

# **Physiological and Psychological Benefits of Bathing style in Japan**

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# Yasuaki Goto

- Occupation: “**FRO**”fessor, professional “**FURO**” scientist

“FURO” = Bath in Japanese

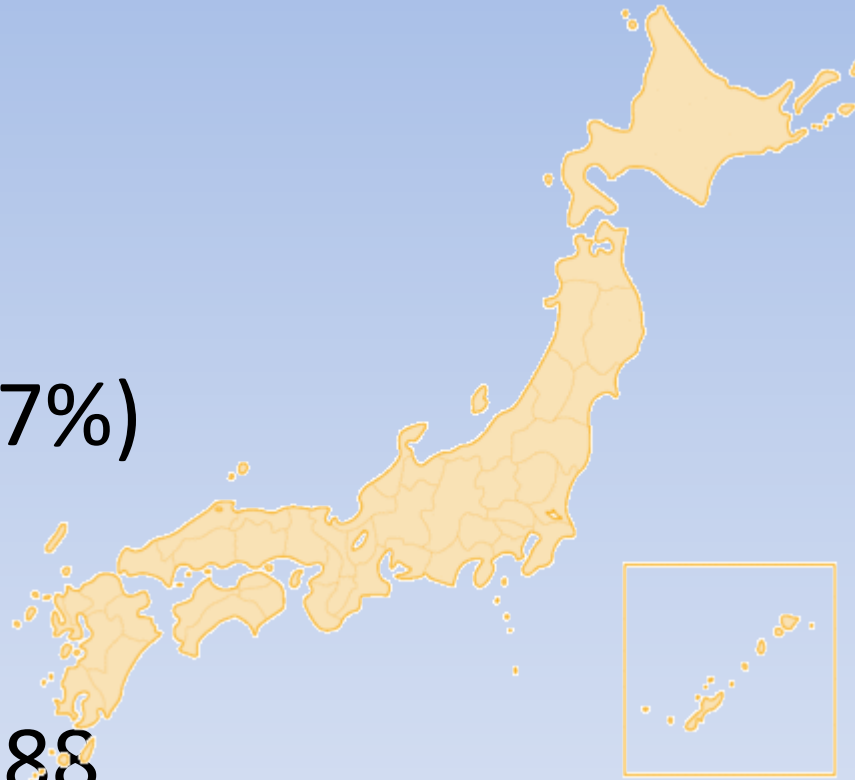
- Major: Psychophysiology, Aging science etc.
- Favorite: ONSEN, bathing and eating
- Research:

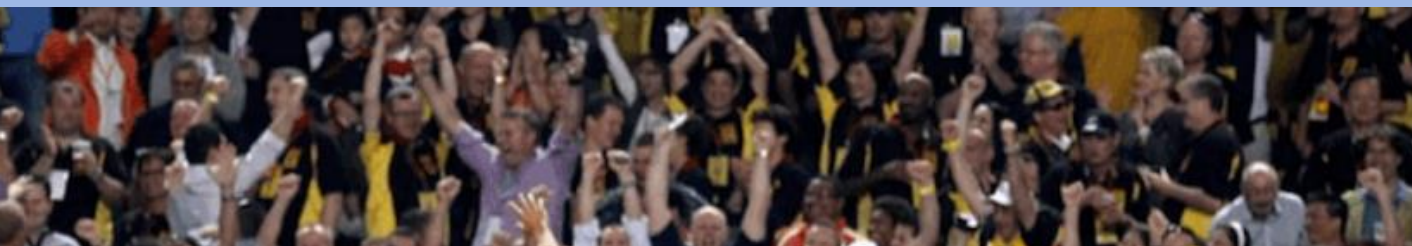
- Physical and Mental Effects of Bathing : A Randomized Intervention Study (Evidence-Based Complementary and Alternative Medicine, 2018)
- Bathing in Hot Water, Bathing in Japanese Style Hot Spring and Drinking Green Tea May Contribute to the Good Health Status of Japanese (J Jpn Soc Balneol Climatol Phys Med 2012)



# Japanese habit of bathing

- Japan: 378,000km<sup>2</sup>
- Active volcanoes: 108 (7%)
- Hot springs: 27,367
- Hot spring regions: 3,088







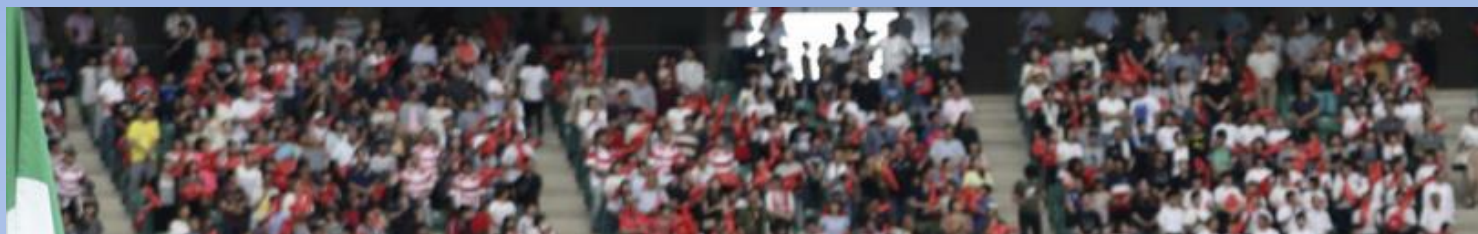












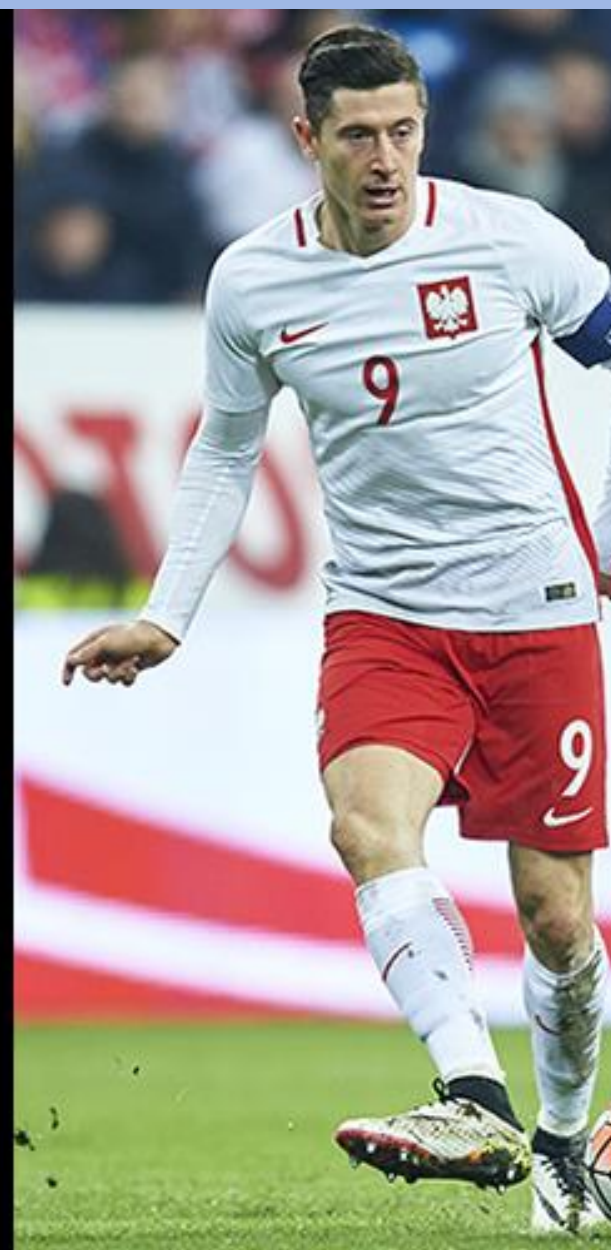












# Goto's highlighted point ①

**“Byaaaa”**  
**“Shashaaaaa”**



## Goto's highlighted point ②

目的から  
入浴を逆引き

Please decide how to bathe  
**depends on the purpose**

You decide the purpose of bathing  
first, and chose the way of  
bathing

# Bath in houses and apartments in Japan

## Diffusion of baths at home

- 96%

## Frequencies of bathing in bathtub

- Summer: 5 days per a week
- Winter: 6 days per a week



# Bathroom in house



# Bathing effects

- **Thermal effect**
- Hydrostatic pressure effect
- Floating effect
- Viscosity and Resistance of water
- Cleaning effect

