mental health.

II. Background and purpose of research

"Laughter" is an essential item for mental health in our daily life. It has been said that "laughter" is effective for improving mood and immunity[2)], but it is difficult to objectively verify the "laughter" effect. Also, researches on the health effects of "laughter" have been conducted in Japan and overseas, but there are many unclear points. Recently, studies have been conducted on the effects of "laughter" on cancer and depression, and it is expected that it will be introduced into the treatment of "laughter"[3-5)].

"Laughter yoga" is one of the health methods with scientific background devised by Indian physician Dr. Madan Cataria. In addition, "laughter yoga" can be called "laughing exercise" (whole body exercise) that combines laughing for no reason, without the need for jokes or humor, and yoga's breathing method. It is supposed to be possible to obtain the same effect as natural “laughter” by increasing “self-activating laughter motion” with training for a time period1).

This study objectively verifies the usefulness of conducting "self-training" (additive / synergistic effect with the "laughter yoga" class) at home and elsewhere for "laughter yoga", and the improvement of the quality of life by implementing this health method. In addition, we will investigate the effects of "laughter yoga" on the change of mood and quality of life by improving the depression scale and examine if "laughter yoga" is useful in terms of mental and physical functions.

III. Subjects and methods

1. Research subject and group of subjects In

Thirty one women in their 40s to 70s (39 at the beginning, but 8 dropped out on the way) who were registered as "Healthcare development citizen supporter" in the healthcare service support project by Foundation for Biomedical Research and Innovation at Kobe, applied for a research "Verification of quality of life improvement effect by "laughter yoga"", agreed and consented to the explanations such as the outline of the research were investigated. The average age of all subjects was 66.9 years old. After conducting a hope survey on the subjects and making adjustments, the subjects were divided into 2 groups; group A (15 people: average age 64.1 years) who did "self-training" for 15 minutes daily at home and elsewhere during the "laughter yoga" course and group B (16 people: average age 69.6 years old) who did “no self-training”, where 4 people in each group were omitted. (Table 1).

(Table1) Subjects and groups

Criteria		1) Health care development citizen supporters living or working in Kobe city 2) Women aged 40 to 80 who fall under the above categories 3)Ability to participate in the "laughing yoga" course for about 3 months (Six times in total) and all 3 tests		
		(Exclusion criteria: Difficult to communicate, "laughing yoga" uncooperative with implementation and testing, or difficult to direct/ understand)		
Groups and sample size	Group A (15)	Household "laughing yoga" implementation (+) group	Participation in "laughter yoga" courses and implementation of "laughter yoga" (self-training) at home every day for 3 months	A comparative study of the effects of "laughter yoga" based on the following evaluation indices before, during, and after the intervention between the two groups
	Group B (16)	Household "laughing yoga" implementation (-) group	Participation in the "laughter yoga" course only. Not implemented at home "laughter yoga"	

2. Research method

2.1. The research designs

Survey / research implementation period was from November 2018 to January 2019 (3 months), and "laughter yoga" courses were held 6 times (twice a month) for 90 minutes each during that period at Kobe Yamate University Small Gymnasium (Kobe City Chuo Ward) and Futaba Gakusha (Kobe City, Nagata Ward). An explanatory meeting was held at the beginning about the outline of the implementation plan of the six "Laughter yoga" courses, the contents of the inspection and survey of 3 times in total that will be enforced during the course, and the significance of the program, etc. Informed consents were made. Each time, based on the course program procedure, we proceeded with the "laughter yoga" course while providing relaxation, presenting and confirming the tasks, etc. As mentioned above, the subjects in group A were doing 15 minutes of "self-training" every day during the period, while the subjects in group B were not. The usefulness of "self-training" was examined by the comparison between the two groups (Table 2).

(Table 2) Study designs

"laughter yoga" effect of a 3-month intervention													
Schedule	"Laughter yoga" training course (Six times in total during the period) and schedule for various inspections and surveys (Three times each)												
Group A: "self-training" in the household "laughter yoga" implementation (+) group and **Group B**: "self-training" in the household "laughter yoga" implementation (-) group	1st time			2nd time		3rd time			4th time		5th time		6th time
	Immediately before implementation					immediately after implementation							immediately after implementation
	inspections/ surveys	Lecture (90 min.)		Lecture (90 min.)		Lecture (90 min.)	inspections/ surveys		Lecture (90 min.)		Lecture (90 min.)		Lecture (90 min.) / inspections/ surveys
Group A: "self-training" in the household "laughter yoga" implementation (+) group			**Self-training (+)**		**Self-training (+)**			**Self-training (+)**		**Self-training (+)**		**Self-training (+)**	
Group B: "self-training" in the household "laughter yoga" implementation (-) group			Self-training (-)		Self-training (-)			Self-training (-)		Self-training (-)		Self-training (-)	

*Group A: "self-training" in the household "laughter yoga" implementation (+) group was implemented for approximately 15 minutes each day at home during the course period.

2.2. Basic concept of "laughter yoga" class

In this "laughter yoga" classes, we focused on three characteristics of "laughter yoga", 1) laughing for a long time (more than 10 minutes of laughter is required to get the effect of it), 2) being able to laugh from the abdomen (a general exercise that incorporates abdominal breathing using the diaphragm). 3) being able to laugh at any time regardless of the environment.

In addition, the training program was structured around the following "basic points." That is, 1) a unique exercise that anyone can laugh for no reason without using humor, jokes, comedy, etc. 2) "make a smile" as an exercise at the beginning, but immediately change to a "real smile" by eye contact and playfulness like a child. 3) you can feel that you are full of energy and energy by taking in a large amount of fresh oxygen into your body ("laughter yoga" is called as so because it is "laughing" exercise, namely "gymnastic" and yoga breathing methods are combined), 4) the concept of "laughter yoga" is that both can obtain physical and mental effects under the condition that the body cannot distinguish "make-up smile" and "real laughter"[1]. For reference, the second implementation program is posted (Table 3) and the scene of the workshop is shown (Fig. 1).

(Table 3) "laughter yoga" Training Program Example (Second training session)	
●doing laughter yoga with deep breathing in mind ● Laughter for switching brain to become 3 years old ① Greeting laughter Namaste・Static electricity ② Self introduction (in 2 teams) Prefarable nickname・Favorite food ③ Spicy soup Sour pickled plum Daifuku mochi (with the image of drooling) *Feed each other ④ Laugh out loud ⑤ Tai Chi style breathing ⑥ Silent laughter	⑦ Laughter that can be made by oneself Various housework laughter Vacuum cleaner, window-cleaning, grinning, Laundry folding (unwillingly, happily) Bath cleaning (with or without laughter) ⑧ "It was me who gave birth to you" laughter (To children.) ⑨ "It was me who chose you" laughter (To the husband) ⑩ "It's troublesome to wear clothes" laughter ⑪ Selfless laughter ● Meditation of laughter ● Just laughing, Giggling ● Relaxation

2.3. “Laughter yoga” self-training

“Laughter yoga” course (for about 3 months), subjects in group A were doing 15 minutes of “self-training” every day, and the contents of the practice in and outside the home were recorded and submitted as reports (laughter alone self-check sheet) for three times. Regarding the content of "self-training," in consideration of the characteristics of "laughter yoga" described above, we decided to comply with the "basic points" and continue to implement it by our own ideas based on various cases. Details of the efforts will be described later (see Table 4).

