NorCal Open Access Publications
Recent Advancement in Food Science and Nutrition Research
Volume 1; Issue 1
Katayama N et.al.

**Research Article**

# Comparison between Eating Habits Improvement by Using the Caloric-Tofu and Gene Analysis Result -For Elderly People

**Naomi Katayama[1,2*], Yui Nakayama[2], Shoko Kondo[3]**

[1]Nagoya Women's University, Nagoya City, Japan

[2]Graduate School of Nagoya Women's University, Nagoya City, Japan

[3]Watanabe Hospital, Noma, Aichi, Japan

[*]**Corresponding author:** Naomi Katayama, Nagoya Women's University, Nagoya City, Japan, **E-mail:** naomik@nagoya-wu.ac.jp

**Received Date:** 29 June, 2018; **Accepted Date:** 26 July, 2018; **Published Date:** 27 July, 2018

## Abstract

Japan becomes the super aged society. It is expected from now on that the population of the elderly person increases more and more. Therefore, disease prevention such as Sarcopenia and Frailty in the elderly person is required. Sarcopenia has decreased quantity of muscle, and muscle weakness means that quality of life decreases for mind and body functional disorder. Frailty has the weak state that the healthy disorders such as the drop of the cognitive function, a drop of the mind activity and the drop of the activity et cetera. However, these problems are reversible. We are improved by increasing quantity of muscle by a dietary modification and can prevent it. Therefore, this study tried the improvement of meal contents by taking in soy protein using caloric-tofu in daily life. The sixteen-elderly people (two men, 14 women: from age 55 years old to 83 years old) who submitted the written consent of the subject participated in this study. We performed the gene analysis (β3AR, UCP1, β2AR) of the subject. The subject lived a normal life every day. The subject had eaten two caloric-tofu's a day. A caloric-tofu has 100 kcal. The subject participated in a study for two months. As for the subject, body composition was measured on the first day and the last day of the study. A result, skeletal muscle rates of eight people increased, and a fat rate decreased. However, eight people changed into neither the skeletal muscle rate nor the fat rate. People who were effective by this experiment were the people who had variation in β2AR, and people that there was not an effect were the people who had variation in UCP1. This experiment had little number of the data, but it was revealed that an intake of the caloric-tofu was more likely to help the reinforcement of the skeletal muscle mass to a participant with the variation in β2AR gene. It will be necessary to increase the number of participants more, and to examine it in detail in future. We thought in future that an effect might appear by doing nourishment instruction based on a result of the gene analysis.

## Keywords

Elderly Person; Gene Analysis; Caloric-Tofu; Skeletal Muscle Rate; Body Fat Rate

## Introduction

Japan is super aged society. According to the announcement of the recent Japanese Government, the ratio in the population of the elderly person of Japan is higher than 27.3% (15 million people is male, 19.59 million people is female: 2016). The Japanese Government performs a campaign to reduce a bedridden elderly person. Specifically, it is lifestyle improvement to postpone the healthy life expectancy of the elderly person. The Japanese Government wants to prevent Sarcopenia [1,2] and Frailty [3,4,5,6,7,8] by the improvement of dietary habits and the exercise custom of the elderly person. We talk about the meal content to increase quantity of muscle of the elderly person. It is necessary to have the elderly person take in a meal with much protein [9]. However, the elderly person has the decline of the chewing function and the decline of the deglutition function. In addition, the elderly person has the person who cannot go for shopping far and wide every day. Therefore, the protein which it is easy to eat which storable duration makes is necessary. The soybean product is the food which it is easy to get and popular for a Japanese very much. As for the tofu in particular, it is high protein and low-fat. The tofu has various kinds. As for the tofu, there are various choices by a person eating from a hard thing to a soft thing. The elderly person cannot often take in a meal of much quantity at a time. Therefore, the elderly person need to eat rich-nutrition food which quantity is not so much. Therefore, this study thought that we used caloric tofu (at 75 g a 100 kilos calorie.) which added a middle chain fatty acid. Quality of protein and lipid can take in the caloric-tofu with a small quantity at the same time. It was intended to reinforce quantity of muscle of the elderly person by eating caloric tofu. We decided to check whether a change of the body composition of the elderly person appeared by adding two caloric tofu to an everyday meal.

