

## Weight Reduction by Effective Protocol of Diet and Exercise

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### Abstract

**Background:** Metabolic syndrome (Met-S) and Locomotive syndrome (Loc-S) have been in focus for years. Authors have reduced weight of patients with Met-S and Loc-S by exercise and Low Carbohydrate Diet (LCD). Moreover, we continued clinical research and enlightening activity about LCD through Japan LCD Promoting Association (JLCDPA).

**Intervention Program:** Enrolled subjects were obese patients with 715 men and 2058 women with  $62.2 \pm 12.1$  years. They attended the intervention of weight reduction program by LCD and exercise. The advisers were registered dietitian nutritionists (RDNs) and physical/exercise therapists, and they regularly interviewed the cases for 6-12 months. LCD included 33% of carbohydrate, and exercise included aerobic and anaerobic exercises with 10 kinds of machines.

**Results and Discussion:** The pre-weight vs post-weight is  $63.7 \pm 11.6$  kg vs  $59.4 \pm 10.8$  kg in average, and 61.8 kg vs 57.5 kg in median. Further, quartiles values on 25%-75% were 55.5 kg-69.9 kg vs 51.5 kg-65.3 kg, respectively. The weight reduction was 6.6% in average, and 2.6%-9.8% in quartiles 25%-75%. The distribution shape of both pre- and post-weight in the figure showed slight shift to left direction by 4.3 kg in average. These results suggest that combined therapy would be successful in the presence of advisers, and that data would become basal data for future research.

**Keywords:** Weight reduction; Locomotive syndrome (Loc-S); Low carbohydrate diet (LCD); Japan LCD Promoting Association (JLCDPA); Registered dietitian nutritionist (RDN)

### 1. Abbreviation

- LCD: Low Carbohydrate Diet
- T2DM: Type 2 diabetes mellitus
- CR: Calorie Restriction
- RDN: registered dietitian nutritionist

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- JLCDPA: Japan LCD Promoting Association
- Met-S: Metabolic syndrome
- Loc-S: Locomotive syndrome

## 2. Introduction

In the world, important diseases have changed historically associated with medical, economical, social structures and circumstance changes [1]. There was an era of national problems of tuberculosis in Japan before. Since then, with the discovery of the antibiotics, it has become the era of “adult disease” from previous infectious disease [2]. Subsequently, Doctor Shigeaki Hinohara of St. Luke's International Hospital advocated the name of a disease, “lifestyle-related disease” along with the medical characteristic aspect of the era [3]. It was approved later by the Ministry of Health and Welfare of Japan, and the philosophy of Hinohara-ism has been also widely known.

After that, it has changed from a lifestyle-related disease to “Metabolic syndrome (Met-S)”. The basis of Met-S has obesity in the basis, and some diseases are associated such as hypertension, diabetes, dyslipidemia. Recently, hyperuricemia and/or gout has been also an important factor in recent years [4]. In other words, metabolic syndrome would be obesity plus high blood pressure, hyperglycemia, high lipids, hyperuricemia, which are Obesity + 4 highs. Consequently, improvement of the obesity should be the basis of the therapy. For patients with metabolic syndrome including diabetes and other diseased states, weight loss should be the first basically challenging treatment before using medicine [5].

Furthermore, there are crucial matters to be discussed. As metabolic syndrome is a problem in internal medicine, locomotive syndrome (Loc-S) or frailty has been emphasized to be a problem in orthopedic field. The reasons are that the elderly population is increasing, and lots of problems with the knees and back are present. Among the causes, obesity and overweight may be involved in a large proportion. In fact, the prevalence of metabolic syndrome and locomotive syndrome would correlate with each other [6,7]. The authors have recognized the necessity of weight control for these patients, and instructed weight reduction guided by our registered dietitian nutritionists (RDNs) for years.

The specific method is to intervene the patients with the combination of diet and exercise therapy. As to diet therapy, the authors and colleagues have introduced low carbohydrate diet (LCD) in Japan [8,9]. The efficacy of LCD have been gradually known broadly [10]. As a result, we succeeded in weight reduction in various situations [11]. Further, various studies about LCD and Calorie Restriction (CR) have been already reported in papers and medical associations [12]. In contrast, we have continued exercise therapy in various cases, from young to aged people in a fitness exercise facility adjacent to the clinic. The exercises consist of conventional aerobic exercise and also anaerobic exercise (resistance exercise). Staffs of physical therapists and/or RDNs are accompanied by the patients. In this report, authors present the current status of these situations and treatments.