# Thermal effect of hot spring

- Hot water (42°C and over)  
incentive and causes stimulant effect
- Warm water (36°C to 40 °C)  
Less incentive and causes  
effect for relaxation





# Natural massage and hydrostatic effects

- Utter a sigh of HUU . . . . .
- Waist circumference shrink 3-5cm in the bath
- Edema is decreased by putting in the bathtub
- Half body bathing is recommended depends on the diseased condition



# Floating effect

- Body weight is 1/10 when put in water at the height of a neck
- Stress relieving effect



# Shower

**Thermal Effect**

Cleaning effect



# Effect of Sauna

**Thermal effect**

Cleaning effect

# Bathing and ONSEN in Europe

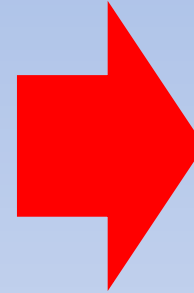
**Thermal Effect**

Hydrostatic pressure effect

Floating effect

**Viscosity and  
Resistance of water**

Cleaning effect



**Drink**

**+ Hydrodynamic  
effect**

**Jet, Bubble,  
etc.**



# Bathing and ONSEN in Japan

## Thermal Effect

Hydrostatic pressure effect

Floating effect

Viscosity and  
Resistance of water

Cleaning effect

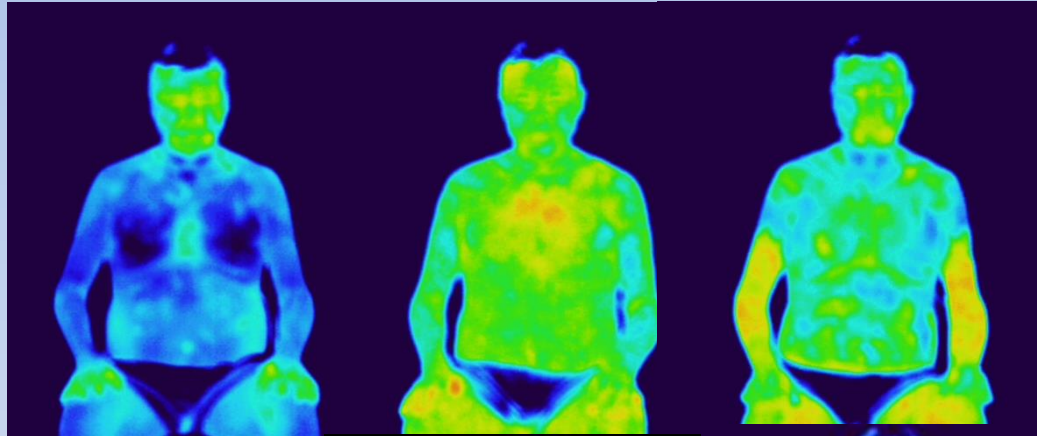
# Change of the body surface temperature

Pre-bathing

Right after bathing

10 min after getting out  
from the bath

Heated  
water



Hot  
spring  
named  
Gozen-yu



# Goto's highlighted point ①

**“Byaaaa”**  
**“Shashaaaaa”**



# Bathing may contribute to Japanese longevity

■ Japanese foods, Medical system, **Bathing**

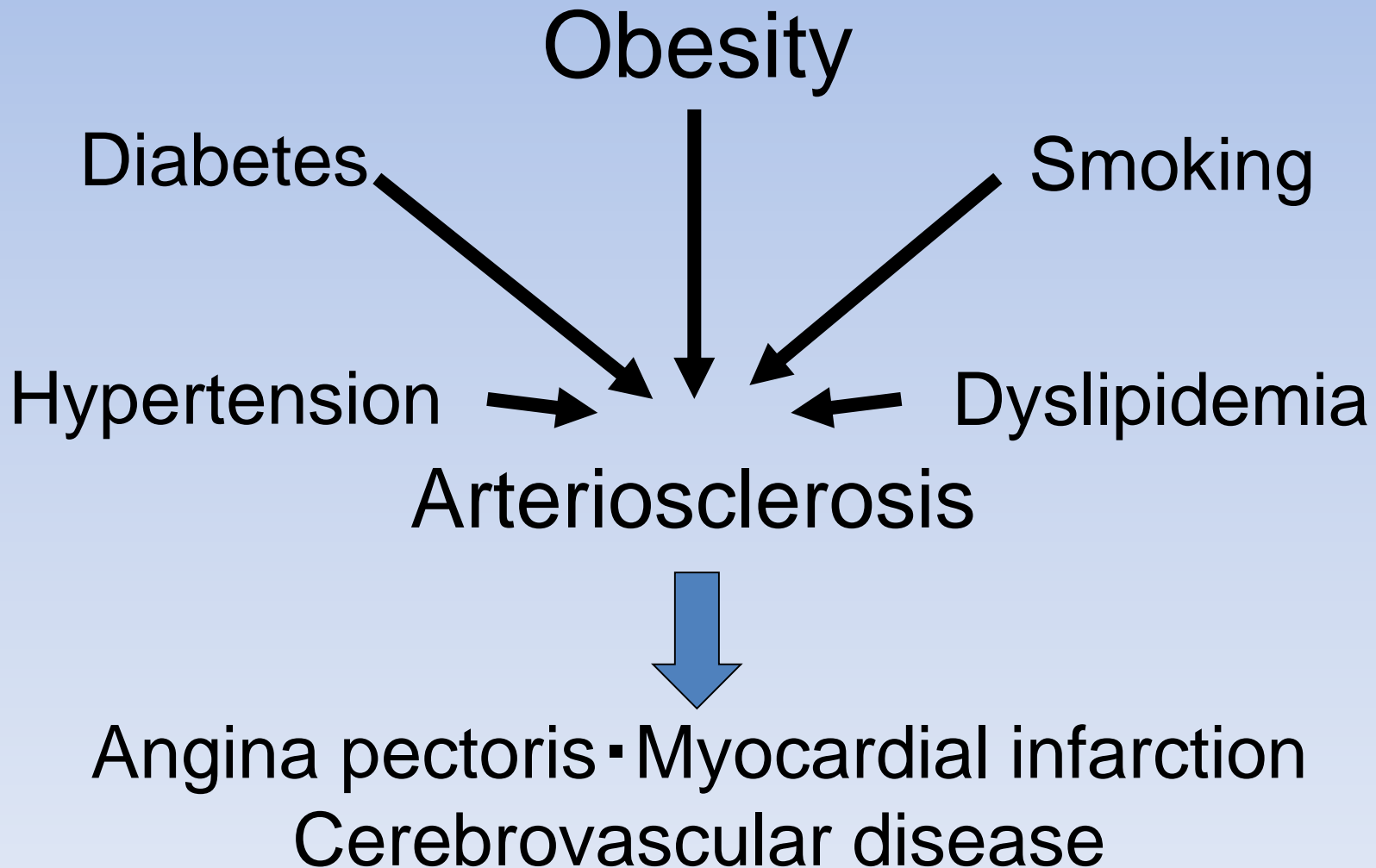
■ In venous blood

Oxygen concentration ↑

Carbon dioxide concentration ↓

■ To wash out body wastes of the day and supply sufficient nutrition to the whole body

# It is very important to keep blood vessels young



Please put “blood vessels” in the  
center of your mind  
and do not change your stance

Do not allow **blood vessels** defective

**血管**(blood vessels)を

**ketkan**

**欠陥**(defective)にしない

**ketkan**



## **Goto's highlighted point ②**

**目的から  
入浴を逆引き**

**Please decide how to bathe  
depends on the purpose**

**You decide the purpose of bathing  
first, and chose the way of  
bathing**

# The latest bathing method to increase feminine ability

- **Beauty with good blood vessel** : Prevention of arteriosclerosis ▪ Anti aging of blood vessel
- Beauty with beautiful legs : Clear an edema ( **Venous recirculation** )
- Beauty with a good posture : Stretching (Softening collagen)
- Beauty with strong immune system : Heat shock protein
- Active beauty : How to use shower
- Beauty with good body balance : Be conscious on breathing
- Beauty with moisture skin : Treatment after bathing
- Beauty with a good sleep : Stimulate parasympathetic nerve system with lukewarm water

# List up the bathing methods

- **Temperature**
- **Duration**
- **Depth**
- **Dynamic water pressure**
- **Sauna etc.**
- **Motion**

# 女子力UPのための最新入浴法

後藤康彰



<http://www.kohyusha.co.jp/nanairo/title/newyork/>

虹有社web nanairo, イラスト: ヤマサキミノリ



# Beauty with good blood vessels

- Theory that Beauty with good blood vessel is the strongest
- When blood vessels become defective . . .
- **Bathing sufficiently for 10min with 41°C of hot water**

Sulfur spring • Carbon dioxide spring

→ Anti aging effect for blood vessels by dilating them

Chloride spring • Sulfate spring •

Hydrogen carbonate spring

→ To have a good effect of retaining warmth by coating



Face is a mirror of the blood vessel age.  
I can tell how old you are when I see  
your face. I won't make a mistake!