## Material and Methods

### Participants

The participant is 16 people. The participant was two men and 14 women. Age distribution is from 55 years old to 83 years old. The participant was told to live in the same way as until now during an experiment period. The participant was told to add two caloric-tofu in meal during an experiment period. The experiment period was two months.

### Assessment of daily life

We informed it that we wanted a participant to spend the life as always. We informed it that we wanted a subject to write down an everyday meal as possible in detail during a period for two months.

### Gene Analysis

As for us, it was decided to check three genes which related to obesity (β3AR, UCP1, β2AR). The gene analysis depended on DHC Co., Ltd. Obesity has a strong genetic component and their inheritance is polygenic. β-adrenergic receptors (β-ARs) and uncoupling proteins (UCP1) have been studied as candidate genes for obesity. B3AR, β2AR and UCP1 have a role in the stimulation of thermogenesis and lipolysis [10]. The β3AR gene is a beta-3 adrenergic receptor. This gene greatly affects leptin resistance. When this gene has variation, a basal metabolic rate decreases 200Kcal.34% of Japanese have this genetic variation. UCP1 gene is a decoupling gene. A Trp64Arg polymorphism of β3AR has been associated with eight gain, clinical features of insulin resistance. Furthermore, the Arg allele is associated with 10-fold decreased agonist sensitivity. There is UCP1 which this gene creates in mitochondria and burns fat. When this gene has variation, a basal metabolic rate decreases 100Kcal.35% of Japanese have this genetic variation. The UCP1 gene variant A (-3826) G has been associated with obesity and metabolic disorders both individually and in combination with β3AR. The β2AR gene is a beta-2 adrenergic receptor. There is this receptor to heart and a bronchus smooth muscle. When this gene has variation, it breaks down the fat positively. When this gene has variation, 200Kcal increases basal metabolism. A Gln27Glu polymorphism of β2AR gene alters the down-regulation of the receptor in vitro and has been associated with body weight.

### Physical Measurement

As for the participant, body composition was measured on the experiment first day and the experiment last day. The measurement item was Weight (Kg); Body Fat (%); Whole Body Subcutaneous Fat (%); Whole Body Skeletal Muscle (%); Both Arms Subcutaneous Fat (%); Both Arms Skeletal Muscle (%); Trunk Subcutaneous Fat (%); Trunk Skeletal Muscle (%); Both Legs Subcutaneous Fat (%); Both Legs Skeletal Muscle (%); Girth of the Abdomen (Cm); total 11 Items.

### Explanation about the Caloric-Tofu

We explained caloric tofu to a participant. It is made in Imuraya Corporation and can purchase the caloric tofu for one 100 yen in supermarkets. We conveyed that we wanted a participant to eat two a day. We conveyed that the caloric tofu was easy to become the energy because a middle chain fatty acid was used, and it was hard to be too fat to a participant.

### Statistical Analysis

We performed a statistical analysis of provided data. At first regular for the data of two that we compare; checked weather was distributed. The method used F test. It was decided that student-t with the correlation gave a regular test when we were distributed the data of two to compare.

### Ethical Review Board

This study was conducted with the approval of the Ethical Review Board (Nagoya women's university 'hito wo mochiita kennkyuu ni kansuru iinnkai'). The approval number is 29-21.

## Results

### Assessment of Daily life

All the participants spent two months safely. The participant ate two caloric tofu every day for two months. The subject recorded everyday meal content and submitted it.

### Gene analysis

The gene of the participant was analysed. The gene analysis depended on DHC Co., Ltd. Three kinds of genes which we analysed were (β3AR, UCP1, β2AR). We show the gene analysis result of 16 participants in table 1. Because I inherit by one from parents, there are two gene. When both genes do not have variation, it is wild type. When one gene has variation, it is Heterozygous. When both genes have variation, it is Homozygous. The participant who had low basal metabolic rate was seven people (S-4, 5, 6, 9, 13, 15, 16). The participant who had high basal metabolic rate was eight people (S-1, 2, 3, 7, 8, 10, 11, 12). The participant that basal metabolism did not have a change was one person (S-14).

