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| Title               | Obesity in elementary school children in Northeast China : affecting factors, the effect of intervention, and the impact of body image on weight reduction [an abstract of dissertation and a summary of dissertation review] |
| Author(s)           | 郝, 明                                                                                                                                                                                                                          |
| Degree Grantor      | 北海道大学                                                                                                                                                                                                                         |
| Degree Name         | 博士(保健科学)                                                                                                                                                                                                                      |
| Dissertation Number | 甲第13780号                                                                                                                                                                                                                      |
| Issue Date          | 2019-09-25                                                                                                                                                                                                                    |
| Doc URL             | <a href="https://hdl.handle.net/2115/76423">https://hdl.handle.net/2115/76423</a>                                                                                                                                             |
| Rights(URL)         | <a href="https://creativecommons.org/licenses/by/4.0/">https://creativecommons.org/licenses/by/4.0/</a>                                                                                                                       |
| Type                | doctoral thesis                                                                                                                                                                                                               |
| File Information    | HAO_MING_abstract.pdf, 論文内容の要旨                                                                                                                                                                                                |



学位論文内容の要旨

博士の専攻分野の名称：博士（保健科学）

氏名：郝 明

学位論文題名

Obesity in elementary school children in Northeast China:

affecting factors, the effect of intervention, and the impact of body image on weight reduction

（中国東北部における小学生の肥満について—影響因子・介入効果・ボディイメージの体重減少に対する影響—）

**Background:**

Childhood obesity has become a major health issue. Obesity is a risk factor for lifestyle-related diseases such as high blood pressure, coronary heart disease, and stroke. While symptoms usually manifest in midlife, these conditions develop progressively over time with signs appearing as early as childhood and adolescence.

There are various kinds of methods for exercise and nutrition interventions among school children. Currently, there is no conclusion on whether the sole use of exercise or nutrition as an intervention is more effective than the combination of the two. In addition, there are a limited number of studies that have focused on changes soon after the intervention in addition to conducting a long-term follow-up survey assessing the effect of the intervention.

Body image is recognized as part of the spectrum of conditions related to disordered eating, and given its increasing trend, its relationship with body image and dissatisfaction has become a focus of research. Moreover, there are not many longitudinal studies on body dissatisfaction and its effects on weight reduction; thus, the causal relationship between body dissatisfaction and weight reduction needs to be clarified.

**Objective:**

The purposes of this study are to explore factors associated with nutritional status and designing obesity intervention program (Chapter I); to verify the long-term and short-term effects of this obesity intervention program (Chapter II); to investigate the impact of body image on weight reduction (Chapter III).

**Materials and methods**

In chapter I, anthropometric measurements, a dietary survey, and a physical fitness test were performed to assess 971 primary school children. Education levels of both father and mother, and monthly income were collected using a self-attested questionnaire at the parents' meeting.

In chapter II, 221 primary school children aged 9 to 12 years determined as overweight/obese were randomly assigned to 1 of 4 groups: exercise intervention, nutrition education, combination of both, and control. Nutrition education and rope-skipping sessions were performed for 2 months. Anthropometric measurements and nutrition knowledge test

were administered at baseline, after 2 months (post intervention), and 1 year later (follow-up).

2 years later, 218 students aged 11-14 years and their parents were examined in the chapter III. Measured height and weight were used for calculating BMI. Ideal weight for children was reported by children themselves and their parents. Body dissatisfaction of children was calculated considering children's actual BMI and the ideal BMI values by children themselves, their fathers, and their mothers.

### **Results and Discussion:**

Proportions of overweight and obesity children were generally higher than the reference of China. Besides, skipping ropes for one minute was correlated with upper arm muscle in both urban and rural children ( $P < 0.05$ ). Skipping rope ( $\beta = -0.34$ ,  $P < 0.01$ ); daily exercise time ( $\beta = -0.30$ ,  $P < 0.01$ ); daily screen time ( $\beta = 0.24$ ,  $P < 0.01$ ); edible oils ( $\beta = 0.15$ ,  $P < 0.01$ ), grain ( $\beta = 0.13$ ,  $P < 0.01$ ); family income ( $\beta = 0.11$ ,  $P < 0.01$ ); and sex ( $\beta = 0.10$ ,  $P < 0.01$ ) were significant predictive factors of overweight and obese for both urban and rural children. Improvement in diet, such as reducing grain and edible oils intake, are essential, and increasing exercise to promote muscle mass are recommended. Finally, by increasing muscle mass, skipping ropes can help reduce obesity and improve physical fitness (Chapter I).

The effect of the intervention by the amount of change in body mass index standard deviation scores (BMI-SDS) was confirmed. Combined intervention was found to be most effective for the score of BMI-SDS followed by exercise intervention and nutrition education. Combined intervention was also most effective for the gap in the score of BMI-SDS between following-up and baseline followed by nutrition education and exercise intervention. Overall, the combined intervention had both strongest short-term and long-term effects compared to the other interventions. The exercise intervention had a better short-term effect than nutrition education, while nutrition education had a better long-term effect than the exercise intervention (Chapter II). This refers to the connotation that nutritional education has a larger impact in the long run, highlighting the importance of enlightening the children in nutritional aspects persistently.

The impact of body image on weight reduction was also investigated. Mothers' dissatisfaction with their children's body was found to significantly predict weight reduction in children. However, children's body dissatisfaction negatively predicted weight reduction. Higher BMI of father and mother negatively affected weight reduction of their same-sex children. Our findings indicate the importance of examining gender roles in body image perceptions of parents and children in order to address obesity issues in rural China (Chapter III).

### **Conclusions:**

Cross-sectional study (chapter I) implicated that skipping ropes may enhance muscle mass while intake of edible oil and grain may exacerbate obesity of children. The findings of the intervention study (chapter II) revealed that the combined intervention had the best short-term and long-term effects for overweight children of all interventions. Furthermore, the exercise intervention had a better short-term effect than nutrition education, while nutrition education had a better long-term effect than the exercise intervention. In psychological aspects, body image perceptions of parents and children had an important impact on weight reduction (chapter III).