# Beauty with good blood vessel

- **Prevention of arteriosclerosis • Anti aging of blood vessel (Do not allow **blood vessels defective**)**
- **At night, you may be tired after whole day work and the body waste may accumulate throughout the body.**
- **By putting into a bath tub, the amount of circulating blood which flows to the periphery increases. I express this condition “Byaaaaa”. Oxygen and nutrition are carried throughout the whole body so that carbon dioxide or fatigue substance are removed. I express this condition “Shashaaaaa”.**
- **Reset the tiredness from the day**

# Beauty with beautiful legs

- Calves are the second heart
- Clearing an edema is important
- **Hydrostatic pressure effect + Massage**

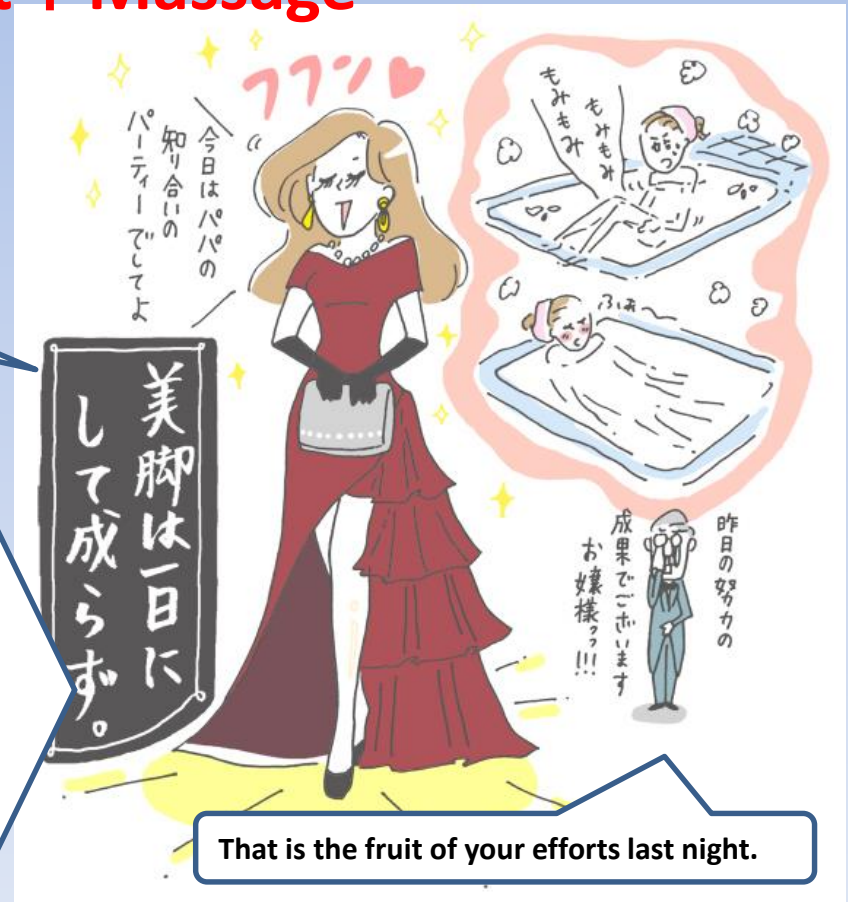
I am invited to the party by my father's friend!

Beautiful legs was not built in a day.

It is OK to take bath with lukewarm water for long time

Examp.) ○○ hot spring

✕ Waterfall, Jet bath, Bubble bath  
Development of shoulder stiffness, back pain



That is the fruit of your efforts last night.

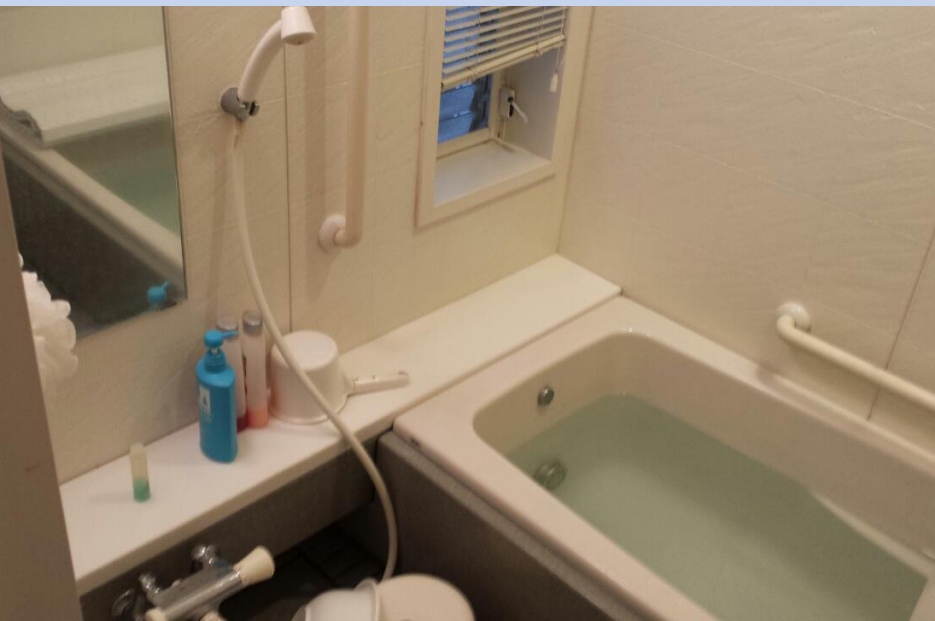
# Beauty with beautiful legs

- **Clearing an edema (Water pressure + Massage)**
- **When the pressure is applied to the tips of the toes, calves, or femurs, blood pumps up to the heart (venous recirculation) leading to reduce edema.**
- **Let's massage from the tips of the toes to the center of the body.**
- **Do stretching or turning the ankle. Massage calves.**



# Purpose

- To investigate whether the bathing in hot water daily has better effects physically and mentally than taking shower.

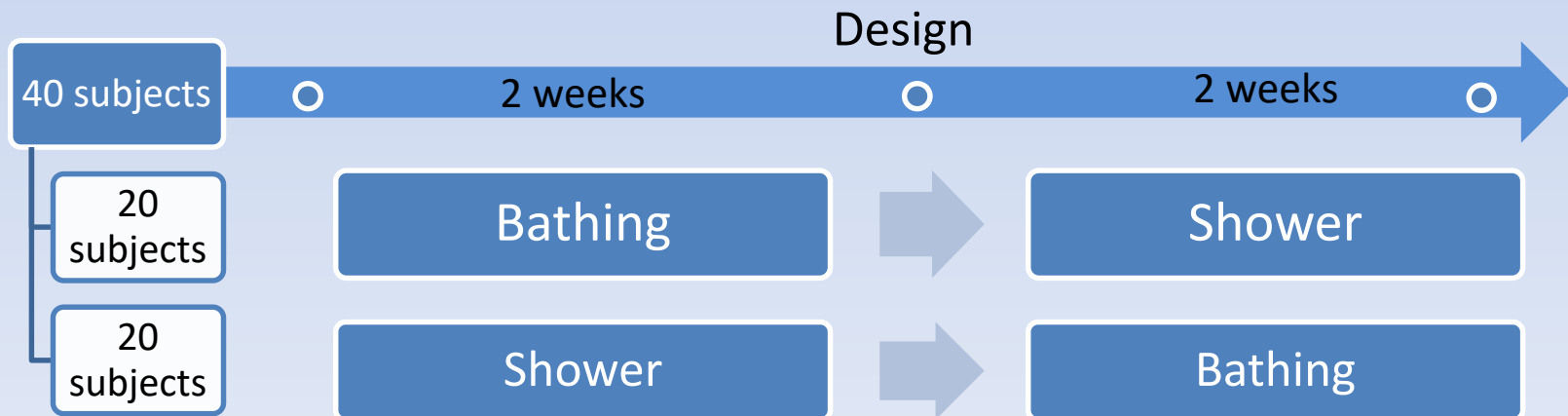


# Study 1

## **Subjective status**

# Materials and methods

- Design: An randomized intervention study
- Subjects: 40 people (30 years old and over)
- Period: From October to November in 2011.
- Methods: To bathe in hot water for 2 weeks and to take shower for 2 weeks continuously using cross-over methods.



