The Effect of The Caloric Restriction Affected with The Longevity

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Abstract

Objective: To determine the effect of the caloric restriction on the longevity

Methods: Experimental research on caloric restriction for longevity was conducted during August 2013 to January 2014 in Raman hospital, Thailand. One hundred health care personnel were enrolled into the study and baseline information were recorded. The participants were assigned to have 30-percentage daily caloric restriction for 6 consecutive months. Demographic characteristics were analyzed in gender, age and nutritional status. The effect on the longevity was analyzed using hemoglobin A1C (HbA1C) as the indicator. The effect on overweight was also analyzed using body mass index (BMI) as the indicator. The effect on cardiovascular risk was also analyzed using high sensitivity C-reactive protein (hs-CRP) as the indicator.

Results: At the end of the study, the participants lose an average of 1.955 kilograms (P value < 0.001). Average BMI, HbA1C and hs-CRP change were -0.7429 kg/m2 (P value = 0.001), -0.0691 mg/dL (P value < 0.001) and -0.0132 mg/L (P value < 0.001), respectively.

Conclusion: Caloric restriction provided the statistically significant decreasing in weight, BMI, HbA1C and hs-CRP. This study insisted the benefit of caloric restriction on longevity, overweight and cardiovascular risk in human.

Keywords: Caloric Restriction/Longevity/Overweight/Cardiovascular Risk/Hemoglobin A1C/ Body Weight/Body Mass Index/High Sensitivity C-Reactive Protein

1.Introduction

Caloric restriction (CR) has been shown to work in a variety of species, among them yeast, fish, rodents and dogs, even in the primates, such as rhesus monkeys, for decelerate the biological aging process, resulting in longer maintenance of youthful health and an increase in both median and maximum lifespan. However, there is no elaborately scientific research to show the effects of CR on humans.

Furthermore, excess caloric intake is the major cause of overweight and metabolic disorder which increase the cardiovascular risk that becomes the top cause of death in Thai population nowadays. Annual health budget was widely spent on the treatment of obesity and its complications. The mortality rate of obese people is also higher than that in people without obesity.

Therefore, it is reasonable to maintain a good health in order to provide a good quality of life, longevity and to prevent complications in case of any disease had already existed.

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2. Objectives

2.1 To study the effect of caloric restriction on longevity.
2.2 To study the effect of caloric restriction on overweight.
2.3 To study the effect of caloric restriction on cardiovascular risk.

3. Methodologies

Experimental research on caloric restriction for longevity was conducted during August 2013 to January 2014 in Raman hospital, Thailand. 100 of all 150 health care personnel who met the inclusion criteria were enrolled into the study by mean of random sampling and baseline information were recorded. The participants were assigned to have 30-percentage daily caloric restriction (daily calorie were reduced to 70% of baseline requirement) for 6 consecutive months. Demographic characteristics were analyzed in gender, age and nutritional status. The effect on the longevity was analyzed using hemoglobin A1C (HbA1C) as an indicator. The effect on the overweight was also analyzed using body mass index (BMI) as an indicator The effect on cardiovascular risk was also analyzed, using high sensitivity C-reactive protein (hs-CRP) as an indicator.

3.1 Populations

Health care personnel in Raman hospital which characteristic of

1. Male or Female
2. Healthy, no underlying disease such as hypertension, diabetes, heart diseases, liver diseases, malignancies, AIDs, thyroid diseases and other endocrine disorders
3. BMI between 23.5-35.0 (Normal to overweight)
4. Neither pregnant nor intended to be pregnant throughout the duration of the research.
5. No current use of anti-obesity medication or weight loss product, lipid-lowering agent or recently discontinued them for a period of less than three months.