図１　「笑いヨガ」講習会実施風景

(Table 4) Contents of "laughter yoga" Self-training in Group A (multiple answer)

Rank	Items of self-training () indicate the content, etc., and numbers indicate the number of responses.	Answers
1	Walking (20) on the way to work (5)	25
2	Doing household chores (Vacuum cleaners 13, Laundry dryer 7: Multiple responses) (Other activities include cooking, washing dishes, cleaning bathrooms and toilets, wiping windows, and opening and closing shutters.)	24
3	In various domestic settings (with care of grandchildren, with cats, talking to goldfish, Massage, toilet, relaxation time, dinner time, inspiration, specialized laughter, etc.)	21
4	During exercise (Radio and TV exercise 9, stretch 4, swimming 2, climbing 1, park 1)	17
5	Bathing	11
6	On the go (discreetly, in front of the shrine, in the park, in a group, in a theater) Karaoke recreation, watching children, etc.)	10
7	In operation (Car, while riding motorbike 7, passenger seat 2)	9
7	watching TV, watching videos, watching videos,	9
9	On rising (With deep breathing ...)	8
9	(Husband, child, grandchild) with your family	8
11	Looking in the mirror, (contain a funny face)	5
12	in the bathroom	4
12	Before going to sleep (With deep breathing ...)	4
12	(Thinking of happy things 3, with gratitude 1) with Thoughts	4
15	during poor physical condition	2

2.4. Evaluation index

For both groups (all subjects), measurements and tests / inspections and questionnaire surveys were conducted three times, before the "Laughter yoga" class starts (before the intervention: as control), at the end of the third class (during intervention), and at the end of the sixth class (after the intervention). The contents of measurements and tests are height and weight measurement (BMI calculation), various physiological tests, cardiovascular test: blood pressure (maximum / minimum / pulse pressure) and heartbeat (pulse rate), metabolic system test: body temperature, respiratory function tests: respiratory rate, oxygen saturation of arterial blood (SpO_2 value) and vital capacity, stress-related tests: salivary α-amylase activity value, 7 items in total. In addition, POMS and CES-D tests were performed, which are related to mental and quality of life (details will be reported in the next report) (Table 5). A briefing session at the beginning of the training session and various test scenes are presented in Figure. 2.

For blood pressure and heart rate measurements, two OMRON digital automatic blood pressure monitors HEM1000 (upper-arm spot arm type) and seven HEM6051 (wrist type) were used. Twelve TER-C231P thermometers manufactured by Terumo were used for measuring body temperature, two Doritec OX-101 pulse oximeters for measuring SpO_2 values, and two No.118-KC pocketable spirometer by HATA Sporting Goods Ind., Ltd. for measuring vital capacity. For the measurement of salivary origin α- amylase value, 2 units of enzyme analyzer, Salivary Amylase Monitor (model CM-2.1) by Nipro Corporation and saliva amylase monitor chips manufactured by the same company were used.

The test data, survey results, and findings obtained above were analyzed in detail, and significance tests were conducted for "quality of life improvement effect" including physiological changes and mental aspects for both groups at each stage, before intervention (before "laughter yoga" training), during intervention (after "laughter yoga" second training = After implementation 1) after intervention (at the end of "Laughter yoga" course implementation = After implementation 2), and the results were discussed with comparison.

(Table 5) Evaluation index

Evaluation index				
Action Item		Evaluation Item	Contents	
"Laughter yoga" Lesson (Twice a month × 3 = 6 times in total) ↓ Various inspections and surveys (Three times in total)	・1st time (Before: Negative control) ・2nd time (After 1: Interim evaluation) ・3rd time (After 2: Final Assessment)	General physiologic examination	A. Cardiovascular System	① Blood pressure (Systolic/Diastolic) ② Pulse pressure (elasticity and arteriosclerosis) ③ Heart rate (Exercise and stress related)
			B. Metabolic sysytem	Body temperature (Regulatory functions and inflammation)
			C. Respiratory Function	① Respiratory rate (respiratory abnormality) ② Arterial oxygen saturation (SpO2: Gas exchange) ③ Vital capacity (restrictive disorder)
			D. Stress related	Salivary α-amylase level
		Questionnaire	Mental/Quality of Life	① POMS ② Depression determination（CES-D）

図２　事前説明会および各種検査実施風景

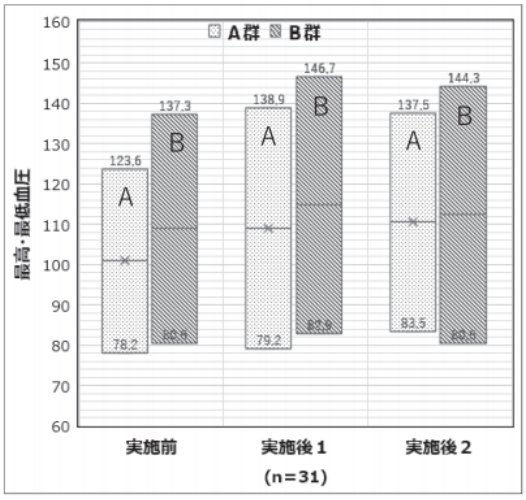
IV. Results of analysis and discussion

The results obtained from this study were examined by the comparison between both groups A and B for each of the following items, on the physiological change with the execution of "laughter yoga". Based on the results, the effectiveness in activity balance of mind and body, stress, mental and physical function by the introduction of "laughter yoga" in daily life were discussed.

1. Changes in cardiovascular vital signs and psychosomatic stabilization effects associated with "laughter yoga"

1.1. Changes in blood pressure(Fig. 3)

The systolic blood pressure (mean value) before the "laughter yoga" training was 123.6 mmHg in group A and 137.3 mmHg in group B, showing a difference of approximately 14 mmHg between the two groups. The difference in diastolic blood pressure (mean value) between the two groups was as small as 2.4 mmHg. The systolic blood pressure (mean value) was 138.9 mmHg (12.4% increase) at the 1st session and 137.5 mmHg (11.2% increase) at the 2nd session in group A, and 146.7 mmHg (6.9% increase) at the 1st session and 144.3 mmHg (5.1% increase) at the 2nd session in group B. In both groups, the systolic



blood pressure (mean value) was higher after the session than before. In addition, the systolic blood pressure (mean value) continued to rise in the 2nd measurement, suggesting that the systolic blood pressure level was maintained during the "laughter yoga" course. The rate of increase in systolic blood pressure (mean value) in group A was about 2 times more than that in group B (1st time: 1.8 times; 2nd time: 2.2 times), but there was no significant difference in the rate of increase in systolic blood pressure within both groups or between the groups by various tests.