# Materials and methods

- Questionnaire survey (Pre, 2 weeks, 4 weeks)
  - VAS Scale:  
Self rated health(SRH), Smile, Pain, Condition of skin,  
Stress and Fatigue
  - Profile of mood states (POMS)
- Statistical analysis was performed using paired t-test



# Results

- Subjects who bath in bathtub with hot water for 2 weeks showed better condition with respect to self rated health, smile and condition of skin than subjects with who take shower for 2 weeks.
- Stress, fatigue, tension-anxiety, anger-hostility, and depression-dejection were less in subjects who bath in hot water for 2 weeks.

# Self-Rated health

	Bathing			Showering			Difference	p value
Self rated health (SRH)	76.5	+/-	9.8	71.8	+/-	14.5	4.6	0.07
Skin condition	72.5	+/-	12.0	67.4	+/-	12.9	5.1	0.05
Fatigue	42.0	+/-	20.9	52.2	+/-	24.6	-10.2	0.03
Stress	39.2	+/-	23.2	50.7	+/-	25.5	-11.5	0.01
Pain	16.2	+/-	20.0	23.5	+/-	26.2	-7.3	0.04
Smile	74.3	+/-	13.2	68.7	+/-	13.5	5.6	0.02

# Profile of mood states

	Bathing			Showering			Difference	p value
Tension-Anxiety	43.7	+/-	6.2	46.5	+/-	8.1	-2.9	0.01
Depression-Dejection	47.5	+/-	8.7	49.6	+/-	8.5	-2.1	0.04
Anger-Hostility	46.9	+/-	6.8	50.0	+/-	9.7	-3.1	0.02
Fatigue	46.2	+/-	7.1	48.1	+/-	8.6	-1.8	0.12
Confusion	48.2	+/-	8.4	49.6	+/-	8.6	-1.4	0.33
Vigor	51.6	+/-	10.8	50.4	+/-	8.2	1.2	0.49

Study 2

**Sleep Quality**

# Study 2

- Bathing and taking shower with hot water cause warming body and at the moment of decrease deep body temperature after warming, falling asleep was induced easily followed by good quality of sleep.
- We think that bathing in bath tub may have better influence on sleep than taking shower.



# Methods

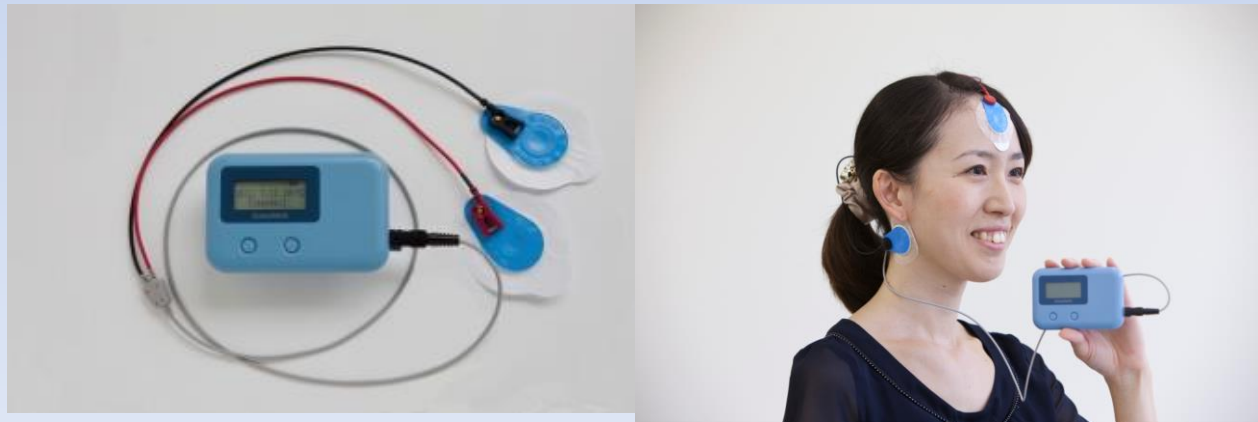
- Subjects: 12 healthy adults (25 y.o and over)
- Period: September to October on 2012
- Methods:
  - Bathing group: to bathe in hot water for 2 weeks
  - Shower group: to take only shower for 2 weeks
- EEG: 3days before and after intervention

	Pre		Intervention	
	9/1 ~ 29		9/30 ~ 10/13	
		27 ~ 29 EEG		11 ~ 13 EEG
Bathing	Shower		Imersion (40°C : 10min.)	
			Shower	

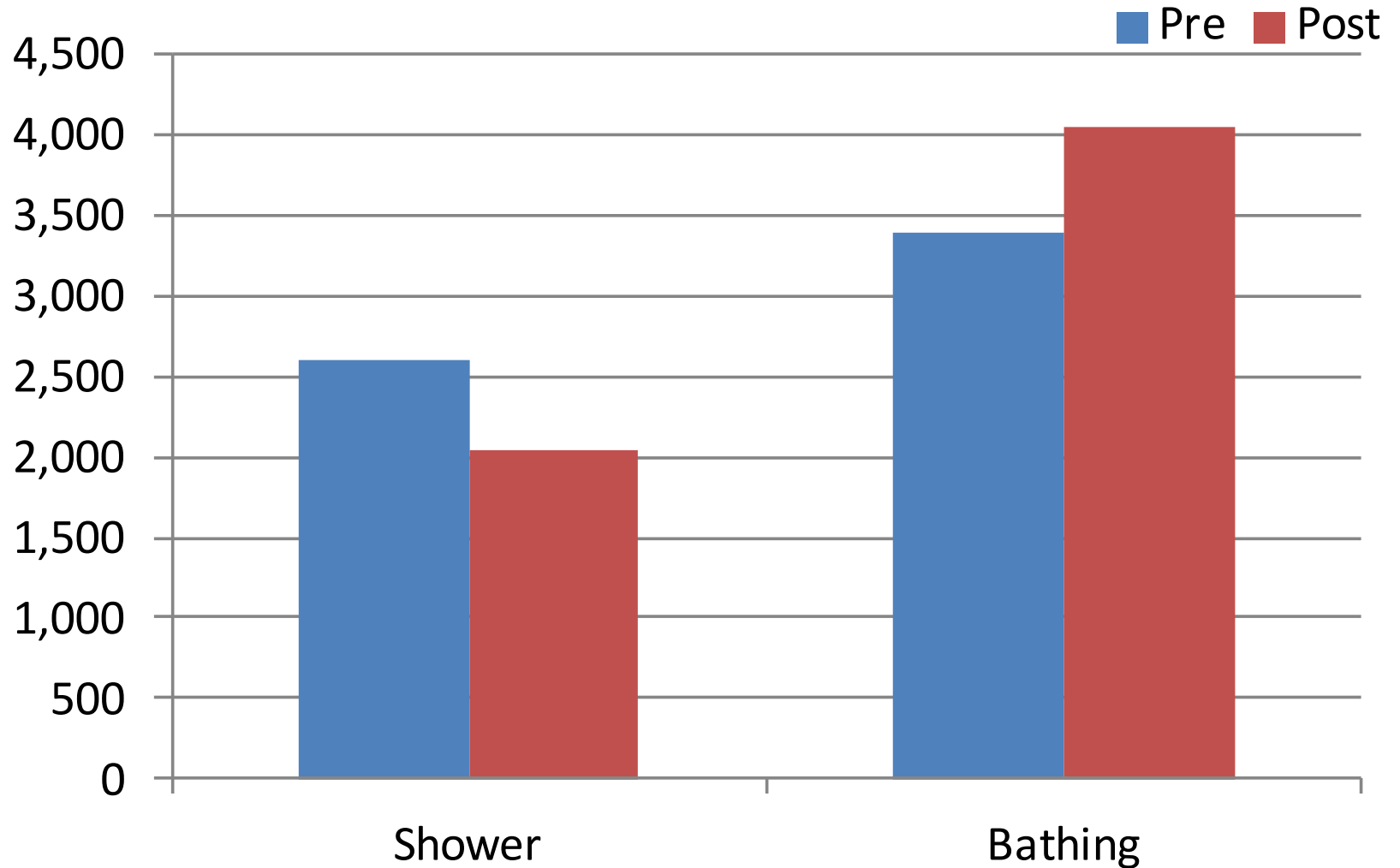
# Methods

- Statistical Analysis: paired t-test (SPSS19.0j)
- Ethical consideration

We received that written informed consents from the all subjects and this study was approved by the Ethics Committee of the Japan Health & Research Institute.



