Study on Relationship between Salt Intake and Environmental Factors
· A Geographical and Ecological approach ·

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To figure a diagram which shows relationship between salt intake and its underlying environment, we made two surveys.

Study I

Objectives :

To figure a diagram which shows relationship between salt intake and its underlying environment, we made two surveys on the amount of taken salt (a word 'salt' implies salt and salt-contained foods in this paper). Subjects of the surveys were individuals and families under different conditions by area comparatively: under different environment or environmental changes, such as urbanization. We extracted environmental factors that affect salt intake.

Both availability and utilization of salt are examined on these area and families.

Methods :

This study is based on data obtained from the following surveys.

Study A: We analyzed the primary data in the study on relationship between the salt intake of adults of the Kingdom of Tonga and their nutrition / health status in comparison between isolated islands and the capital. Not only from it but also differences of the research in 1991 and 1977, we obtained a diagram of salt intake in the family under food environment including food system. we numerically evaluated a tendency of salt intake.

Study B: We made a survey in 1995 using geometric method within the Tokyo district, where tremendous environmental changes has been arising due to urbanization. This research aimed to investigate relationship among the followings: land utilization, farming management, families, behavior of housewives, and other factors.

Results:

Study A: Focusing on salt availability from the point of the food environment of the area, we extracted salt distribution and its mutation from data relating to farming, restaurants, foodmarkets, and so on . Positive correlation was observed between salt distribution and salt intake of the subjects, indicating that the later does greatly depend on salt·availability.

Using geographic analyze, we extracted the following environmental factors which were supposed to increase:

· Salt availability for each family: changes in marketing style of food shops.

· Salt utilization: changes in land utilization, employment, and life style of house-wives (e.g. increase in leisure time, active joining in local communities, changes in shopping behavior).

Study B: This area having the variety of food markets, we extracted the following factors, whose changes were supposed to increase salt utilization: working style, daily life time, food behavior including shopping and cooking, exchange of food information relating to processed foods, food behavior (e.g. skipping a meal, out·home eating, and eating behavior such as what being eaten), dietary belief and food-preference.

Study Ⅱ

Objectives:

The relationship between the intake of salt and salt contained food (herein after calledsalt) and environmental factors has been examined by a longitudial survery .

Method:

The case studies on the relationship among changes in locals created by regional developments, local administration, food system, food information system, people's life-styles and eatinghabits, and salt intake and health status.

By the analysis of local governmental records from 1945 to 1994, a log kept by health nurse and medical examination records of the community people, a longitudinal survery was prepared on the framework designed on study Ⅰ. Based on this longitudinal table, six people whose changes in their health conditions grasped were selected and they were individually interviewed to confirm their eating habits and salt intake of each household, and the findings were examined for the relationship with the environmental factors.

Results:

It was found that in addition to the changes in health plans in the community, An Agriculture and Farming Project, improvement of roads, which triggered opening of supermarkets and decrease in mobile vendors etc. affected directly the lifestyles and eating habits of the community people , becoming the major factor to influence their salt intake.

Study Ⅲ

Objectives:

Behavior of salt intake and its related factors were observed among the different individuals, households, and the areas during two consecutive years; the focus on the firstyear was the area comparison, while on the second year was the comparison among different lifestyle groups and the changes from the previous year. Since this final year, these results have been reconfirmed by comparing with other subject groups. This is for the purpose of [1] generalizing the characteristics of relationship between behavior of salt intake and its reason. In other words; the problems of nutrition and health factors of meals for those who take less salt, passive dietary attitude, dietary behavior and health behavior for those who take less salt, the relationship between

the salt intake and the usage of convenience stores, which was selected for an index of lifestyle. Also this is for the purpose of [2] clarifying the characteristics in nutritious aspect, dietary behavior aspect and lifestyles by understanding the behavior of salt intake in different stages of behavior · obtaining, cooking and taking salts, and classifying the behavior in relation to attitudes, etc.

Method:

We uesed questionnaires which were prepared from the framework of the research designed last academic year. By selecting effectiveitems for the research, the questionnaire was designed to be useful under the different environments and lifestyles.

Study A: [Research Subjects and the period] 135 junior college students of the faculty of nutrition in Kanagawa Prefecture, 35 university student of the faculty of home economics in Kochi prefecture. All of them are female students and research was conducted in December 1996.

Study B: [Research Subjects and the period] 102 university tudents of the faculty of nutrition in Saitama Prefecture , 147 junior college students of the faculty of nutrition in Kanagawa Prefecture , 38 university students of the faculty of home economics in Kochi Prefecture and 200 university students of the faculty of home economics in Korea were the research subjects. All of them are female students and the research was conducted in December 1997.