## 3. Intervention Program

The subjects were the patients who received nutritional guidance on weight loss from 2003 to 2017 in the obesity clinic at our clinic. The background of the health problem included metabolic syndrome in the internal medicine, or locomotive syndrome, frailty or joint problems in the orthopedic medicine.

The methods include several stages, and are shown in the following

- **Dietary instruction:** Three RDNs regularly provided nutritional guidance to patients several times. The meal content recommended in the guidance was low carbohydrate diet with the ratio of 33% carbohydrate [13].
- **Aerobic exercise:** There is a fitness club adjacent to the clinic which has rather large space. As for exercise therapy, physiotherapists, exercise therapists, trainers and staffs are always in the room and instruct the subjects. They recommended walking for 30 minutes or light jogging on a walking machine, a few times a week. If subjects has some difficult situation for the schedule, walking or some exercise would be recommended to continue at home.
- **Anaerobic exercise:** Furthermore, anaerobic training (resistance training) was also recommended to continue for the subjects. The fitness club has lots of necessary equipment for resistance training. There are ten kinds of machines and one circuit training takes about 15 minutes. A series of machines are NewStep<sup>R</sup> and Transforming Lives<sup>R</sup> by Arthritis Foundation, Japan (FIG. 1) [14]. This mechanism is not gravity-produced resistance, but fluid resistant type exercising device, which is safer for the young to the aged population. As exercise rehabilitation approach, total-body recumbent stepper training (TBRST) was continued using several apparatus [15]. There are ten kinds of apparatus as a circuit muscle resistance loading.



FIG. 1. Exercise machines for anaerobic training.

- **Research analysis:** The subjects received the intervention of diet and exercise therapy as described above. Body weight was measured initially and was taken as the pre-weight. Body weight was measured periodically, and the weight after the intervention was taken between 6 and 12 months when the body weight becomes stable as the post-weight. Both of them were used for calculation of the ratio of weight reduction.

#### 4. Results and Discussion

In current study, obtained data are revealed in the following. There are 715 men and 2058 women, and the average age was  $62.2 \pm 12.1$  years (mean  $\pm$  standard deviation). The age in median was 64 years and the quartiles value on 25%-75% was 55-71 years old.

Body weight was influenced by the intervention in those subjects. The pre-weight vs post-weight was  $63.7 \pm 11.6$  kg vs  $59.4 \pm 10.8$  kg, respectively. Analysis of the median was 61.8 kg vs. 57.5 kg. The quartiles values were 55.5 kg - 69.9 kg vs 51.5 kg - 65.3 kg, respectively. Quartiles values on 25%-75% means that 50% of people in the center are situated in this range.

The rate of weight reduction was  $6.6 \pm 5.6$  % (mean  $\pm$  standard deviation), which is statistically reference value. The rate of weight reduction in median was 5.6%, and the quartiles value 25% -75% was 2.6%-9.8%. The central 50% of the subjects are located between 2.6% and 9.8%.

The data mentioned above was revealed in FIG. 2. The pre-weight and post-weight are shown red color and green color, respectively. The distribution of post-weight was shift to left side compared with pre-weight.

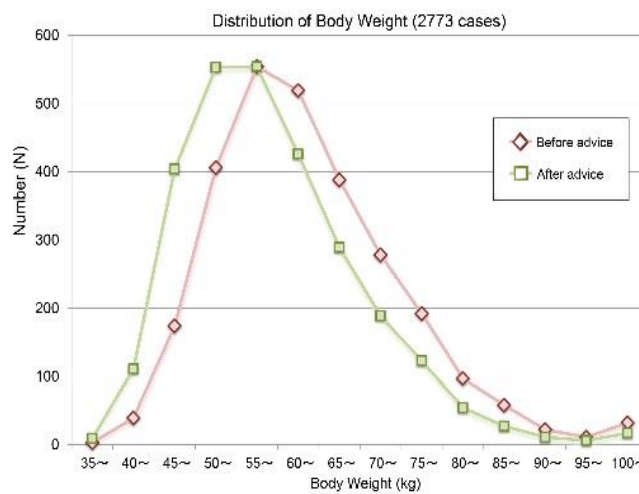


FIG. 2. The distribution of body weight for before and after intervention advice.

