

The Influence of Foods Containing Zinc on the Wound healing Condition in Pressure Ulcer Cases

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Summary

Pressure ulcer is a disease seen in the elderly and bedridden. Once a pressure ulcer is created, it takes several months to heal. Nutrition management is indispensable to heal chronic wounds such as pressure ulcers. In this research, we examined whether changes were observed in pressure ulcer wound healing conditions, according to the kind of foods they ingested and whether adding zinc, one of the micronutrients reported to have effect on wound healing, was a factor. We have made a comparative study based on these results.

Subjects were patients with pressure ulcer over 65 years old, divided into 3 groups according to the kind of foods ingested. The three groups consisted of the ordinary foods group composed of 5 persons, patients given foods for pressure ulcers composed of 5 persons, in which foods were supplied to all pressure ulcer cases who were able to ingest orally, and patients given foods for pressure ulcer cases plus zinc-enriched foods group composed of 5 persons. Scoring was conducted by the amount of energy, protein and zinc ingested respectively, which was based on the amount of the foods ingested, and conducted by DESIGN, a tool for scoring bed sore conditions with passage of time. Scoring was performed with each group at the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days. A difference in the amount of energy or protein ingested was not observed in each three groups respectively; however, the amount of zinc ingested was significantly different in each group. The changes in pattern with DESIGN was significantly different in the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days with each group. The ordinary foods group saw no significant recovery at 30 days and at 60 days, while the group ingesting foods for pressure ulcer cases and the foods for pressure ulcer cases plus zinc significantly recovered at 60 days. There was no difference between patients given foods for pressure ulcer cases and those given zinc enriched foods for pressure ulcer cases. Taking this into consideration, it is apparent that the amount of micronutrients as vitamins and minerals, including zinc, resulted favorable pressure ulcer healing conditions, although the amount of energy or protein ingested respectively was the same.

key words: the bedridden aged, pressure ulcer, zinc

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I Foreword

It is anticipated that due to the rate of increase in the aging population, the weak, bedridden and those with dementia will continue to increase in Japan. Pressure ulcer is a disease seen in the aged and is said that one out of every 5-10 persons in the 1.7 million of the bedridden population will suffer from pressure ulcer in 2010. The factors in which the aged are affected by pressure ulcers are largely divided into external and internal. The internal factors are aging, malnutrition, low blood pressure and so on. As seen in Tanaka and her report in 1998, the cases of the pressure ulcer generating groups ingests more amounts of nutrition or the same amount, than the non-pressure ulcer cases¹⁾. This lowers the tendency of protein indication, anemic tendency and significantly lowers zinc serum concentration in pressure ulcer patients recognized in the cases of the bedsore generating group. It has been known that zinc, which is a micronutrient, plays an important role in wound healing.

We conducted a comparative study of these results aimed to make a clear correlation between pressure ulcer conditions and nutrition, by observing whether changes were seen in sore healing depending upon the kind of foods ingested, and whether changes were observed in wound healing conditions by adding zinc to the foods. We were able to obtain guidelines on nutrition indications to promote pressure ulcer management.

II RESEARCH METHOD

1. Subjects

Subjects were patients with pressure ulcer cases over 65 years old, sent to hospitals of a specific medical corporation in a particular prefecture and met all standards mentioned below.

- ① activity level-B or C rank by the standard to score bedridden degree prescribed by the Ministry of Health Labor and Welfare.
- ② not limited to diseases except for terminal stage cancer
- ③ cases able to ingest foods orally
- ④ use of Helsinki declaration as a basis which requires consent of the patient or the patient's family. In addition, the consent of the doctor in charge and the ward nurse were obtained.
- ⑤ cases where treatment and management is provided based on the rules for treating pressure ulcer prescribed by Agency for Health Care Policy and Research (AHCP²⁾)

2. Research Period

From June till December in 2003

3. Research Content and Method

1) Research 1 (Research for attributes of subjects and their bedsore condition)

Age, sex and diseases of each subject were assessed and the degree of each subjects' pressure ulcer formation was scored by the Braden Scale³⁾, which predicts the generating risks of creating pressure ulcers. The stage of each subject's pressure ulcer condition was scored by DESIGN⁴⁾, a tool for scoring pressure ulcer condition with passage of time. Total Score by Braden Scale and Total Score by DESIGN among the groups of subjects were equal at the beginning of this research.