| Subjects | Age, Sex | β3AR Gene | UCP1 Gene | β2AR Gene |
|---|---|---|---|---|
| S-1 | 67F | Wild (-) | Heterozygous (+) | Homozygous (++) |
| S-2 | 61M | Wild (-) | Heterozygous (+) | Heterozygous (+) |
| S-3 | 83F | Heterozygous (+) | Wild (-) | Homozygous (++) |
| S-4 | 76F | Heterozygous (+) | Wild (-) | Wild (-) |
| S-5 | 66F | Heterozygous (+) | Homozygous (++) | Heterozygous (+) |
| S-6 | 55F | Heterozygous (+) | Heterozygous (+) | Heterozygous (+) |
| S-7 | 72F | Wild (-) | Heterozygous (+) | Homozygous (++) |
| S-8 | 81F | Wild (-) | Wild (-) | Heterozygous (+) |
| S-9 | 81M | Heterozygous (+) | Homozygous (++) | Heterozygous (+) |
| S-10 | 82F | Wild (-) | Wild (-) | Heterozygous (+) |
| S-11 | 76F | Wild (-) | Wild (-) | Heterozygous (+) |
| S-12 | 68F | Wild (-) | Heterozygous (+) | Homozygous (++) |
| S-13 | 78F | Wild (-) | Heterozygous (+) | Wild (-) |
| S-14 | 61F | Heterozygous (+) | Wild (-) | Heterozygous (+) |
| S-15 | 75F | Heterozygous (+) | Wild (-) | Wild (-) |
| S-16 | 70F | Heterozygous (+) | Heterozygous (+) | Wild (-) |

**Table 1:** Results of gene analysis.

| | Weight Kg | | Whole body subcutaneous fat % | | Whole body skeletal muscle % | |
|---|---|---|---|---|---|---|
| | Experiment start | Two months later | Experiment start | Two months later | Experiment start | Two months later |
| Average | 49.438 | 50.2 | 27.525 | 27.063 | 21.325 | 22.063 |
| SD | 10.527 | 10.571 | 4.997 | 4.761 | 1.893 | 1.499 |
| | **Body fat %** | | **Both arms subcutaneous fat %** | | **Both arms skeletal muscle %** | |
| | Experiment start | Two months later | Experiment start | Two months later | Experiment start | Two months later |
| Average | 34.938 | 33.613 | 45.1 | 43.388 | 24.563 | 25.263 |
| SD | 5.216 | 4.494 | 6.096 | 5.311 | 3.381 | 3.062 |
| | **Girth of the abdomen cm** | | **Trunk subcutaneous fat %** | | **Trunk skeletal muscle %** | |
| | Experiment start | Two months later | Experiment start | Two months later | Experiment start | Two months later |
| Average | 83.825 | 81.5 | 24.825 | 24.063 | 15.75 | 16.288 |
| SD | 9.254 | 8.652 | 5.124 | 4.727 | 2.099 | 1.763 |
| | | | **Both legs subcutaneous fat %** | | **Both legs skeletal muscle %** | |
| | | | Experiment start | Two months later | Experiment start | Two months later |
| Average | | | 35.813 | 34.713 | 33.263 | 34.425 |
| SD | | | 6.494 | 5.892 | 2.165 | 1.711 |

**Table 2:** Body composition level of experiment start and two months later (Average ± SD) (Effect existence group: S - 1,3,4,5,7,8,11,14).

| | **Weight Kg** | | **Whole body subcutaneous fat %** | | **Whole body skeletal muscle %** | |
|---|---|---|---|---|---|---|
| | Experiment start | Two months later | Experiment start | Two months later | Experiment start | Two months later |
| Average | 57.863 | 57.163 | 25 | 25.1 | 24.875 | 24.388 |
| SD | 9.927 | 9.94 | 6.616 | 6.843 | 2.959 | 3.303 |
| | **Body fat %** | | **Both arms subcutaneous fat %** | | **Both arms skeletal muscle %** | |
| | Experiment start | Two months later | Experiment start | Two months later | Experiment start | Two months later |
| Average | 30.963 | 31.625 | 37.213 | 38.213 | 28.238 | 27.725 |
| SD | 5.11 | 6.622 | 10.648 | 11.496 | 4.956 | 5.334 |
| | **Girth of the abdomen cm** | | **Trunk subcutaneous fat %** | | **Trunk skeletal muscle %** | |
| | Experiment start | Two months later | Experiment start | Two months later | Experiment start | Two months later |
| Average | 82.671 | 82.914 | 21.975 | 22.338 | 18.613 | 18.288 |
| SD | 6.816 | 6.807 | 5.792 | 6.14 | 3.058 | 3.325 |
| | | | **Both legs subcutaneous fat %** | | **Both legs skeletal muscle %** | |
| | | | Experiment start | Two months later | Experiment start | Two months later |
| Average | | | 31.45 | 32.125 | 38.45 | 38.05 |
| SD | | | 7.766 | 8.497 | 4.914 | 5.393 |