# Result





**Except for Love Sickness**



**7years / egg**



# Study 3

## **Gene expression**

# Study 3

**To clarify the effects of bathing in bath tub compared with taking shower on health with the aspect of gene expression.**

# Methods

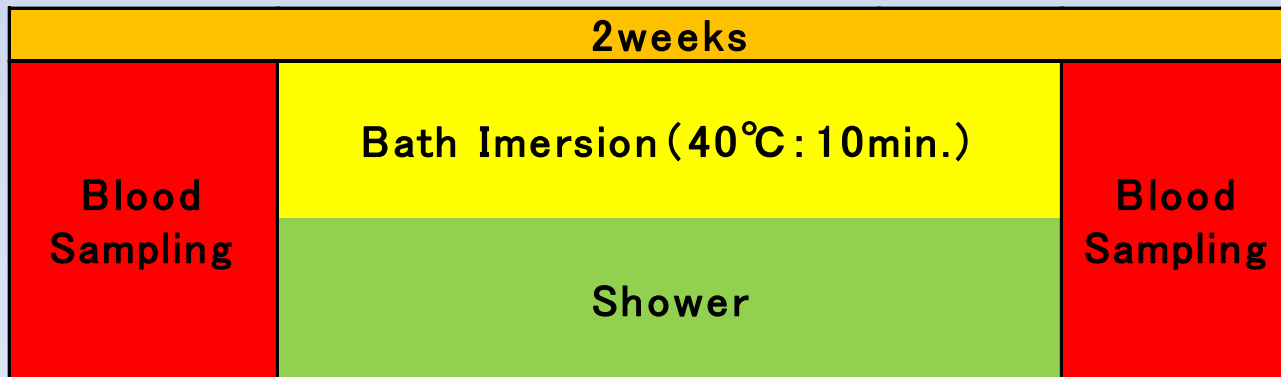
Subjects: 12 healthy adults

Period: From October to November in 2013.

Methods:

Bathing in bathtub for 2weeks: 6

Only taking shower for 2weeks: 6



# Methods

- Gene expression:

Analyzed by total RNA from total blood using Whole Human Genome oligo DNA microarray .

## Ethical consideration

We received that written informed consents from the all subjects and this study was approved by the Ethics Committee of the Japan Health & Research Institute.

# Results

In bathing group

- Fold change  $>1.3$ : 1,262 probes
- Up-regulation  $>1.3$  (Bath $>$ Shower):  
121 probes
- Down-regulation  $>1.3$  (Shower $>$ Bath)  
118 probes



# Results

Up-regulated genes included  
GABRG2 (fold change: 5.87)

Anti-stress

SIRT4 (fold change: 1.53)

Anti-aging

DEFA4 (fold change 1.62)

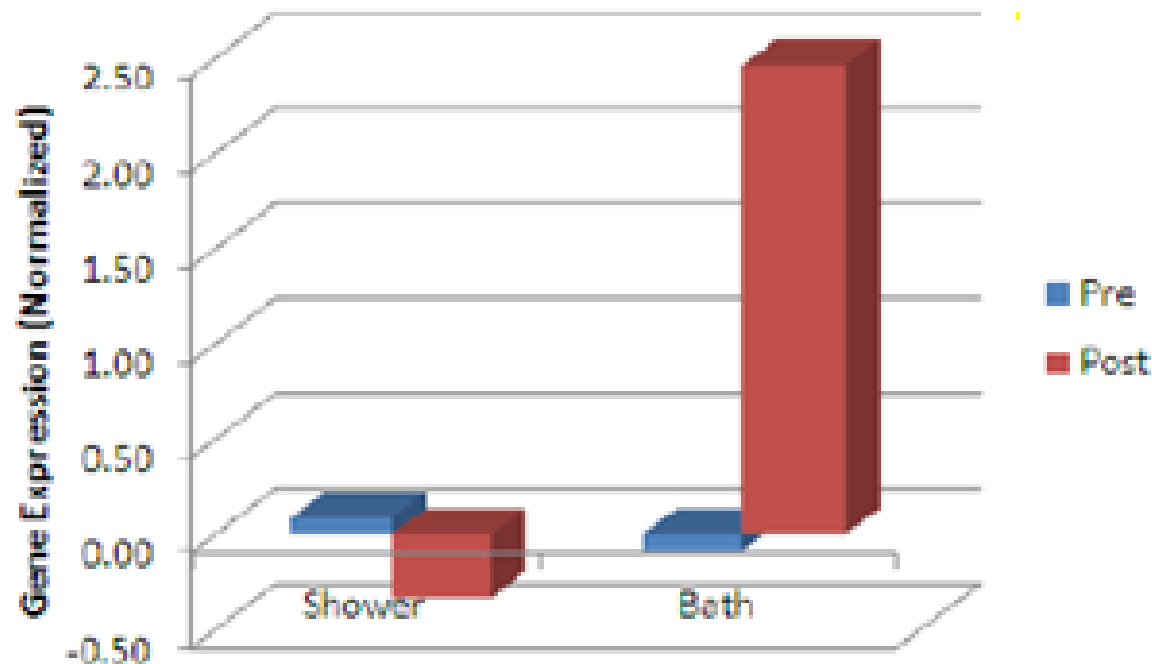
Anti-bacteria

IRF4(fold change: 1.46)

Anti-virus.

# Up-regulated genes / GABRG2

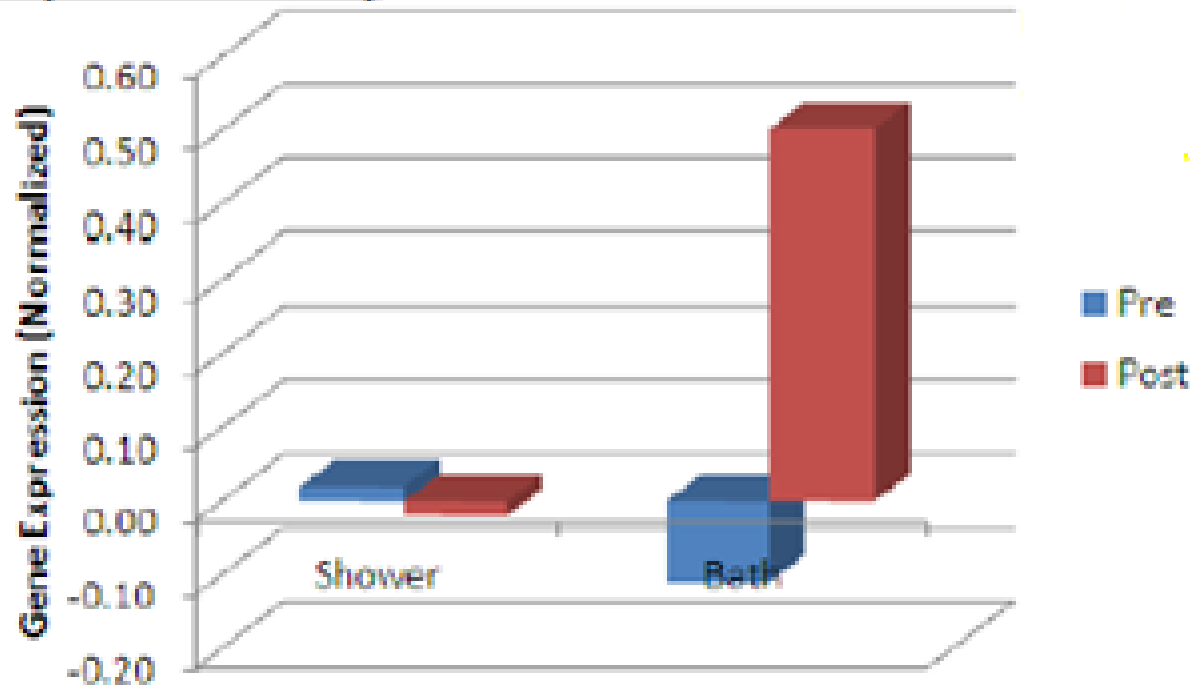
GABRG2: gamma-aminobutyric acid (GABA) A receptor, gamma 2