3.2 Materials

1. Personal database form
2. Weight and height measuring devices
3. E-book “Calorie of the food”
4. Dietary diary

3.3 Data collecting

1. General data such as name, gender, age, weight, height, underlying disease, past medical history, history of drug and allergy, past surgical history, family history, current medications and supplements use. Lifestyles such as dietary habits, exercise, alcohol drinking, smoking, addictive substances use.
2. Physical examinations included vital sign, body weight, body height for calculated for BMI, basal metabolic rate (BMR) and daily calorie requirement, before and after the study.
3. Blood tests for HbA1C and hS-CRP, before and after the study.

3.4 Analysis

Collected data were analyzed using Microsoft office excel and SPSS.

1. Analysis of demographic data: age, gender and nutritional status using percentage and mean.

2. Analysis of the relationship of the variable factors before and after the study, using paired t-test, if data were normally distributed or using Wilcoxon Match-Pairs Signed-Rank Test if data were not normally distributed.

4. Results

Table 4.1 Demographic data

Characteristic	Amount	Percentage
Gender		
Male	50	50.0
Female	50	50.0
Age		
25 – 29 years old	6	6.0
30 – 34 years old	26	26.0
35 – 39 years old	25	25.0
40 – 44 years old	16	16.0
45 – 49 years old	12	12.0
50 – 54 years old	11	11.0
55 – 60 years old	4	4.0

As shown in tables 4.1, the ratio of males to females is equal, 50:50. Most samples were in 30-34 years old age group accounted for 26.0 percent. 35-39 years old age group was 25.0 percent. 40-44 years old age group was 16.0 percent. 45-49 years old age group was 12.0 percent. 50-54 years old age group was 11.0 percent. 25-29 years old age group was 6.0 percent. 55-60 years old age group was 4.0 percent. Mean was 39.5 years old. Standard deviation was 7.87. Maximum age was 58 years old and minimum age was 28 years old. The characteristics of the sample by age group are shown in Figure 4.1 and the characteristics of the sample by age group and gender are shown in Figure 4.2.

Figure 4.1 The characteristics of the sample by age group.

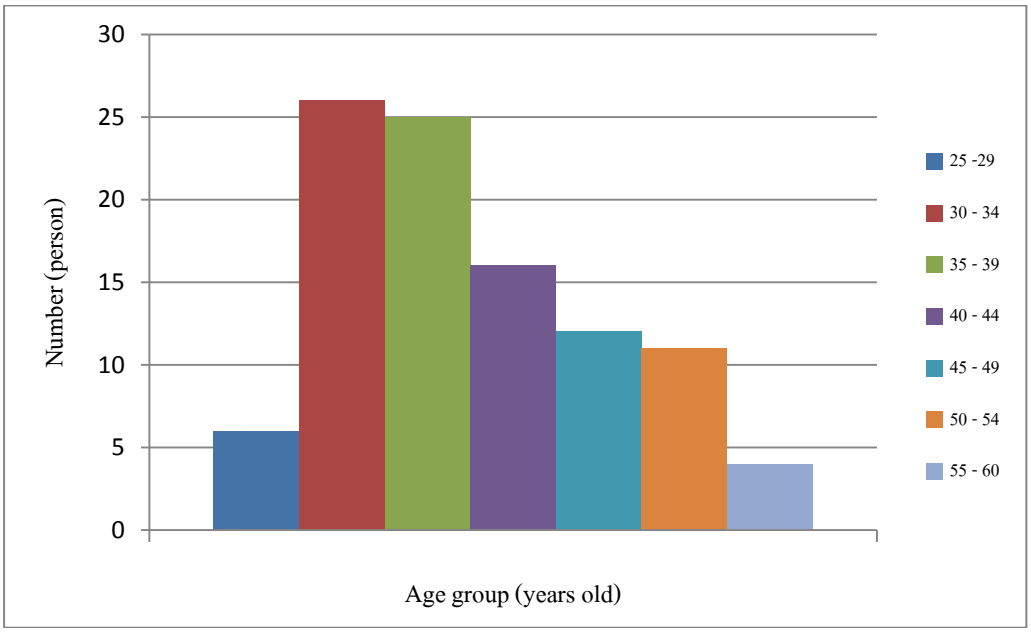

Figure 4.2 The characteristics of the sample by age group and gender.