**Table 3:** Body composition level of experiment start and two months later (Average ± SD) (Not Effect existence group: S - 2,6,9,10,12,13,15,16).

## Physical Measurement

As for the participant, body composition was measured on the experiment first day and an experiment end day. The measurement item was 11 items. Among 16 participants, the participant whom a skeletal muscle mass increased to was eight people. We divided the data to the participant whom a skeletal muscle mass increased to and the participant who did not increase. Eight participants whom a skeletal muscle mass increased to were S-1, 3, 4, 5, 7, 8, 11, 14. Eight participants whom a skeletal muscle mass did not increase to were S-2, 6, 9, 10, 12, 13, 15, 16. We show the average ±SD of body composition 11 items of the experiment first day and the experiment last day of eight people whom a skeletal muscle mass increased to in table 2. We show the average ±SD of body composition 11 items of the experiment first day and the experiment last day of eight people whom a skeletal muscle mass not increased to in table 3. The participant whom a skeletal muscle mass increased understood that a subcutaneous fat rate decreased. The participant whom a skeletal muscle mass did not increase to understood that quantity of subcutaneous fat increased.

## Statistical Analysis

Statistically, we compared body composition 11 items at the time of the experiment end with experiment start time of the participant whom a skeletal muscle mass increased. Data distribution was check by using F-test (Cf. Table 4). All data did not have the statistical significant difference. Therefore, we compared the data using student-t test with the correspondence (Cf. Table 5). It was proved that skeletal muscle masses of this participant statistically significantly increased. In addition, as for the participant whom a skeletal muscle mass increased to, it was statistically significantly proved that quantity of subcutaneous fat decreased. Similarly, we compared body composition 11 items at the time of the experiment end with experiment start time of the participant whom a skeletal muscle mass did not increase. Data distribution was check by using F-test (Cf. table 4). A result, all data did not have the statistical difference. Therefore, we compared the data using student-t test with the correspondence (Cf. table 5). There was not the statistical significant difference in experiment start time and data at the time of the end, except three data. Statistically significantly, the weight of the participant decreased, and skeletal muscle rates of both arms decreased, and skeletal muscle rates of both legs decreased.

## A Skeletal Muscle Mass and Gene Analysis Result

We divided 16 participants of gene analysis result into two sets; the participant whom a skeletal muscle mass increased (Cf. Table 6), the participants who did not increase (Cf. Table 7). The participant whom a skeletal muscle mass increased was mutated β2AR gene mainly. The participant whom a skeletal muscle mass did not increase was mutated UCP1 gene mainly.

| | Weight body fat % | | Whole body | | Both arms | | Human trunk | | Both legs | | Girth of the Abdomen |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Subcu-taneous fat % | Skeletal muscle % | Subcu-taneous fat % | Skeletal muscle % | Subcu-taneous fat % | Skeletal muscle % | Skeletal muscle % | Subcu-taneous fat % | |
| Effect of existance group | 0.495 | 0.364 | 0.447 | 0.262 | 0.353 | 0.393 | 0.413 | 0.317 | 0.395 | 0.26 | 0.427 |
| Not effect existance group | 0.499 | 0.397 | 0.463 | 0.381 | 0.417 | 0.42 | 0.436 | 0.406 | 0.403 | 0.399 | 0.499 |

**Table 4:** Comparison of each body composition level at the time of experiment stat time and the end (Statistical analysis of F test).