Results:

Study A:

The statistical reseach on salt intake, nutrient intake, eating patterns, life styles and preference for salt, food preparation and their relationship: Further studies were conducted to 188 women college students on the tendency for lower nutrientintake which had been observed among those who had taken less than 7.5g of salt in the research last year.

(1) From one week of eating records, the average daily salt intake per person was 9.8 g, and5.3g per 1000kcal, the week variance for each individual was at the level of the factor of 34.0 average variance.

(2) The group who took less than 7.5g of salt daily were acutely deficient in calcium, iron and several other nutrients, thus the nutrients balance scores were low. Those who took more than 10g daily were seemed to intake various nutrients well, which showed the same tendency as last year.

(3) Among the 130 items of investigation made up the framework of the research last year, we picked 15 items which showed meaningful relation with the amount of salt intake. Analyzing these 15 items in accordance with the quantification theory of Hayashi's quantification theory type Ⅱ&Ⅲ, 11 out of the 16 were selected as the factors that helped lower amount of salt intake (problematic nutrient intake conditions).

Especially those who were categorized in this group, it was noted high frequency to use convenience stores with three to four times a week. Furthemore, as the factors that have a strongrelation to this tendency following were also remarked: For the food intake situation, the food they eat tends to be highly processed. Judging from their attitude and knowledge for eating, they are not willing to keep "regular habits ". They tend to skip meals. They do not bring self·prepared lunch boxes. They used

to skip habitually their breakfasts in their high school time. As their typical lifestyles, they spend relatively small amount for living expenses and frequently use convenience store even at mid-night. The frequency of use of convenience store in their high school time is more than three to four time a week. As to salt intake, they have less than 7.5g of average intake per week. From the above, it was confirmed that the frequency to use convenience store could be an important factor of the lifestyle or an environmental factor that relates to salt intake.

Study B:

(1) The amount of salt intake and the meal patterns

① The amount of salt intake was 8.4g (±3.1g) in Saitama area, 9.5g (±3.4g) in Kanagawa area and 9.8g (±3.9g) in Korea. If these salt intakes were observed in view of the relationship with the amount of energy intake, high correlation is witnessed in every area and also in the different year of the same area. Similarly high correlation is attested between the amount of salt intake and the major nutrient factors such as protein, lipid, minerals and vitamins.

② If observed by the groups separated by the amount of salt intake, the least salt intake group (less than 7.5g) is significantly low in the amount of energy intake and the proper range scores are lowest that shows the balance between the nutrient factors. The intake of major foods such as cereals, fish, meat and vegetables was considerably small in their food habit, the number of cooking was few and the ratio of ready-made takeout foods was high. Besides, if the combination of cooking is observed, they had the lowest ratio of matching three factors, Shushoku (staple food), Shusai (main dish), Fukusai (side dish) ($p < 0.05$) for breakfast, $p < 0.01$ for lunch)

③ On the other hand, "the group taking more than 13g of salt" was high in the amount of energy and fat intake. Their proper range scores were high but at the same time excessive range scores were also high. This tendency was also observed among the same area and different onesin the longitudinal survey.

④ The relationship between the amount of salt intake, dietary attitude, dietary behavior, health behavior and lifestyles.

The following characteristics were seen in the group taking less than 7.5g of salt in comparison with the other groups.

a) People of this group do not tend to watch or TV programs on cooking and nutrition nor read something about them. Many of them skip meals and their lunch consist of ready-made takeout food most of the times. They do not tend to show much interest in their body or health and the frequency of using convenience stores is high, especially during late at night.

b) In regard to their salt intake behavior, there are high percentage of; "those who cannot obtain information on salt," "those who can check the salt content of foods at the time of the purchase," "those who can eat considering their salt intake," and "those who use table salt or soy sauce before or after tasting it" at the time of meals.

(2) The behavioral classification in three stages (obtaining salt, cooking and taking it) was conducted in regard to the relationship between salt intake behavior and dietary attitude (by quantifiation classification III, cluster analysis) and four

behavior types were obtained. These are type A (those who do not check salt when taking it · 48%), type B (those who take it after checking it · 30%), type C (those who do not take salt after checking it · 16%)and type D (those who do not take it at all · 6%). Different attitudes in the salt intake were observed according to the above types. Especially type B was significantly higher in study needs, intention, and self efficacy than other types, specifically prominent in their attitude of future food procurement (p<0.01). Further their average salt intake amount was 8.7g($\pm$3.0g), which was lower than other groups (p<0.001). In their aspect of lifestyles, they showed the characteristic; the lower frequency of use of convenience stores.

(3) The results of (1) and (2) show almost similar tendency in Korea where they have different food culture.