In this study, medical intervention of diet / exercise therapy was given to the subjects. They are obese and overweight, which probably come from inadequate lifestyle for years. Lifestyle factors may partly affect the prevalence of Loc-S, suggesting the importance of regular lifestyle and future study of correlation between the both [6]. When health checkup, adding a locomotive test may be useful for identifying patients with high risk of Loc-S or Met-S. The prevalence rates of Los-S and Met-S seem to correlate positively in women. Further, the ratio of lower limb power / body weight may become an index for locomotor dysfunction [7].

According to 2013 AHA/ACC/TOS guideline, there is “Determine Weight Loss and Health Goals and Intervention Strategies” [16]. Recommended goals for weight loss would be described as follows:

- A realistic and meaningful weight loss goal is an important first step,
- Weight loss of only 3%-5% of body weight may lead to clinically meaningful reductions in some cardiovascular risk factors, Larger weight losses than 5% produce greater benefits,
- 5%-10% of reduced weight within 6 months is recommended as an initial goal [16].

Regarding the weight loss mentioned above, discussion would be considered from the three axes which are LCD, aerobic exercise, and anaerobic exercise.

Firstly, Atkins et al. started LCD in Western countries, and LCD has spread [17]. In Japan, the authors and collaborators introduced and spread LCD through JLCDPA. For easier understanding and practice, three types of LCDs were known, which are super, standard, petite with carbohydrate content 12%, 26%, 40%, respectively [18].

On the other hand, carbohydrate ratio was set as 33% in this study. There are some reasons:

- Patients are easy to start and continue at home
- The authors have developed “Nakamura method's food pyramid” with 33% of carbohydrate
- Terry Grossmann who is one of the authority of anti-aging medicine, has also recommended 33% [19].

Secondly, there is a standard guideline from American College of Sports Medicine (ACSM) [20]. ACSM recommended a minimum of 150 min/week of moderate-intensity Physical activity (PA) for overweight and obese adults to improve health. However, 200-300 min/week was recommended for long-term weight loss. After that, rather detailed data with evidence were presented. Moderate-intensity PA 150-250 min/week would be effective to prevent weight gain. Moderate-intensity PA 150-250 min/week provides only modest weight loss. Greater amounts of PA >250 min/week would bring clinically significant weight loss. Moderate-intensity PA between 150-250 min/week improves weight loss in studies that use moderate diet restriction but not severe diet restriction [20].

Tertiary, there are discussions about muscular rehabilitation and kinestherapy appliances. One is traditional type that opposing gravity-produced resistance is provided to the muscle, by raising weights. Another is fluid resistant type exercising device [21]. It uses a piston and cylinder device operated by muscular force. Furthermore, it can provide an opposing force in both directions. The hydraulic resistance system can be widely applied in various situations [22]. The beneficial point is safe for injured or aged person [23]. As the muscle power is smaller, the response load becomes lighter. As the speed is slower to push, the response speed becomes slow, too. Consequently, it can prevent the muscle injury.

Current research has limitations. The ACSM guidelines are helpful, which can be the reference to our research direction. As detailed data in our cases are small, then data analyses are not shown yet. In the future, it would be necessary to measure and evaluate exercise intensity and time in each case. Consequently, in addition to longitudinal and temporal research in each case, many cases from various perspectives can be investigated such as cross-sectional / epidemiological point of view.

## 5. Conclusion

In this study, lots of patients with obesity were given combined treatment of LCD and exercise therapy. The advisers were registered dietitian nutritionists (RDNs) and physical/exercise therapists. The treatment showed successful weight reduction. Then, several axes functions were improved, such as metabolic, endocrine, immunity and circulatory function. Furthermore, some problems related musculoskeletal system would be relieved, such as frailty and locomotive syndrome.

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