1.2. Changes in pulse pressure (Fig 4)
The pulse pressure values (mean value) before the "laughter yoga" training were 45.4 mmHg in group A and 56.7 mmHg in group B. After the training, the pulse pressure values in group A were 59.7 mmHg (31.5% increase, see arrow (1) in Fig. 4) for the 1st session, 54.0 mmHg (18.9% increase) for the 2nd session, 63.8 mmHg (12.5% increase, see arrow (2) in Fig. 4) for the 1st session and 63.7 mmHg (12.3% increase) for the 2nd session. Both groups showed an increase in pulse pressure width after the training compared to before the training. In the meantime, the extension of the pulse pressure width seemed to be mainly brought about by the rise in the systolic blood pressure value, because the change of the diastolic blood pressure before and after the execution was slight in both groups. However, looking at the changes in pulse pressure width in the 1st and 2nd trials, group A showed a decrease of 59.7% in the 1st trial, 53.9% in the 2nd trial, and 9.1% in the 2nd trial, compared with group B, which maintained this (63.8% each). However, there were no significant differences in the changes in pulse pressure width between groups.

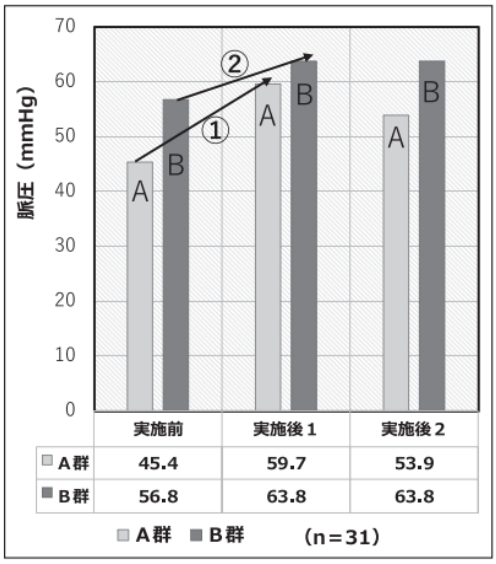


図４　「笑いヨガ」実施による脈圧の推移（平均値）

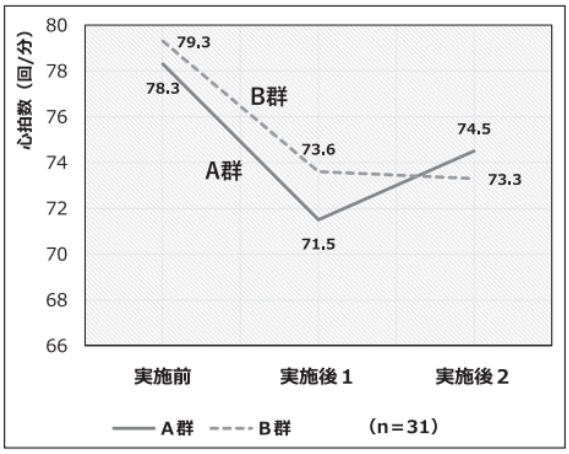


図５　「笑いヨガ」実施による心拍数の推移（平均値）

1.3. Change in heart rate (Fig. 5)
The heart rate (mean value) before the "laughter yoga" training was 78.3 beats in group A and 79.3 beats in group B, showing little difference between the two groups. Both groups showed a decrease in heart rate after implementation compared with before implementation: group A, 71.5 times for the 1st time (9.7% decrease), 74.5 times for the 2nd time (4.91% decrease), group B, 73.6 times for the 1st time (7.2% decrease), and 73.3 times for the 2nd time (7.6% decrease). In group B, the heart rate showed a further decreasing trend from the first exercise to the second exercise. In group A, the heart rate decreased in the first exercise but increased in the second exercise. There were no significant differences in heart rate between groups.

1.4. Changes in vital signs of the cardiovascular system during exercise and physiological effects

Exercise is done by muscle contraction and relaxation, and blood pressure increases during exercise. The increase in blood pressure is due to the need to supply more oxygen to muscles by exercise, and the accompanying increase in respiratory rate enables sufficient oxygen supply. At the same time, the heart must pump more blood to meet muscle oxygen demand. Thus, increased frequency of contraction and dilation of the myocardium increases heart rate (pulse rate) and cardiac output, or volume of blood flow, and thus BP over the arterial wall. And, though the pulse pressure is a difference between the highest blood pressure value and the lowest blood pressure value, the pulse pressure width is an index which estimates the elasticity of the blood vessel, and it becomes an aid which judges the degree of the arteriosclerosis in the clinic. The elasticity of the artery is ensured by expanding the pulse pressure width in response to the blood pressure rise by the exercise.

According to the demonstration study for the adolescence by the authors, it is proven that the elasticity of the artery is ensured by the expansion of pulse pressure width in proportion to the blood pressure rise by light mountain climbing exercise. That is to say, in the same study, it was clarified that the obvious expansion of the pulse pressure width with the lowering of the lowest blood pressure value was induced with the rise of the highest blood pressure value with the exercise load by light mountain climbing, and that the pulse pressure width also gradually decreased with the lowering of the highest blood pressure value with the exercise load reduction. In addition, from a series of these kinesiological phenomena, it has been speculated that smooth blood circulation is ensured while maintaining good hemodynamics by providing reserve power to oxygen supply by maintaining a slightly excessive state of vasoconstriction during exercise loads.[6)].

On the other hand, there have been only a few studies on "laughter yoga" [7)], and no empirical studies on systematic physiological effects in this study have been reported to our knowledge. "Laughter yoga" is a "gymnastics" combination of light exercise and yoga breathing techniques incorporated into a variety of programs as "laugh" exercises (See Table 3 and Table 4). As described above, in this study, both groups A and B showed an increase in pulse pressure width due to an increase in systolic blood pressure after the "laughter yoga" course. Therefore, it can be said that the exercise by "laughter yoga" has the same exercise effect as the light mountain climbing exercise mentioned above. In addition, the rate of increase in systolic blood pressure (mean value) after the "laughter yoga" course was approximately 2 times higher in group A than in group B. Therefore, it is considered possible that the "self-training" course, which was continued during the "laughter yoga" course, produced a "hypertensive effect" equivalent to a light exercise effect, which will be described later.