2) Research 2 (Foods Content)

Since two years ago, based on exchange of opinions between the nutritionist and the doctor in charge, the hospital has supplied all pressure ulcer patients able to ingest orally, with foods based on each pressure ulcer cases' biochemistry datum. For example, low serum albumin cases were provided with protein-enriched foods and the serious anemic cases were provide with specific foods for anemia such as jelly, pudding, and juices, to the main foods

known as nutritional supplements.

The group of the cases ingesting existing foods for pressure ulcer cases was called Group 1, and the group ingesting foods for pressure ulcer cases plus zinc-enriched foods was called Group 2. The zinc-enriched food (Group 2) was prepared by adding a teaspoon of foods containing zinc to the foods for pressure ulcer cases (Group 1), which was prepared as follows. Food containing zinc (shelled oysters extract - balanster WZ made by NIPPON CLINIC COMPANY) was refined into powder mixed with Japanese plum paste. Before the foods were supplied for the cases, tasting was done to ascertain that it was good enough to eat. Under the doctor's indication, nutritionists' cooperation, and reference to statistical materials presented by the U.S. Environment Protection Agency (EPA) and reference to the 6th revised edition of the Japanese Nutrition document, which states that the maximum permissible amount of zinc ingestion is 30mg/day and the amount of zinc required was 10mg/day at the age of 70, we decided that the amount of zinc for the zinc-enriched foods (Group 2) should be 20mg/day which is double the requirement. Moreover, in order to make the effect of foods distinct, the group of pressure ulcer cases ingesting the ordinary foods for the aged (foods consisting of rice gruel, mixer and puree foods) was called the ordinary foods group (Group 1). In consideration of morals, research for the ordinary foods group (Group 1) was done retroactively at the time when the foods for pressure ulcer cases did not exist, and data was gathered in the same way as Group 2 and Group 3. The amounts of each nutrition ingested was measured by using the 5th Edition of the Japan Food Constituent list, by the amount of foods supplied and the rate of the foods ingested three days before, 5 days after pressure ulcer cases were sent to hospital, at 30 days and at 60 days in each group.

3) Research 3

- ① Height, weight and Body Mass Index (BMI) were measured at the time of blood tests, namely, in the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days.
- ② Scoring was conducted by using the Braden Scale and DESIGN in the beginning (when bed sore cases were sent to hospital), at 30 days and at 60 days, by the doctor, who is also the chairman of the pressure ulcer committee and by the WOC nurse. To better understand the progress, pictures of the sores were taken to assess pressure ulcer conditions.

4. Totaling and Analysis

SPSS (ver.11.0, Windows version) was used to manage the statistics. Repetitive distribution analysis in duality arrangement was used to compare the three groups. Repetitive distribution analysis in unitary arrangement was used to analyze change with passage of time in each group, and distribution analysis in unitary arrangement was utilized to compare the three groups in each time. Schaffe's examination was utilized for multiplex comparison. A significant level was decided to be 5%. The result was indicated in the mean value \pm standard deviation.

III. Result and Consideration

1. Subjects' Outline

No problem was identified that the number of women subjects was more than that of men subjects. Average age of women subjects was higher than that of men subjects, and the average age was 82.4 ± 4.5 years old in the ordinary foods group (Group 1), 81.6 ± 7.1 years old in the foods for pressure ulcer cases group (Group 2), 83.2 ± 8.3 years old in the zinc-enriched foods group (Group 3), which meant no significant differences among the groups. There was also no difference in the height among the groups. The average of BMI was under 18.5kg/m^2 in each three groups, which meant subjects were emaciated and body weight did not improved 60 days later. The location of the pressure ulcer was concentrated mostly in the sacral area. For the main underlying diseases, cerebrovascular

trouble was most prevalent in the three groups, dementia and whole body debility at home were next and diseases particular to the aged were distinguished.