| | Weight body fat % | | Whole body | | Both arms | | Human trunk | | Both legs | | Girth of the Abdomen |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Subcu-taneous fat % | Skeletal muscle % | Subcu-taneous fat % | Skeletal muscle % | Subcu-taneous fat % | Skeletal muscle % | Subcu-taneous fat % | Skeletal muscle % | |
| Effect of existance group | 0.001** | 0.037* | 0.142 | 0.007** | 0.028* | 0.020* | 0.084 | 0.022* | 0.045* | 0.013* | 0.030* |
| Not effect existance group | 0.030* | 0.12 | 0.483 | 0.06 | 0.072 | 0.040* | 0.195 | 0.129 | 0.134 | 0.039* | 0.85 |

**Table 5:** Comparison of each body composition level at the time of experiment stat time and the end (Statistical analysis of associated Student-t test).

Statistical Significant Difference Existence* = $p < 0.05$ ** = $p < 0.01$

| ID | β3AR Gene | UCP1 Gene | β2AR Gene |
|---|---|---|---|
| S-1 | Wild (-) | Heterozygous (+) | Homozygous (++) |
| S-3 | Heterozygous (+) | Wild (-) | Homozygous (++) |
| S-4 | Heterozygous (+) | Wild (-) | Wild (-) |
| S-5 | Heterozygous (+) | Homozygous (++) | Heterozygous (+) |
| S-7 | Wild (-) | Heterozygous (+) | Homozygous (++) |
| S-8 | Wild (-) | Wild (-) | Heterozygous (+) |
| S-11 | Wild (-) | Wild (-) | Heterozygous (+) |
| S-14 | Heterozygous (+) | Wild (-) | Heterozygous (+) |

**Table 6:** Gene analysis result (Effect existence group).

## Discussion

The 16 participants ate two caloric-tofu every day for two months. As for the participant, gene (β3AR, UCP1, β2AR) was analysed on the experiment first day. As for the participant, body composition 11 items were measured on the experiment first day and the experiment last day. We compared a gene analysis result, skeletal muscle rate, the result of the quantity of subcutaneous fat. The participant whom a skeletal muscle mass increased to had a variation in β2AR gene mainly. When the β2AR gene has variation, basal metabolism becomes high 200Kcal. We understand that there is hard to be muscle when this gene has variation. However, in this participant, quantity of muscle statistically significantly increased this time by eating two caloric-tofu. In addition, the quantity of subcutaneous fat statistically significantly decreased in this participant. It was proved that we could increase quantity of muscle because an elderly person ate two caloric-tofu every day. We think that it is more likely to be effective for the muscle reinforcement to take in caloric-tofu to a person having β2AR gene. However, we think that we are insufficient

| ID | β3AR Gene | UCP1 Gene | β2AR Gene |
|---|---|---|---|
| S-2 | Wild (-) | Heterozygous (+) | Heterozygous (+) |
| S-6 | Heterozygous (+) | Heterozygous (+) | Heterozygous (+) |
| S-9 | Heterozygous (+) | Homozygous (++) | Heterozygous (+) |
| S-10 | Wild (-) | Wild (-) | Heterozygous (+) |
| S-12 | Wild (-) | Heterozygous (+) | Homozygous (++) |
| S-13 | Wild (-) | Heterozygous (+) | Wild (-) |
| S-15 | Heterozygous (+) | Wild (-) | Wild (-) |
| S-16 | Heterozygous (+) | Heterozygous (+) | Wild (-) |

**Table 7:** Gene analysis result (Not effect existence group)

by the data of 16 people. However, we show the possibility that there is the muscle reinforcement by taking in caloric-tofu when these data surely have β2AR gene. However, on the other hand, there was the participant who was not able to increase quantity of muscle. The gene of this participant was the UCP1 gene which mutated mainly. The UCP1 gene affects adipose metabolism. When the UCP1 gene has variation, lipid metabolism is delayed. The caloric tofu includes a middle chain fatty acid. A middle chain fatty acid is the fat which it is easy to do for energy in the body. However, a middle chain fatty acid is fat, too. Therefore, as for this caloric tofu, a person with the variation of the UCP1 gene has possibilities without an effect. Of course, we think that these data are insufficient in 16 people. However, we show the possibility that there is not the muscle reinforcement even if we take in caloric tofu when these data surely have UCP1 gene. We want to think about a gene and food choice for the effective skeletal muscle mass reinforcement in future by increasing participants more and continuing studying it. And next time, we would like put our protocol add resistance - type exercise training to get good muscle for old age [11].