1.5. Exercise effect of “laughter yoga”

With regard to "hypertensive effect" associated with exercise, the existence and continuity of past exercise experience seem to be deeply related. In our previous study with 42 adolescent males and females, the changes in blood pressure and heart rate with graded exercise load, i.e., "before exercise" (control), "after light exercise", and "after moderate exercise" were examined in 7 "No exercise experience" and 10 "Exercise experience" subjects. In the "exercise experience" group, blood pressure and heart rate fluctuated only slightly with increased exercise load. On the other hand, the rate of increase in blood pressure was greater in the "no exercise experience" group than in the "exercise experience" group at the stage of light exercise load, and the rate of increase in blood pressure and heart rate was greater with moderate exercise loads.[8)].

Among the participants of this "laughter yoga" course, there were some who had experienced sports long before, but most of them had little experience of continuous exercise other than walking, and both groups were considered to correspond to the "no

exercise experience" group. In this course, the "laughter yoga" course, which included the elements of light exercise, was continued for a certain period of time and the effects of light exercise were accumulated, indicating that "hypertensive effect". It should be noted that the rate of increase in systolic blood pressure (mean value) in group A (with "self-training") after the course was conducted was about 2 times higher than that in group B (without "self-training"), suggesting that the implementation of "self-training" conducted continuously during the course period increased the effect and intensity of exercise through exercise habits, leading to a continuous "hypertensive effect".

1.6. Vital sign and psychosomatic stabilizing effect of "laughter yoga"

The continuous rise in blood pressure by this exercise effect seems to be a healthy "hypertensive effect", and it seems to be connected with the improvement on the hypotension which is mainly observed in women. On the other hand, for those with hypertension who deviated from age-related hypertension, a certain level of awareness should be promoted when conducting "laughter yoga" and "self-training" courses.

In any case, if exercise experience is accumulated in a natural way without awareness through the continuous implementation of self-training inside and outside the home, including findings in the aforementioned case[8)], participation in the "exercise experience" group will become possible by breaking away from the "no exercise experience" group. Therefore, by acquiring the daily exercise habit naturally, the lowering of the exercise intensity is led under the unawareness and unconsciousness, and it seems to cause the lowering tendency of the blood pressure gradually. In addition, if the improvement of the breathing method is added by the training of "laughter yoga", the fluctuation of blood pressure value, heart rate, respiratory rate, etc. decreases with the stabilization of mind and body, and it seems to lead to the stabilization of the vital sign.

Vital signs such as blood pressure, heart rate, and respiratory rate become unstable when exercise and stress are added, when exercise experience and daily exercise orientation are scarce in the past, and there is a fear that health and wellness risks increase [8)]. The continuous training practice of "laughter yoga" in the daily life brings about the maintenance of the light exercise effect, and it seems to contribute to the prevention of cardiovascular system disease. On the other hand, accumulation of such daily "exercise habit" by "laughter yoga" becomes a latent basis for training mind and body. And, it seems to induce the relaxation effect by digesting and reducing the rapid emotional movement by "emotions" and suppressing the expression of the emotion. Therefore, daily continuous "laughter yoga" exercise is considered to promote stabilization of the mind and body as well as stabilization of vital signs, and it can be said that it is indispensable for health maintenance and promotion from the viewpoint of disease prevention such as hypertension, tachycardia (arrhythmia), and cerebral thrombosis caused by atrial fibrillation.

2. Changes in metabolic system associated with "laughter yoga"

2.1. Fluctuations in body temperature (Fig. 6)

The mean body temperature before the "laughter yoga" training was 36.2 degrees C for group A and 36.3 degrees C for group B, showing no difference between the two groups. After implementation, group A showed a slight decrease to 36.1 degrees C for both the 1st and 2nd time (0.1 degrees C = 0.3% reduction), whereas group B showed a slight decrease to 35. 8 degrees C for the 1st time (0.5 degrees C = 1.4% decrease) and 36.0 degrees C for the

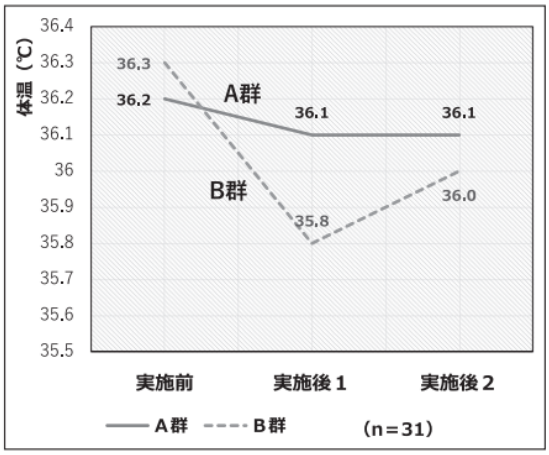


図６　「笑いヨガ」実施による体温の推移（平均値）

2nd time (0.3 degrees C = 0.8% decrease) in the 1st time and a rise of about half of the decrease in the 2nd time. There were no significant differences in body temperature between groups A and B. However, in group A, body temperature during the training period of "laughter yoga" was almost constant, whereas in group B, a clear decrease was observed in the 1st measurement after the training, and unstable changes such as a shift to an increase in the 2nd measurement after the training were shown.

2.2. The effect of increasing body temperature with "self-training"

Resting thermogenesis is mediated by blood circulation in major organs such as the liver and heart. Skin temperature decreases as temperature decreases. A further decrease causes shivering and autonomic thermoregulatory responses are triggered by autonomic nervous system action, leaning toward increasing muscle thermogenesis [9, 10].

In this study, the reasons for the decrease in body temperature in the 1st measurement after the "laughter yoga" lecture in group B without the "self-training" may be as follows: 1) the temperature when group B attended the lecture which was held about once every 2 weeks "laughter yoga" was low at about 13 degrees C, and the body temperature was linked, 2) the average age of group B subjects was close to 70 years old (group A is about 64 years old), and it is possible that the induction of the autonomic thermoregulatory response was not sufficient, and in addition, when the temperature was low, the thermogenesis in muscle and skin becomes active by the exercise, and the body temperature rises, and 3) the reactivity of the behavioral thermoregulatory mechanism in the brain thermoregulatory center was decreased or delayed.

On the other hand, in group A, body temperature was constant after two examinations. The reason may be that, in addition to the daily "self-training" effect during the "laughter yoga" course, the autonomic and behavioral thermoregulatory responses worked smoothly because the mean age was slightly lower. Based on these findings, it is possible that the continuous implementation of "self-training" during the "laughter yoga" course in group A resulted in a "thermo-protective effect" to maintain a stable body temperature.