Measuring contact pressure and scoring serious degree of bedsore by Braden Scale were done on the same day by measuring the amount of foods ingested. Significant differences were not seen in each group in the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days. Concerning these two items, since no difference was seen in each group in any time from the beginning (when pressure ulcer cases were sent to hospital), it could be said that each group was homogenous.

3. The amount of foods ingested

The amount of foods ingested per day in each time was measured by the amount of foods prepared and the average rate of foods ingested for three days in the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days in each three groups. The amount of energy, protein and zinc ingested did not change with passage of time nor differed in each group at each interval. (table 1) In the amount of energy ingested per kg of body weight, there was also no difference in each group in the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days. It is assumed that although the amount of energy supplied increased, the amount of foods ingested did not differ because ordinary foods intake decreased, which was replaced by jelly and other food taken for pressure ulcer cases resulting in the same amount of energy intake. As for the amount of protein ingested, different trends were seen in at 60 days between Group 2 and Group 1, which was not a significant difference. Concerning the amount of protein ingested per kg of body weight, no difference was seen in each group in the beginning (when pressure ulcer cases were sent to hospital), at 30 days and at 60 days. This also indicates the amount of energy ingested was not different among the three groups. Concerning the amount of zinc ingested (table 1), although no difference in each group was evident in the beginning (when bedsore cases were sent to hospital), at 30 days and at 60 days, significant difference was seen among three groups in each time, namely, in the beginning (when bedsore cases were sent to hospital), at 30 days and at 60 days ($p < 0.05$).

Table 1 Amount of energy and zinc ingested

	Group 1 N=5		Group 2 N=5		Group 3 N=5		Energy	Zinc
	Energy (kcal)	Zinc (mg)	Energy (kcal)	Zinc (mg)	Energy (kcal)	Zinc (mg)		
beginning	1050 ± 180	4.8 ± 0.8	1030 ± 160	7.0 ± 0.0	1000 ± 290	18.4 ± 1.1	NS	P < 0.05
30 days	1110 ± 220	4.8 ± 0.8	1140 ± 270	8.4 ± 0.6	1120 ± 380	18.8 ± 1.1	NS	P < 0.01
60 days	1020 ± 190	4.0 ± 1.4	1120 ± 270	8.4 ± 0.6	1030 ± 210	18.8 ± 1.1	NS	P < 0.01

4. Scoring by DESIGN

Using DESIGN for scoring, all pressure ulcer cases (except the cases of Group 1) improved at 60 days' hospitalization. The group of the cases ingesting the ordinary foods (Group 2) did not improve significantly at 30 days and at 60 days. On the other hand, considering the foods for pressure ulcer cases group (Group 2), a significant difference was seen between both the beginning (when pressure ulcer cases were sent to hospital) and at 60 days, and between 30 days and 60 days ($p < 0.05$) (Fig. 1) and the pressure ulcer case improved. However, a difference was not seen between the beginning (when pressure ulcer cases were sent to hospital) and at 30 days. Considering the zinc-enriched foods group (Group 3), a significant difference was seen only between the beginning (when pressure ulcer cases were sent to hospital) and at 60 days ($p < 0.05$) (Fig. 2), and a difference was not seen between 30 days and 60

days. Next, considering the difference of change at 30 days and at 60 days among three groups, there was no difference at 30 days among three groups, while at 60 days a significant difference was seen, meaning that the zinc-enriched foods group were superior to the ordinary foods group ($p<0.05$)(Fig. 3). Although different trends of foods for pressure ulcer cases group (Group 2) was seen in comparison with the ordinary foods group (Group 1) at 60 days ($p=0.051$), the difference was not of significant. There was no difference between the foods for pressure ulcer cases group (Group 2) and the zinc-enriched foods group (Group 3) at 60 days.