This gene encodes a gamma-aminobutyric acid (GABA) receptor. GABA is the major inhibitory neurotransmitter in the mammalian brain, where it acts at GABA-A receptors, which are ligand-gated chloride channels. GABA-A receptors are pentameric, consisting of proteins from several subunit classes: alpha, beta, gamma, delta and rho. Mutations in this gene have been associated with epilepsy and febrile seizures. Multiple transcript variants encoding different isoforms have been identified for this gene. [provided by RefSeq, Jul 2008]

# Up-regulated genes / SIRT4

SIRT4: sirtuin (silent mating type information regulation 2 homolog) 4 (*S. cerevisiae*)

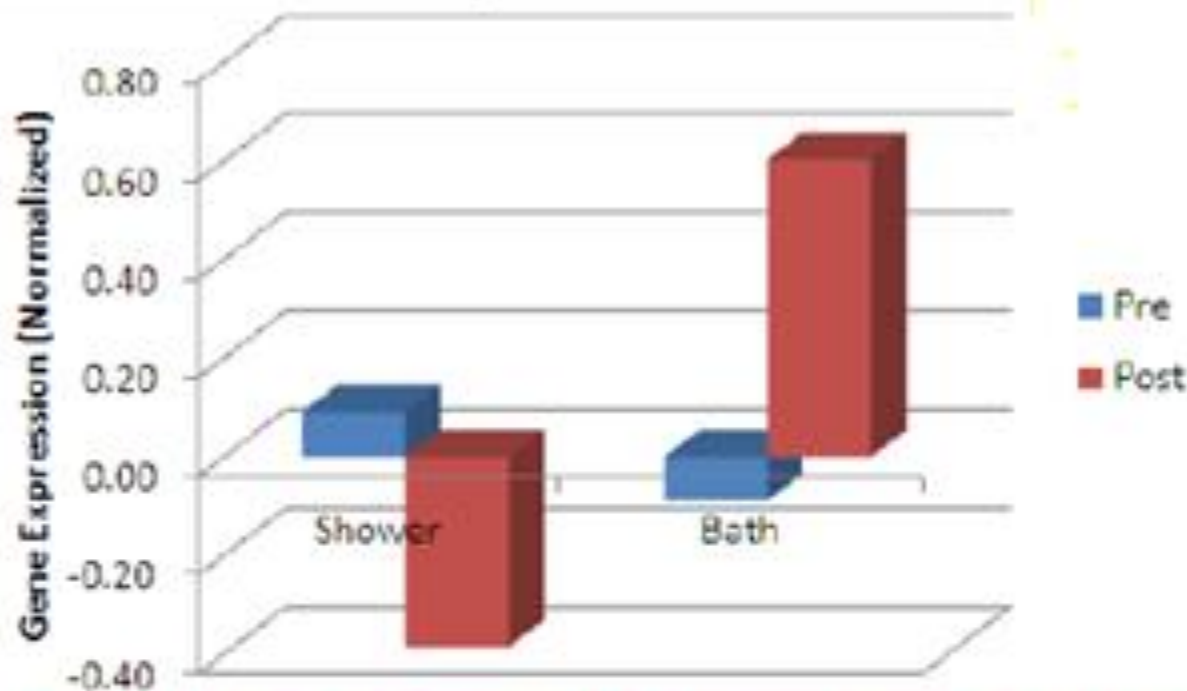


This gene encodes a member of the sirtuin family of proteins, homologs to the yeast Sir2 protein.

Members of the sirtuin family are characterized by a sirtuin core domain and grouped into four classes. The functions of human sirtuins have not yet been determined; however, yeast sirtuin proteins are known to regulate epigenetic gene silencing and suppress recombination of rDNA. Studies suggest that the human sirtuins may function as intracellular regulatory proteins with mono-ADP-ribosyltransferase activity. The protein encoded by this gene is included in class IV of the sirtuin family. [provided by RefSeq, Jul 2008]

# Up-regulated genes / DEFA4

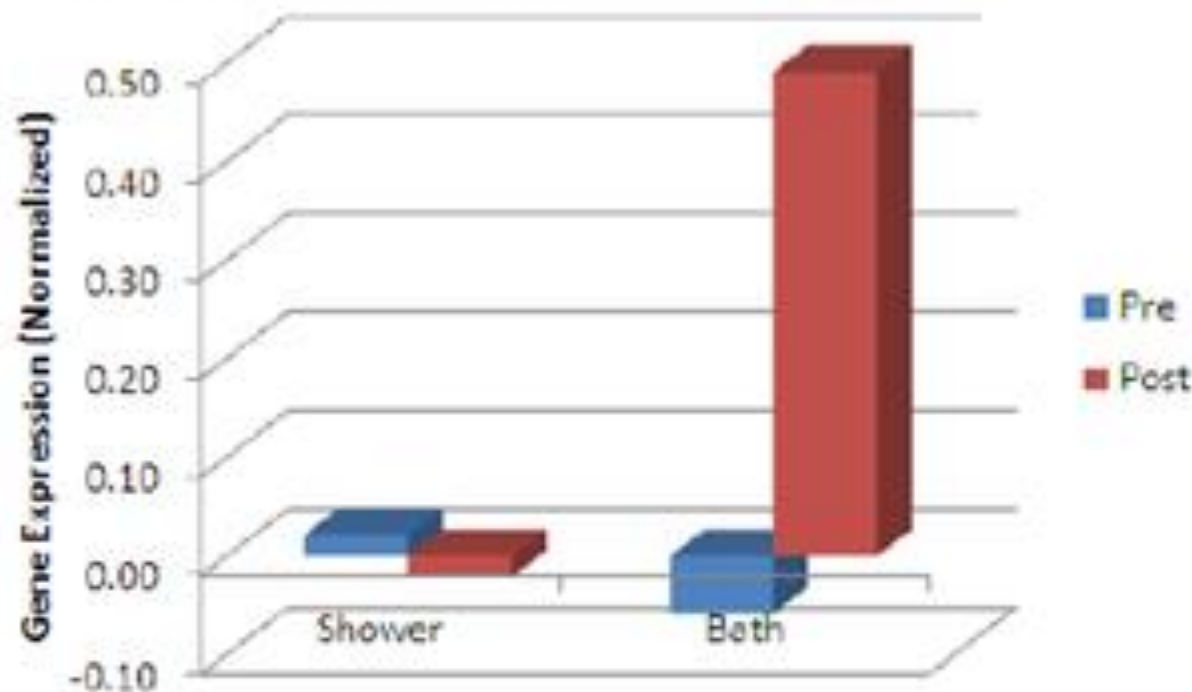
## DEFA4: defensin, alpha 4, corticostatin



Defensins are a family of microbicidal and cytotoxic peptides thought to be involved in host defense. They are abundant in the granules of neutrophils and also found in the epithelia of mucosal surfaces such as those of the intestine, respiratory tract, urinary tract, and vagina. Members of the defensin family are highly similar in protein sequence and distinguished by a conserved cysteine motif. Several alpha defensin genes are clustered on chromosome 8. This gene differs from other genes of this family by an extra 83-base segment that is apparently the result of a recent duplication within the coding region. The protein encoded by this gene, defensin, alpha 4, is found in the neutrophils; it exhibits corticostatic activity and inhibits corticotropin stimulated corticosterone production. [provided by RefSeq, Jul 2008]

# Up-regulated genes / IRF4

## IRF4: interferon regulatory factor 4



The protein encoded by this gene belongs to the IRF (interferon regulatory factor) family of transcription factors, characterized by a unique tryptophan pentad repeat DNA-binding domain. **The IRFs are important in the regulation of interferons in response to infection by virus, and in the regulation of interferon-inducible genes.** This family member is lymphocyte specific and negatively regulates Toll-like-receptor (TLR) signaling that is central to the activation of innate and adaptive immune systems. A chromosomal translocation involving this gene and the IgH locus, t(6;14)(p25;q32), may be a cause of multiple myeloma. Alternatively spliced transcript variants have been found for this gene. [provided by RefSeq, Aug 2010]



# Conclusion

It is possible to bathing with hot water daily may contribute to good health status.