3. Changes in respiratory function associated with "laughter yoga"(Figs 7-9)

3.1. Changes in respiratory rate(Fig. 7)

The mean respiratory rate before the "laughter yoga" training was 17.4 times in group A and 24.4 times in group B, indicating a considerable gap between the groups. In both groups, the respiratory rate showed a consistent and mild decreasing trend after the treatment compared with before the treatment: 17.2 times for the 1st treatment (1.2% decrease), 16.1 times for the 2nd treatment (7.5% decrease) in group A, 22.9 times for the 1st treatment (6.1% decrease), and 22.2 times for the 2nd treatment (9.0% decrease) in group B. There was no significant difference in these changes between groups A and B.

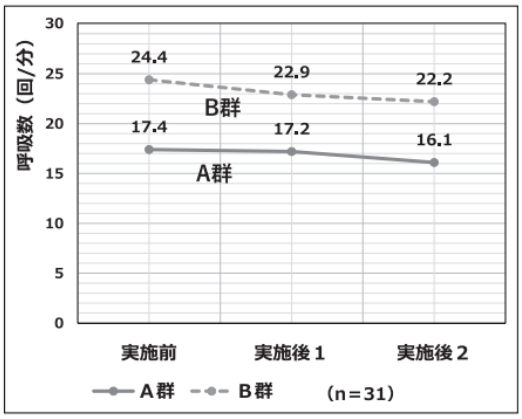


図７　「笑いヨガ」実施による呼吸数の推移（平均値）

It is very significant that respiratory rate decreased about 1 ~ 2 times per minute in both groups. As described in 4) and 5) of the preceding paragraph, the exercise in "laughter yoga" seems to bring about the light exercise effect. Thus, the need for more oxygen in response to exercise increases respiratory depth as well as respiratory rate. However, this finding did not indicate an increase in respiratory rate, but rather a decrease. In other words, it is expected that "laughter yoga" will lead to improvement in respiratory function even in patients with respiratory diseases, such as asthma, emphysema, and chronic

bronchitis, because it can be performed without increasing the respiratory frequency, namely respiratory discomfort or restrictive load.

3.2. Arterial oxygen saturation (SpO2 Changes invalue)(Fig. 8)

Arterial oxygen saturation (SpO2) is the percutaneously calculated percentage of Hb in RBCs in arterial blood that is delivered systemically by the heart. The sensor in the probe detects the blood flow of the pulsating artery and calculates and displays the SpO2 value from the absorption value of the light.

The mean values before the "laughter yoga" training were 97.2% in group A and 97.5% in group B, showing slight differences between the two groups. Both groups showed a consistent upward trend in SpO2 values after implementation compared with before implementation: 97.8% (0.6% increase) for group A, 98.2% (1.0% increase) for group B, 97.7% (0.2% increase) for group A, and 97.9% (0.4% increase) for group B. The rate of increase in SpO2 was 2.5 ~ 3 times higher in group A than in group B (1st time: 3 times; 2nd time: 2.5 times). There was no significant difference between the two groups.

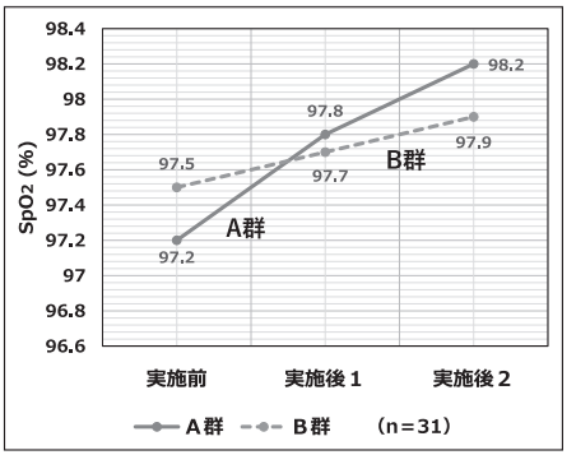


図８　「笑いヨガ」実施による SpO_2 値の推移（平均値）

The SpO2 value decreases in conjunction with the lowering of the oxygen uptake force to the body by lung and heart disease. It is said to fluctuate during exercise. In present opinion, it changed in the range of the standard value (96 ~ 99%) throughout before and after the execution, and the A group with the execution of "self-training" exceeded the B group 2.5 ~ 3 times. This may be one of the effects of "self-training" accumulated during the "laughter yoga" course, suggesting that the incorporation of "self-training" is more effective in improving cardiopulmonary function.

3.3. Changes in vital capacity (Figure 9 left figure individual values, also the right drawing shows the average value, respectively)

The mean lung capacity before the "laughter yoga" training was 2263.3 cc in group A and 2156.3 cc in group B, showing a slight difference of 107 cc between the two groups. After the administration, the post-administration vital capacity increased by 1 (Group B) to a little less than 20% (Group A) compared with the pre-administration level in both groups: 2691.0 cc (18.9% increase) for the 1st administration, 2392.3 cc (18.6% increase) for the 2nd administration, and 2354.2 cc (9.2% increase) for the 1st administration in group A, and 2684.6 cc (10.9% increase) for the 2nd administration in group B. The rate of increase in vital capacity after the intervention was approximately 2 times higher in group A than in group B (Figure 9 - Left). There was a significant difference ($p < 0.01$) in the Wilcoxon t-test in the comparison of vital capacity before and after the "laughter yoga" in both groups (Figure 9 - Right), but there was no significant difference in the rate of increase in vital capacity between the two groups.

3.4. Reinforcement of respiratory function with the implementation of

The program of "laughter yoga" says, "Taking in large amounts of fresh oxygen.". In the present demonstration study, it was found that the increase effect of the vital capacity could be obtained comparatively early in both A and B groups. In other words, the lung capacity of group A increased by less than 20% and that of group B increased by more than 10% at

the stage of 3 "laughter yoga" workshops, and it was found that the lung capacity of group B continued to increase. In addition, the effect of "self-training" was big, and it became clear that lung capacity "increasing effect" of about 2 times was obtained in comparison with the case of the non-execution by advancing this. In the comparison before and after the individual execution, the example in which vital capacity became over 2 times after the execution in the A group and also about 1.5 times in the B group was observed sporadically (Left side of Figure 9).
Increasing vital capacity is the most important finding for improving respiratory function. In particular, the combined use of "self-training" is very effective, and as mentioned above, it is considered to be highly reliable due to the backing up from the side by the decrease in respiratory rate and the improvement in SpO2 value. Therefore, it is expected that not only general users but also "improvement in the quality of life" based on the health promotion in old people and constitutional improvement by the reinforcement of respiratory function in various patients mainly on the respiratory system disease patient can be expected.