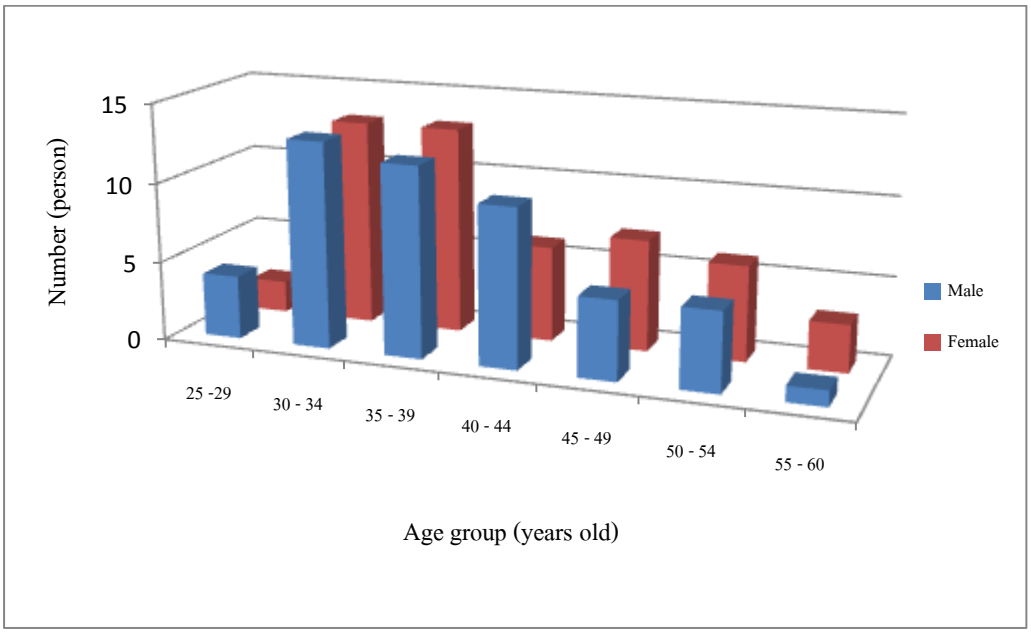

Table 4.2 The test for normality.

	$\bar{X}$	S.D.	K.S.	*p*-value
Age	39.54	7.868	1.376	0.045
Height	160.120	6.5817	0.923	0.362
Weight before the study	65.395	6.3669	0.631	0.821
Weight after the study	63.440	5.9124	0.703	0.706
BMI before the study	25.4695	1.47472	1.251	0.088
BMI after the study	24.7813	2.30932	0.707	0.700
HbA1C before the study	4.7008	0.46587	0.832	0.507
HbA1C after the study	4.6317	0.42286	0.766	0.599
hs-CRP before the study	0.1866	0.09859	1.362	0.049
hs-CRP after the study	0.1734	0.18202	2.590	0.000

As shown in tables 4.2, the data with normal distribution ($p > 0.05$) were height, weight before the study, weight after the study, BMI before the study, BMI after the study, HbA1C before the study and HbA1C after the study. The data with non-normal distribution ($p \leq 0.05$) were age, hs-CRP before the study and hs-CRP after the study.

Table 4.3 The results before and after the study.

Indicators	Results
Weight	
Before the study	65.3950 ± 6.3669
After the study	63.4400 ± 5.9124
Change	-1.955 ± 2.2384
BMI	
Before the study	25.4695 ± 1.47472
After the study	24.7266 ± 2.30932
Change	-0.7429 ± 0.82831
HbA1C	
Before the study	4.7008 ± 0.46587
After the study	4.6317 ± 0.42286
Change	-0.0691 ± 0.12349

Table 4.3 (Continued)

Indicators	Results
hS-CRP	
Before the study	0.1866 ± 0.09859
After the study	0.1734 ± 0.18202
Change	-0.0132 ± 0.16960

As shown in tables 4.3, after the study, weight, BMI, HbA1C and hs-CRP were decrease compared to those before the study.