# To set up bathing program

- Temperature
- Duration
- Depth
- Dynamic water pressure
- Sauna etc.
- Motion

# To think out additional way

- Bathing agents
- Shower
- Lighting
- Sound
- Aroma
- Candle

# Think about items other than bating

- Eat
- Move
- Rest
- Laugh

# **Health!**

**Is the fundamental assets  
of human being!**

# Health by WHO

**A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.**



# Health tourism!

- Defined as a type of tourism that offers value to customers in terms of health
- Health tourism programs have been developed as healthcare services that raise awareness of health among many people, in addition to providing the pleasure of traveling.

# Various types of health tourism

## ■ Do something good for health

- Treatment of diseases
- Prevention of diseases
- Releasing stress
- Being relaxed
- To be refresh
- Beauty • Cosmetics
- Anti aging

# Difference of World SPA scene



**Medical**

Europe



**SPA**

Asia



**Leisure**

Japan

**Long**

**Short**

# ONSEN ?

**Not only water but also....**

# ONSEN ?

**Cuisine, Culture,  
Environment, Climate....**

# **Health Tourism, also (Wellness tourism)**

**Of course!,  
Depends on the purpose!**



# It is not true that beautiful women die young ( The fairest flowers soonest fade)

## Energize your feminine beauty!

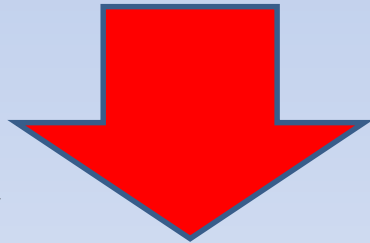
If you increase your feminine beauty  
by bathing, it will be said that  
beautiful women live long



# Illness to Wellness

**Illness**

G3T,  
FEMTEC



Global  
Wellness  
Summit

**Wellness**

**Gokuraku,  
Gokuraku**



# Benefits of Bathing in hot water

- Physiological factor ;
  - Hydrostatic pressure, buoyancy, heating effect
- Thermal effects;
  - Augmentation of cardiac output, decrement in resistance of peripheral blood vessel, dilatation of vessel followed by decrement of blood pressure
- Secretion of hyper metabolic hormones
  - Adrenaline, growth hormone and so on.

# What are the reasons for Japanese longevity?

- Japanese diet
  - Low in fat
  - Rich in fiber (vegetable, soya beans), fishes
- High quality of public health insurance system
- Bathing style ?
  - Bath in bathtub with hot water (40-42°C)  
mostly every day

# Bath in houses and apartments in Japan

## Diffusion of baths at home

- 96%

## Frequencies of bathing in bathtub

- Summer: 5 days per a week
- Winter: 6 days per a week

# Difference of the World SPA scene



**Medical**

Europe



**SPA**

Asia



**Leisure**

Japan

**Long**

**Short**



# Accommodation and visitor to OONSEN

Ryokan(inn)-Hotel with hot spring

- 13,754

Visitors who stayed overnight

- 128,000,000/year

Day trippers utilizing hot spring

- 7,902/year







# Discussion

These studies suggested that bathing in bathtub as a daily habit may contribute to the expression of genes which have benefits on one's health.

# Jigokudani-hot springs



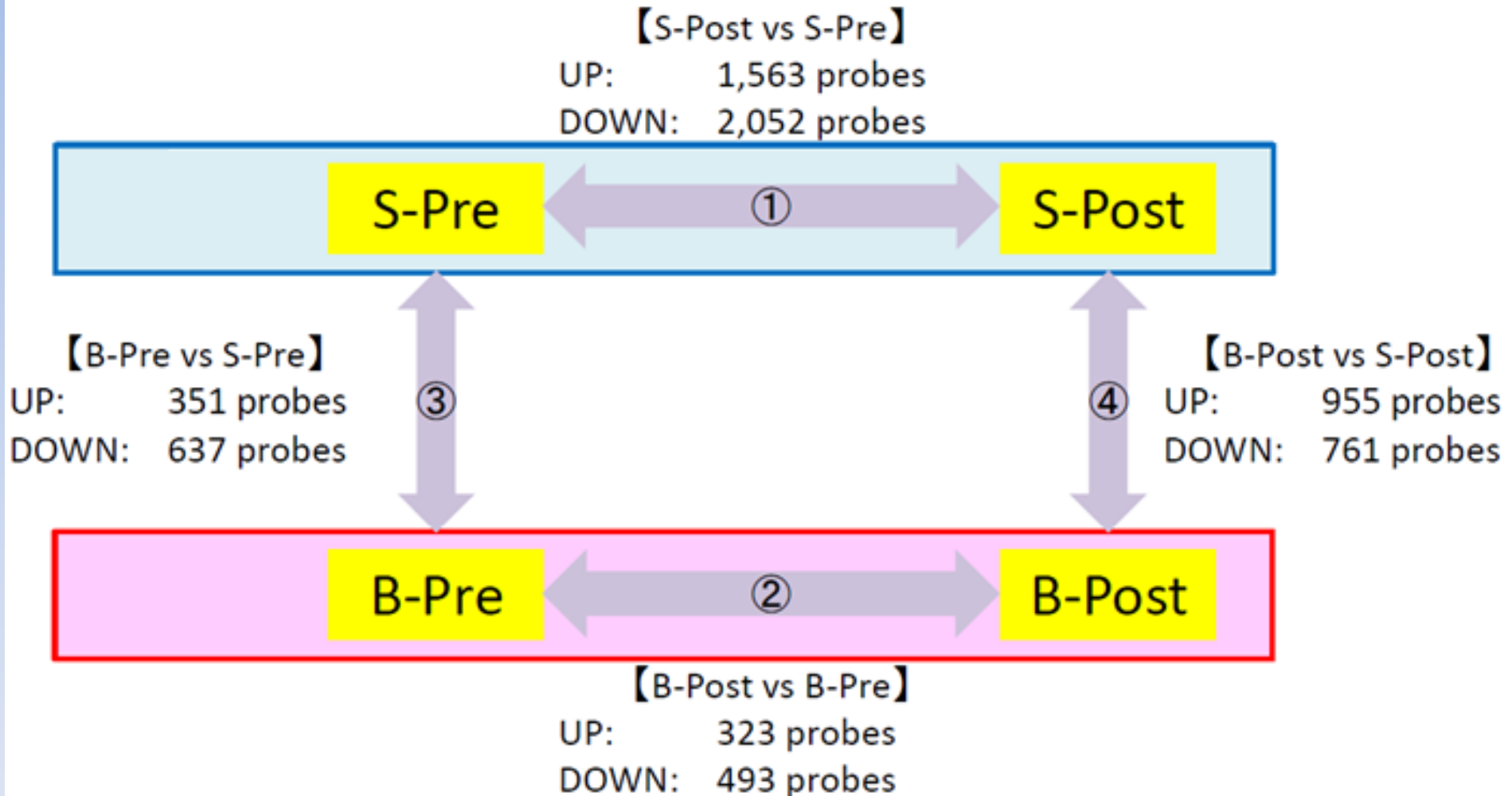
	Fold change([B- Post] vs [B-Pre])	Regulation([ B-Post] vs [B-Pre])	Fold change([S- Post] vs [S- Pre])	Regulation([ S-Post] vs [S-Pre])	Fold change([B- Pre] vs [S- Pre])	Regulation([ B-Pre] vs [S-Pre])	Fold change([B- Post] vs [S- Post])	Regulation([ B-Post] vs [S- Post])
gammalytic acid (GABA) A receptor, gamma 2	5.87	up	1.34	down	1.13	down	6.96	up
cytochrome c oxidase subunit 2, mitochondrial	3.98	up	1.08	up	1.04	up	3.86	up
cytochrome c oxidase subunit 2, mitochondrial (S. cerevisiae)	3.97	up	2.13	up	1.18	up	2.19	up
cytochrome c oxidase subunit XI	3.26	up	1.63	up	1.26	up	2.52	up
cytochrome c oxidase subunit XI (S. cerevisiae)	3.07	up	1.02	down	1.28	down	2.45	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.89	up	1.60	up	1.17	up	2.11	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.76	up	2.04	up	1.03	up	1.39	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.61	up	1.01	down	1.00	down	2.63	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.42	up	1.55	up	1.27	up	1.98	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.31	up	1.43	down	1.09	down	3.02	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.25	up	1.10	up	1.19	down	1.71	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.23	up	1.18	up	1.24	up	2.35	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.17	up	1.05	up	1.08	up	2.23	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.14	up	1.56	down	1.26	down	2.66	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.12	up	1.30	up	1.18	up	1.94	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.12	up	1.12	up	1.09	up	2.07	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.10	up	1.41	up	1.02	up	1.52	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.08	up	1.45	up	1.12	up	1.60	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.08	up	1.03	down	1.14	down	1.88	up
cytochrome c oxidase subunit XI (S. cerevisiae)	2.05	up	1.63	down	1.16	down	2.89	up
cytochrome c oxidase subunit XI (S. cerevisiae)								
cytochrome c oxidase subunit XI (S. cerevisiae)	1.53	up	1.03	down	1.09	down	1.44	up
cytochrome c oxidase subunit XI (S. cerevisiae)	1.62	up	1.39	down	1.13	down	1.99	up
cytochrome c oxidase subunit XI (S. cerevisiae)	1.46	up	1.03	down	1.06	down	1.43	up