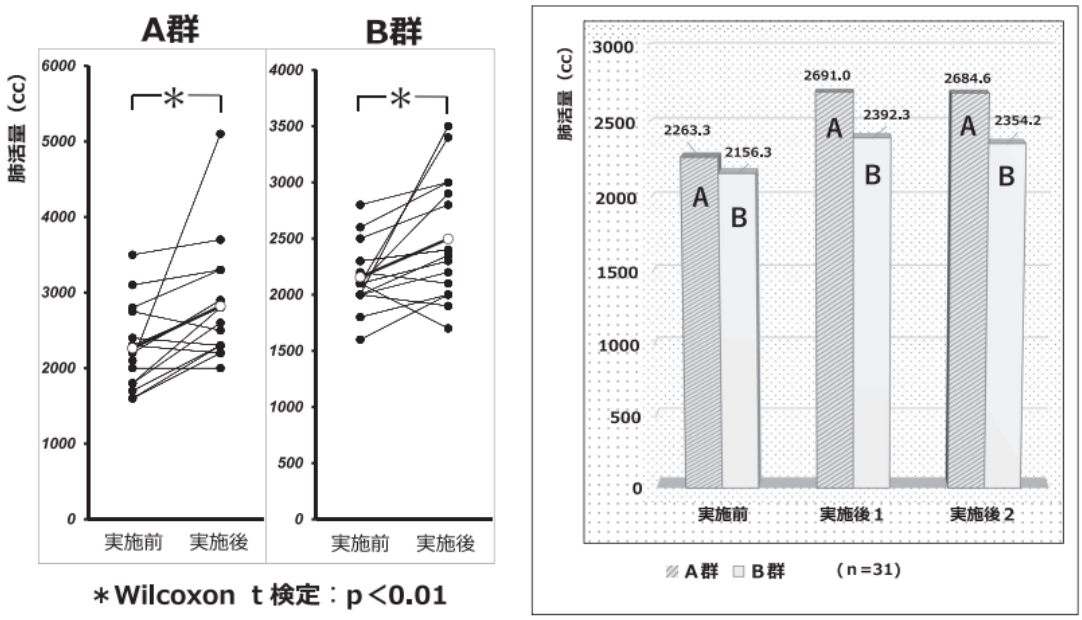


図９　「笑いヨガ」実施による肺活量の推移（左図：個別の値，右図：平均値）

4. Changes in salivary α-amylase activity associated with "laughter yoga"(Fig. 10)
4.1. Salivary amylase activity value as an index for stress evaluation,
The human unknowingly accumulates the stress in the daily life environment. In addition, in recent years, the number of vacant houses and households living alone has increased rapidly due to the declining birthrate and aging population, and human relationships have been weakened. Deterioration of the social environment and social anxiety cause mental anxiety, which is a stressor [11]. These stresses, which are applied daily, are feared to cause cancer and depression by damaging the genes of cells, causing the autonomic nervous system to work in an unstable condition, and lowering the immune system. [12]. Therefore, establishment of social environment for stress release and stabilization of mind and body and planning of measures for the improvement are required.
Salivary α-amylase, a marker of sympathetic nervous system stress, increases its activity as a body's self-protective response when stress excites excitatory signals in the sympathetic nervous system. Salivary α-amylase activity level is very useful as an index for evaluating the nerve activity of the sympathomimetic adrenal medulla system (SAM

system), and is used as an objective stress evaluation method [13, 14], and will be greatly utilized in the future.

4.2. Linkage between salivary amylase activity and changes in vital signs
As a part of the analysis on stress response processing, the authors conducted a comparative study of changes in salivary α-amylase activity, which is considered to be closely related to stress, in addition to changes in vital signs, in 20 young adults, and reported in the 1st and 2nd reports [6, 15]. From these study results, it was verified that the change of each vital sign such as maximum blood pressure value, pulse pressure value, heart rate and respiratory rate in the exercise load by light mountain climbing closely cooperated and cooperated. Salivary α-amylase, on the other hand, acts predominantly on the sympathetic nervous system, whereas salivary α-amylase acts predominantly on the parasympathetic nervous system.

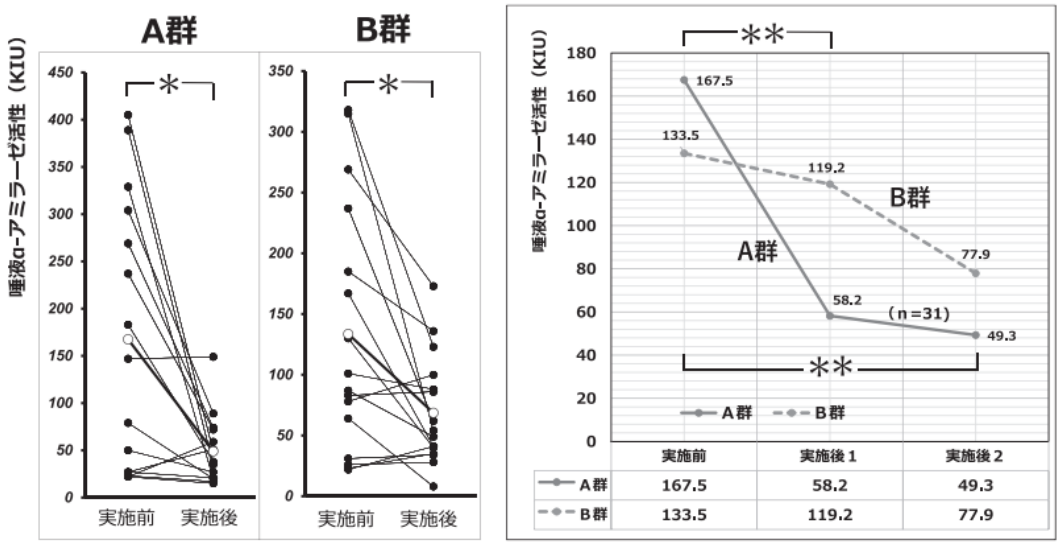


図10 「笑いヨガ」実施による唾液α－アミラーゼ活性の推移（左図：個別の値，右図：平均値）

4.3. Changes in salivary α-amylase activity as a stress-related test (Fig. 10. Left shows individual values and right shows average values)
The results of this study showed that the mean salivary α-amylase activity before the "laughter yoga" course was 167.5 KIU in group A and 133.5 KIU in group B, with a difference of 34 KIU (12.5%) between the two groups. In both groups, the salivary α-amylase activity after the first administration was significantly decreased by more than 70% in group A and by 40% more than 8.7% in group B, compared with that before the first administration: 14.3 58.2 77.9 KIU (109.3 KIU = 65.2% decrease) in group A, 49.3 KIU (118.2 KIU = 70.6% decrease) in group 2, and 119.2 KIU (55.6 KIU = 41.7% decrease) in group B. In addition, the reduction rate of salivary α-amylase activity after treatment was slightly less than 30% (28.9%) higher in group A than in group B. There was a significant difference ($p < 0.01$) in the Wilcoxon t-test in the individual comparison of salivary α-amylase activity values before and after "laughter yoga" both groups (Figure 10 - Left). There was also a significant difference ($p < 0.05$) in the reduction rate of salivary α-amylase activity between the two groups in the 2 * 2 Chi-Fischer test (Figure 10 - Right).