Table 4.4 Weight comparison before and after the study.

Weight	**Mean**	**S.D.**	**n**	**t-value**	**t-prob**
Before the study	65.395	6.3669	100	8.734	0.000
After the study	63.440	5.9124	100		

As shown in tables 4.4, using paired t-test revealed a statistically significant difference of weight between before and after the study at the p < 0 .05 level.

Table 4.5 BMI comparison before and after the study.

BMI	**Mean**	**S.D.**	**n**	**t-value**	**t-prob**
Before the study	25.4695	1.47472	100	3.537	0.001
After the study	24.7813	2.30932	100		

As shown in tables 4.5, using paired t-test revealed a statistically significant difference of BMI between before and after the study at the p < 0 .05 level.

Table 4.6 HbA1C comparison before and after the study.

HbA1C	**Mean**	**S.D.**	**n**	**t-value**	**t-prob**
Before the study	4.7008	0.46587	100	5.595	0.000
After the study	4.6317	0.42286	100		

As shown in tables 4.6, using paired t-test revealed a statistically significant difference of HbA1C between before and after the study at the p < 0 .05 level.

Table 4.7 hs-CRP comparison before and after the study.

hs-CRP	**Mean**	**S.D.**	**n**	**Wilcoxon value**	**Wilcoxon prob**
Before the study	0.1866	0.09859	100	-6.547	0.000
After the study	0.1734	0.18202	100		

As shown in tables 4.7, using Wilcoxon Signed Rank test revealed a statistically significant difference of hs-CRP between before and after the study at the p < 0 .05 level.

5. Conclusion and discussion

5.1 Conclusion

Caloric restriction provided the statistically significant decreasing in weight, BMI, HbA1C and hs-CRP between before and after the study at the $p < 0.05$ level.

5.2 Discussion

The study revealed the benefits of caloric restriction on longevity, overweight and cardiovascular risk in human. This confirmed the hypothesis that caloric restriction could slow down the aging process, decreased overweight and cardiovascular risk.

The results in this study were consistent with the results from previous study "Alameda County Study" which described three specific lifestyles that can extend the lifespan, the first was limit amount of alcohol consumption, adequate sleep and avoid snack, [1] demonstrated the benefit of caloric restriction not only on the longevity, but also on overweight and cardiovascular risk.

Biomarkers of aging should assay the biological process of aging and not a predisposition to disease It should also cause a minimal amount of trauma to assay in the organism and should be reproducibly measurable during a short interval compared to the lifespan of the organism. [2] Hence, HbA1C was considered to be a suitable choice because of its uncomplicated method, need small amount of blood sample, can be repeated every 2-3 months and affordable.

There are many studies that demonstrate a relationship between HbA1C and aging. [3–10] Especially the study of Pani LN, et al. which studied on HbA1C in each age group among 6,000 non-diabetic participants during 2001–2004 concluded that A1C levels are positively associated with age in non-diabetic populations even after exclusion of subjects with IFG and/or IGT. [11]

5.3 Recommendations

The appropriated amount of CR was not be studied yet, but severe or extreme CR may result in serious deleterious effects, as shown in the "Minnesota Starvation Experiment"[12], It also did not study proportion and types of foods to provide enough energy and essential nutrients for the body. Supplementations may be required.

For further studies, other indicators should be used for more validity and accuracy such as serum insulin, VO_2 Max and IGF-1 level in order to evaluate the effect of CR on longevity, Waist-Hip Ratio, Fasting Blood Sugar (FBS) and Oral Glucose Tolerance Test (OGTT) in order to evaluate the effect of CR on overweight, homocystein, fibrinogen and lipoprotein A in order to evaluate the effect of CR on cardiovascular risk.

Using the applications on smart phone and tablet would provide the convenience for the participants. Moreover, the information will be more accurate, more complete and easy to be collected and analyzed as well.

References

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