# Sleep Scope

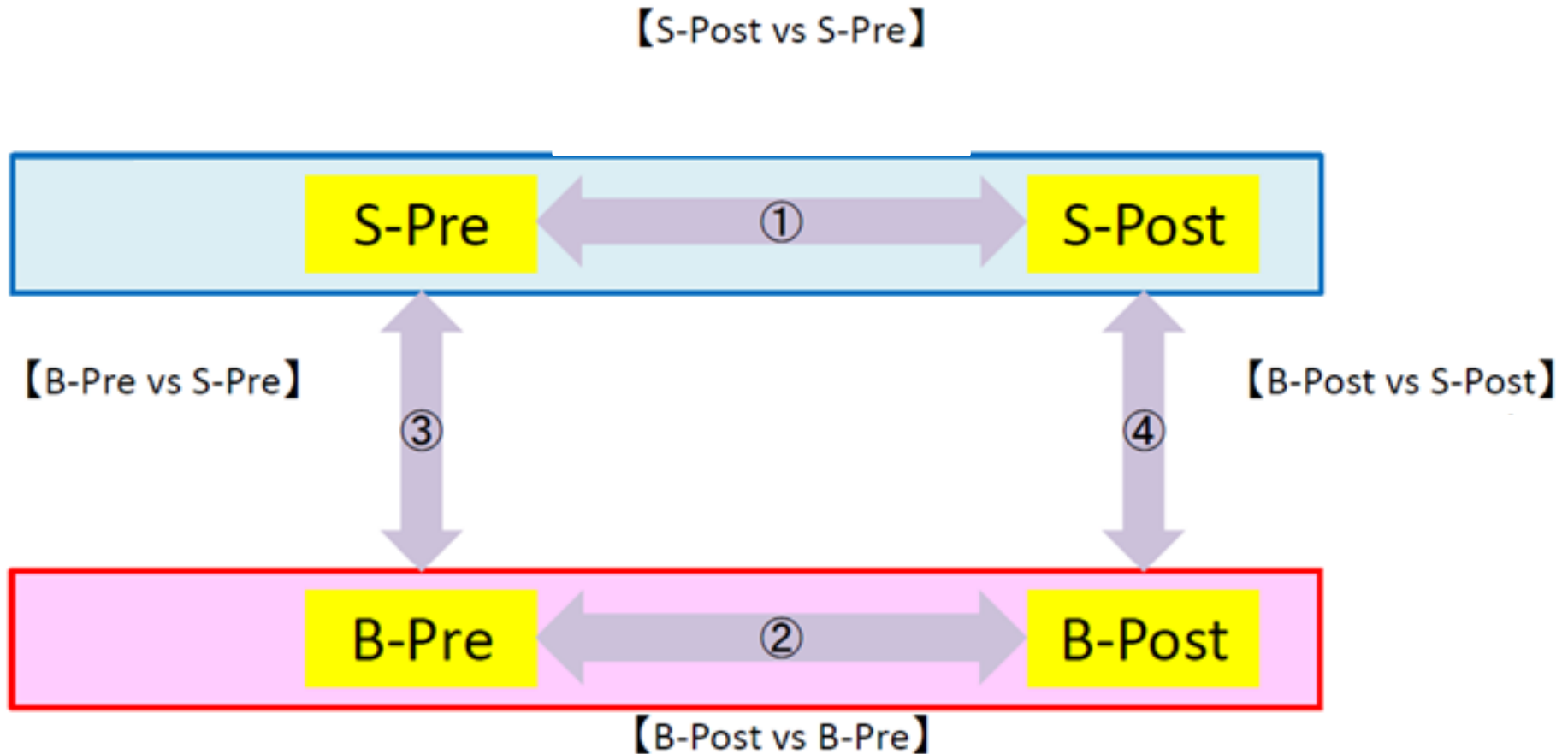
- Sleep scope by Sleepwell
  - 被験者負担少
  - 額(1ch)で計測
  - PSGと80%相関
  - 医療機器認証取得



# Results



# Results



# Bathing: Before and After

	Before			After			Difference	p value
SRH	67.1	+/-	17.2	77.0	+/-	13.8	9.9	0.01
Skin Condition	64.1	+/-	16.8	76.0	+/-	13.8	11.9	0.01
Fatigue	56.3	+/-	23.0	40.8	+/-	24.1	-15.5	0.01
Stress	43.9	+/-	26.3	28.6	+/-	22.1	-15.3	0.01
Pain	20.6	+/-	26.8	13.9	+/-	20.3	-6.8	0.01
Smile	63.2	+/-	19.3	75.9	+/-	16.7	12.6	0.01

# Shower: Before and After

	Before			After			Difference	p value
SRH	67.5	+/-	17.0	73.0	+/-	16.1	5.5	0.01
Skin Condition	62.8	+/-	14.2	69.3	+/-	13.4	6.5	0.01
Fatigue	57.2	+/-	25.5	48.8	+/-	25.9	-8.4	0.01
Stress	49.0	+/-	28.2	38.7	+/-	24.7	-10.2	0.01
Pain	24.9	+/-	28.7	21.9	+/-	26.8	-3.0	0.01
Smile	62.0	+/-	19.8	70.3	+/-	20.2	8.3	0.01

# SF-8

	Bathing			Showering			Difference	p value
General health	54.5	+/-	6.2	50.2	+/-	7.0	4.3	0.01
Physical functioning	51.2	+/-	4.2	50.7	+/-	4.2	0.5	0.58
Role physical	50.5	+/-	5.7	50.9	+/-	5.1	-0.4	0.68
Bodily pain	50.4	+/-	8.0	49.4	+/-	8.8	1.0	0.38
Vitality	51.2	+/-	6.6	49.2	+/-	5.8	2.1	0.11
Social functioning	50.2	+/-	7.8	46.4	+/-	7.3	3.8	0.02
Mental health	49.9	+/-	6.5	47.0	+/-	5.7	2.9	0.02
Role emotional	49.6	+/-	7.7	48.3	+/-	4.7	1.3	0.36
Physical component summary	50.8	+/-	6.0	50.4	+/-	6.0	0.4	0.69
Mental component summary	48.9	+/-	6.6	45.6	+/-	5.4	3.3	0.01

# Discussion

- This interventional study showed good physical and mental effects of bathing in bathtub.
- With these results, we recommend to take bath with hot water to promote health condition.
- It is also possible that these results may explain part of the reasons for higher life expectancy of Japanese.

# Result

- ・ 12名中、脳波計測を妥当に行った10名（シャワー5名、浴槽5名）分のデータを解析対象とした。
- ・ 介入前3日間、介入後3日間のデータの内、それぞれ後半2日間のデータを原則的に採用した。
- ・ 寝つき（睡眠潜時）、睡眠効率（睡眠時間/着床時間）、睡眠リズム、睡眠の質（ $\delta$ 成分）につき検討した。