4.4. Salivary α- amylase activity as stress related tests and stress mitigation effects

Based on the findings of the previous section regarding stress load using salivary α-amylase activity as an index, it was found that stress load was significantly alleviated after the "laughter yoga" course (post-intervention) compared to before the "laughter yoga" course (pre-intervention), and that the approach of "laughter yoga" was effective for stress control. In addition, a significant decrease in salivary α-amylase activity after the "laughter yoga" course was demonstrated at the 1st interim examination, which was performed about 1 month after the start of the course. The results also showed that the stress relieving effect appeared very early. In the 2nd final examination, it was demonstrated that the continuous implementation of the "laughter yoga" led to a further decrease in salivary α-amylase activity and enhanced the stress-relieving effect thereafter.

In addition, as mentioned above, the enhancement effect of the same effect by the addition of self-training was slightly less than 30% (28.9%) (See Group A findings above). From the above opinion, it was proven that the execution of "laughter yoga" was more effective for the improvement in the mental aspect with the stabilization of mind and body to carry out it in the form which emphasized the autonomy and continuity based on the basic program.

5.The necessity of "laughter" in daily life

5.1 The root of "laughter"

Have you fallen into the daily "lack of laughter" affiction, or in short, "laughlack disease" (it is very similar to the name of a certain life insurance company, but it is a coined word that the author thought up on his own.), or "hypomelia"? As mentioned at the beginning, the development and popularization of SNS such as smart phones and "LINE" weakens communication between individuals, and "laughter" tends to be lost.

Schools are now in a very "it's not funny." situation. According to the "Survey on problematic behavior and truancy" published by the Ministry of Education, Culture, Sports, Science and Technology in October this year, the number of violent acts in elementary schools, junior high schools, and high schools in FY 2018 16 increased by 9,615 (About 15%) from the previous year to a record 72,940). Although the number of violent acts increased only slightly in junior and senior high school students, it increased sharply in elementary school students, especially in the lower grades, indicating the agony of schools. According to the Yomiuri Shimbun survey, the principal of a public elementary school in Yamagata Prefecture said, "The number of children who complained about their feelings by hitting others without words increased." This indicates that it is caused by not being able to express feelings in words and moving to action. Troubles mainly occur in the break time, and the origin is said to be that in the past, many troubles such as "I was scolded." and "lost at dodge ball" were merely quarreled. The principal cites "Children's poor vocabulary is due to fewer conversations at home because parents and children don't give up their smartphones." as one of the causes, and at present, no effective measures can be taken. 17). Thus, the root of the disease in the human formation is deep, when it is considered that the environmental factor which alienates "laughter" is induced from the stage of elementary school children, or even more earlier.

It may be a little sudden, but at present, the declining birthrate and super-aging society are progressing, and behind this background, about 1 out of 7 has become vacant, and about 1 out of 4 has become a solitary life zone (single life), which has become a social problem. Many are considered to be forced to lead lonely lives, and in some cases, they are almost like "laughruck" (= This ruck is "torture"). Therefore, it is necessary to construct the daily life in which "laughter" is born.

5.2. "Laughter" enhances immunity and suppresses stress

At present, the smile of Hinako SHIBUNO is a hot topic in women's golf. Research in the field of mental health in sports has also shown that "laughter" has the effect of making the inner side positive and relaxing [18].It has also become necessary to reexamine "laughter" itself and improve the quality of life by strengthening mental health. Therefore, "laughter" is

an indispensable item in our daily life from the viewpoint of mental health, and it is also the main axis of "emotions", and if possible, we want to be close friends in a long life.
As previously mentioned, "laughter" has a relaxing effect that improves mood. This leads to balance of the autonomic nervous system, stress reduction, and immune enhancement. Miyake et al. (2) searched for 40 articles on the effectiveness of laughter in the nursing care area, and divided "laughter" into "physical effect" and "psychologic effect" The former was analyzed in 28 articles in Japan and overseas, and the latter in 12 articles (Duplicate). As the result, the report on the immune system is the largest on "physical effect", and the following are mentioned: Activation of NK cell through various "laughter" experiences such as manzai, rakugo, comedy and humorous video [19, 20], increase of secretory IgA concentration in the saliva and secretion rate [21], immunopotentiation effect with the allergy reaction control [22]. In addition, as for "psychologic effect" in "laughter" stress coping [23, 24], anxiety and relaxation of tension 19), etc. are mentioned.
At present, the effectiveness of "laughter" in the therapeutic aspect such as cancer and depression is being examined [3 -5], and the disease treatment effect is expected. If "laughter" helps to improve the condition, "laughter" would "bring happiness" and would be "laugh-luck" and would be "good luck".

6. Improve the quality of life with “laughter yoga”
6.1. Utility of "laughter yoga" in everyday life
Most of the reports mentioned in the preceding paragraph are based on the "laughter" experience, but "laughter yoga" does not require jokes or humor, and is considered to be a combination of the behavior of laughing without reason and the breathing method of yoga, in other words, "laughter exercise" (general exercise) [1], which is greatly different from these reports. The origin of "laughter yoga" comes from 'It is a program combining "laugh" exercise (gymnastics) and yoga breathing method that enables you to feel full of energy and energy by taking in a large amount of fresh oxygen into the body.'. In other words, by accumulating training for a certain period of time and increasing the level of "the action of laughing oneself" it is possible to obtain the same effect as a natural "laughter" [1]. Fukushima et al. found that aerobic exercise with conscious laughter reduced the STAI state anxiety score, tension anxiety, depression, and fatigue scores, and reduced stress, and reported that fake laughter had the same effect as natural laughter (n = 6) [7].
In addition, "laughter exercise" which forms the basis of "laughter yoga" increases the oxygen supply in the blood and promotes blood circulation by inhaling a large amount of oxygen (air) to the utmost through abdominal respiration. By this, the activation of the brain function with the increase in the cerebral blood flow seems to be induced. Iwase et al. [25] found increased cerebral blood flow in the frontoorbital and prefrontal areas of the cerebrum in healthy adults (n = 22) who underwent "laughter experience" by comedy imaging. In the "laughter exercise", in addition to the continuous implementation of such deep breathing, by shouting "Yeah! Yeah! Keep it up!" etc. each time, it is considered that brain cells are given energy from both physical and mental aspects, and that feelings are induced and changed to a positive direction. Since the continuous implementation of "self-training" suitable for oneself inside and outside the home may promote the hyperactivity of high-level brain function, it is expected that the continuous implementation of this health method will lead to "improvement in quality of life" suitable for each individual.