Japan is super aged society. Elderly people will increase more and more in future. A protein intake is required for the health maintenance of the elderly person. I think that the caloric tofu is helpful to prevent Sarcopenia and Frailty of the elderly person. The caloric tofu is available in a supermarket. From this result, we are at home and want to enlighten the use of the caloric tofu positively at old man facilities, a hospital.

## Conclusions

The participant is 16 people. The participant was two men and 14 women. Age distribution is from 55 years old to 83 years old. Sixteen participants (2 male, 14 female) was intake two caloric-tofu every day (75 g x 2, 100kcal x 2) during two months. Skeletal muscle masses of result, eight people increased, and quantity of subcutaneous fat decreased (statistically significant). The gene of these subjects was β2AR gene mainly. The gene of eight subjects whom a skeletal muscle mass did not increase to was UCP1 gene mainly. However, there is little number of the data in 16 subjects. Therefore, it is precedent findings to grasping it as a result of this time. It will be necessary to increase the participants to a study more in future to clarify the relations with the gene. However, the possibility that an intake of the caloric tofu helped the reinforcement of the skeletal muscle mass and a decrease in quantity of subcutaneous fat became clear.

## Acknowledgement

This study was conducted by a research aid of Nagoya Women's University 2902 (2017-2018).

## References

1. Silva Neto LS, Karnilowiski MG, Tavares AB, Lima RM (2012) Association between sarcopenia, sarcopenic obesity, muscle strength and quality of life variables in elderly women. Rev. Bras Fisioter 16: 360-367.
2. Go SW, Cha YH, Lee JA, Park HS (2013) Association between Sarccopenia, Bone Density, and Health-Related Quality of life in Korean Men. Korean J Fam Med 34: 281-288.
3. Rizzoli R, Reginster JY, Arnal JF, Bautmans I, Beaudart C, et al. (2013) Quality of life in sarcopenia nad frailty. Calcif Tissue Int 93: 101-120.
4. Fried PL, Ferrucci L, Darer J, Williamson JD, Anderson G (2004) Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. J Gerontol A Biol Sci Med Sci 59: 255-263.
5. Ferrucci L, Guralnik JM, Studenski S, Fried LP, Cutler GB Jr (2004) Interventions on Frailty Working Group. Designing randomized, controlled trials aimed at preventingor delaying functional decline and disability in frail, older persons: a consensus report. J am Geriatr Soc 52: 625-634.
6. Bandeen-Roche K, Xue OL, Ferrucci L, Walston J, Guralnik JM, et al. (2006) Phenotype of frailty: characterization in the women's health and agingstudies. J Gerontol a Biol Sci Med Sci 61: 262-266.
7. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, et al. (2001) Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 56: M146-M156.
8. Ensrud KE, Ewing SK, Taylor BC, Fink HA, Cawthon PM, et.al. (2008) Comparison of 2 frailty indexes for prediction of falls, disability, fractures, and death in older women. Arch Intern Med 168: 382-389.

9. Malafarina V, Uriz-Otano F, Iniesta R, Gil-Guerrero L (2013) Effectiveness of nutritional supplementation on muscle mass in treatment of sarcopenia in old age: a systematic review. J Am Med Dir Assoc 14: 10-17.

10. Salopuro T, Lindstronm J, Erilsson JJ, Valle TT, Hämäläinen H, et al. (2004) Common variants in beta2- and beta3-adrenergic receptor genes and uncoupling protein 1 as predictors of the risk for type 2 diabetes and body weight canages. The Finnish Diabetes Prevention Study. Ckub Genet 66: 365-367.

11. Cermak NM, Res PT, Groot LC, Saris WH, van Loon LJ (2012) Protein supplementation augments the adaptive response of skeletal muscle to resistance-tipe exercise training: a meta-analysis. Am J Clin Nutr 96: 1454-1464.