Taking the above into consideration, it is assumed that pressure ulcer cases' improvement by foods for pressure ulcer cases, which were basic foods for pressure ulcer cases group (Group 2) and the zinc-enriched foods group (Group 3) was a result by adding vitamins and minerals containing zinc. This is because the amount of energy or protein ingested in itself was not increased despite the addition of energy or protein. Therefore, it is suggested that the improvement is influenced by micronutrients rather than energy or protein. However, the nutrient or micronutrient that contributed to the improvement of bedsores cases cannot be specified from this research.

The most ideal condition to accomplish the purpose of this research is to make two groups, namely, the group of cases ingesting ordinary foods and the group of the cases ingesting ordinary foods adding only zinc and comparing the two groups. If this comparison had been fulfilled, the effect of zinc would have been more clearly distinguished because the influences of other minerals and micronutrients could have been excluded. However, the comparison was not fulfilled because this would presently cause ethical problems in hospitals if caretakers created pressure ulcer caused by providing only ordinary foods despite the existence of the better foods for the patients.

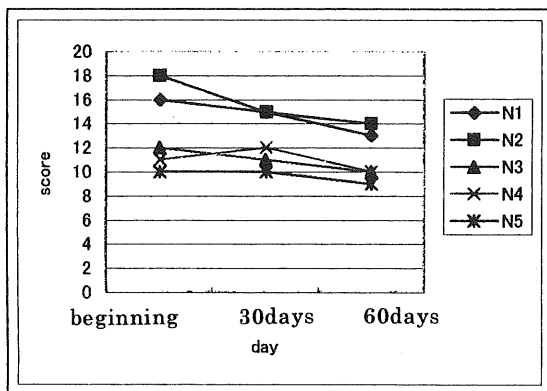


Fig. 1 Changes in score byDESIGN Group 1

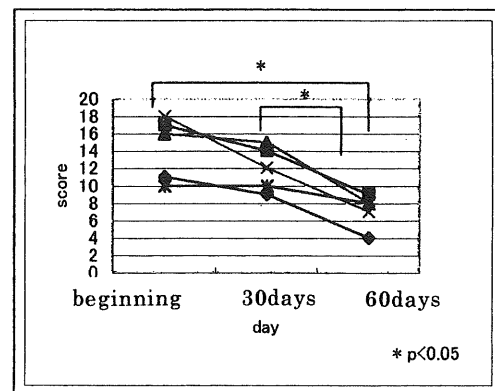


Fig. 2 Changes in score byDESIGN Group 2

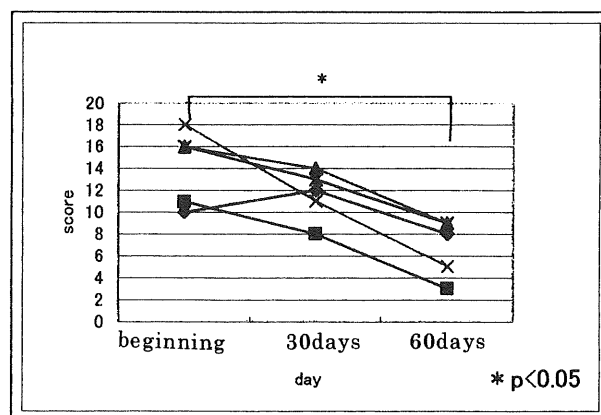


Fig. 3 Changes in score byDESIGN Group 3

IV. Conclusion

1. Zinc was not effective in the improvement of pressure ulcer cases, although twice the amount required was added to the foods for pressure ulcers.
2. Vitamins and minerals were added to the foods for pressure ulcer cases and was effective in improvement of the pressure ulcer condition. However, in comparison with ordinary foods, which the patients ingested prior the study, it was not clear which nutrient or micronutrient were added to the foods for pressure ulcer cases contributing to the improvement of pressure ulcer cases.

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