6.2. Demonstration of quality of life improvement effect by continuous implementation of "laughter yoga" (conclusion)
It was proven that the following effects were obtained by continuously carrying out the "laughter yoga" program mainly as described in sections 3 and 4.
<u>1) Prophylactic effects of continuous mild exercise and maintenance of arterial elasticity on cardiovascular diseases</u>
The retention effect of the elasticity of the artery by slight rise of the highest blood pressure value and slight or moderate rise of the pulse pressure value with this was shown.

Especially, the daily light exercise effect is maintained by the practice of "self-training", and since the exercise intensity is also strengthened, it contributes to the prevention of cardiovascular system disease.

2) Relaxation effect and health maintenance and promotion effect by promoting stabilization of mind and body

The accumulation of daily "exercise habit" by the "laughter yoga" training shown in the preceding paragraph becomes a potential basis for training mind and body. And, the relaxation effect is induced by suppressing the expression of the emotion, while the movement of the emotion by the rapid "emotions" is reduced. It is considered that the stabilization of mind and body is promoted with the stabilization of vital sign by the above, and it is indispensable for health maintenance and promotion from the viewpoint of disease prevention such as hypertension, tachycardia (arrhythmia), cerebral thrombosis caused by auricular fibrillation, etc..

3) Body temperature increase and retention effect of self-training

The practice of "self-training" may result in "thermoprotective effect" to raise body temperature and maintain a constant body temperature stably.

4) Enhancement of respiratory function and prevention and improvement of respiratory diseases

The enhancement of vital capacity became remarkable by this training, and especially, the enhancement and improvement of respiratory function are expected, because the improvement on respiratory rate decrease and SpO2 value was recognized by the continuous training, and it is positioned in present most important opinion. Not only general users but also "improvement in the quality of life" based on the health promotion in old people and constitutional improvement by the reinforcement of respiratory function in various diseased persons mainly on the respiratory system disease patient are expected.

5) Stress mitigation effects (validated by salivary α-amylase activity)

Our previous studies have demonstrated that salivary α-amylase activity closely correlates with changes in vital signs such as peak blood pressure, pulse pressure, heart rate and respiratory rate during exercise. Salivary α-amylase, on the other hand, acts predominantly on the sympathetic nervous system, whereas salivary α-amylase acts predominantly on the parasympathetic nervous system. Therefore, the rise and fall of salivary α-amylase is very useful as an indicator of efforts to stabilize the mind and body by improving stress in "laughter yoga" training.

The significant decrease in salivary α-amylase activity during the "laughter yoga" course suggests that the training has a stress-relieving effect very early after the start of the training. The training practice led to a further decrease in salivary α-amylase activity levels, demonstrating that this effect was further enhanced.

6) Improving quality of life through mental stabilization through stress relief

It was proven that the execution of "laughter yoga" was more effective for the improvement in the mental aspect with the stabilization of mind and body to carry out it in the form which emphasized the autonomy and continuity based on the basic program.

The challenge of "laughter yoga" is equivalent to the light exercise, and it induces the feeling positively by "cloud spray" the negative content encapsulated in "emotions", while it adjusts the respiration and activates the brain function. By this, the stress coping is advanced, and the stabilization of mind and body is stimulated with the stabilization of the vital sign mentally and mentally. Therefore, the training of "laughter yoga" is very useful for those who suffer from mental and physical disorders such as anxiety neurosis, panic disorder, autonomic imbalance, and depression, those who have chronic diseases such as respiratory diseases such as chronic bronchitis and bronchial asthma, and arrhythmia due to hypertension and tachycardia, as well as rehabilitation such as cerebral infarction, health promotion and maintenance, and also from the viewpoint of mental health, and it greatly contributes to the improvement in the quality of life.

V. Afterword

At the beginning, the "laughter yoga" effect seemed to be a rather abstract concept, and the demonstration, that is, the objective verification, seemed to be considerably high hurdle. As a result, the planning and execution of the research plan remained difficult. The main factors are as follows. Number 1: Do most of the participants attend all 6 workshops and "self-training" and complete the entire 3-month program? Also, the 2nd question is whether there is a (significant) difference between the "self-training" implementation group and the non-implementation group, which is a hypothesis for the usefulness of the "laughter yoga"? The third point is whether it is possible to smoothly carry out a large number of examinations and measurements for a large number of subjects within a set time. In addition, the 4th point was the problem of "selection" considering the significance of inspection and measurement items for evaluating "quality of life".
Especially, on the 4th point, it was the most important problem, because it becomes "objective criteria" which tries whether "laughter yoga" is useful or not. A hint was obtained in "Demonstrative research on the healing effects of forests" 26) reported in 2010. The "healing" effect is a more abstract and ambiguous expression than the "laughter yoga" effect in this study, but in this study, immunological tests and stress-related tests were performed, and mental changes were added to these, enabling objective verification. From this background, in the selection of inspection and measurement items in the effect judgment of "laughter yoga", the extraction of the item which seemed to be useful from these inspection items became an opportunity to obtain the fixed result.
As mentioned in the text, the SDF was fortunate to have many collaborators, and thanks to the sincere efforts and logistical support of the people around them, it seems that they managed to overcome any hesitation "factor". On the other hand, due to various circumstances, the target population was limited to women in the senior population, and we could not examine the differences by age group and gender that we had originally planned, and we did not perform immune-related tests through blood sampling, and we needed to expand the population further. We would like to discuss the results of the study and considerations regarding the changes in mental aspects (POMS and CES-D testing) associated with the implementation of the "laughter yoga" for the convenience of the magazine.

[Acknowledgment]
Many people who supported this study from the "Health Care Development Citizens' Supporters" introduced at the beginning participated in the "laughter yoga" course. I would like to take this opportunity to express my sincere gratitude to all of you for your continued participation in the program, which will be held 6 times in total in addition to the briefing session, as the implementation period will be from late autumn to winter (busy season) and the temperature will drop. In particular, I hear that many of the people in Group A continue to attend "laughter yoga" classes, being encouraged by their daily "self-training" during the period. I would like to add that I have come to realize the "Continuity is power.".
In addition, I would like to express my sincere gratitude to the seven students who assisted in the various physiological and mental examinations and measurements, etc. three times in total, including Miu Tanaka from the Joint Laboratory of Nagoya University, Riori Ii, Honoka Imai, Teru Ozawa, Kohei Takaoka, Hiroka Nishi, Naoki Hamaguchi, and Manami Fukuie.

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