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Short Report

A Suggestion for a Supplementary Diet Using Potato Chips

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Key words: potato chips, low-salt potato chips, unsalted potato chips, chronic kidney disease, potassium

Abstract

Commercially available potato chips are snack foods with high fat and high salt contents, so they have been regarded as inappropriate foods for many patients in need of dietary restrictions. However, some manufacturers have begun to sell low-salt and salt-free products. For patients with chronic kidney disease who need to secure low salt and adequate energy, potato chips are a food that meets these requirements and is low in protein. The problem is that they are high in potassium. It may be possible to reduce this potassium by modifying the cooking process. If a salt-reduced and potassium-reduced product becomes commercially available without an impaired taste, it can be taken occasionally as one of a number of the supplements.

1. Introduction

According to the 2019 National Health and Nutrition Survey[1)], the average salt intake of Japanese is 10.1 g / day, being 10.9 g / day for men and 9.3 g / day for women. Although salt intake has decreased in the last 10 years, it has not reached the target amount of the Japanese dietary intake standard 2015 edition. Nevertheless, in the 2020 edition, the target amount was further reduced by 0.5 g to 7.5 g / day for men and 6.5 g / day for women.

Sodium is abundant in extracellular fluid in the body and is involved in the regulation of osmotic pressure and acid-base balance, but overdose is a risk factor for lifestyle-related diseases such as hypertension.

In an overview of the 4th Basic Plan for the Promotion of Shokuiku[2)], the goal is to reduce the average salt intake from 10.1 g in the current situation (2019) to 8 g or less by 2025. In addition, Health Japan 21 (second)[3)] states that "the number of registered food companies and restaurants working to reduce salt and fat in foods will increase." It is the responsibility of not only people but also businesses to reduce salt intake and lifestyle-related diseases.

The number of low-salt and unsalted products is increasing in supermarkets. We have also begun to see unsalted and low-salt potato chips. Shortly after World War Ⅱ, potato chips were manufactured by a company called American Potato Chips, which was established by Mr. Toshiba Hamada in 1925, and started selling

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under the Hula brand name, but mass production was only carried out in 1967 by Koikeya. Almost 60 years have passed since then, and many people, from children to adults, now eat them. The purpose of this study was to explore the possibility of using low-salt or unsalted potato chips to help patients achieve a low-salt diet.

2. Methods

2.1 Sample (commercially available potato chips)

Using 75 types from 10 companies (Figure 1) purchased from June to July 2020 at a nearby supermarket or convenience store, the nutrition labels (energy, protein, lipids, carbohydrates, and salt equivalent) per bag were recorded and converted to values per 100 g. The samples were divided into those molded from dried mashed potatoes as a raw material (hereinafter referred to as molding) and those processed from sliced potatoes as a raw material (hereinafter referred to as slicing).

Figure 1　Commercially available potato chips

2.2 Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics 22 (IBM Japan, Ltd., Tokyo) .

To investigate the correlation between energy and nutrients, we checked whether the data were normal, but there was no normality.Therefore, the r-value and p-value were calculated using Spearman's rank correlation coefficient, and the correlation was confirmed.

3. Results

3.1 Commercial potato chips

3.1.1 Comparison of salt equivalent

Of the 75 types from 10 companies, 17 types from 5 companies involved molding and 58 types from 6 companies involved slicing. There was 1 company both molding and slicing, 4 companies molding only, and 5 companies slicing only. The salt equivalent of all the potato chips purchased was 0.06 to 1.82 (median 1.17, hereinafter the same) g per 100 g. There was no low-salt molding, and the weight was 0.80 to 1.70 (1.34) g (Figure 2). There was no-added-salt or reduced-salt slicing, with chips weighing 0.06 to 1.82 (1.17) g (Figure 3).

3.1.2 Comparison of energy and nutrient contents

The amount of energy per 100 g of all purchased products was 492 to 576 (554) kcal, the amount of protein was 3.7 to 7.2 (5.5) g, the amount of lipids was 23.5 to 40.0 (34.9) g, and the amount of carbohydrate was 45.1 to 63.7 (55.1) g. Table 1 shows the energy and nutrient contents by molding and slicing. There was

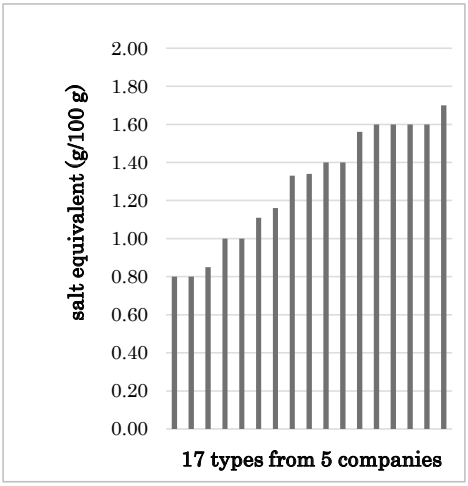

Figure 2 Salt equivalent of commercial potato chips (molding)

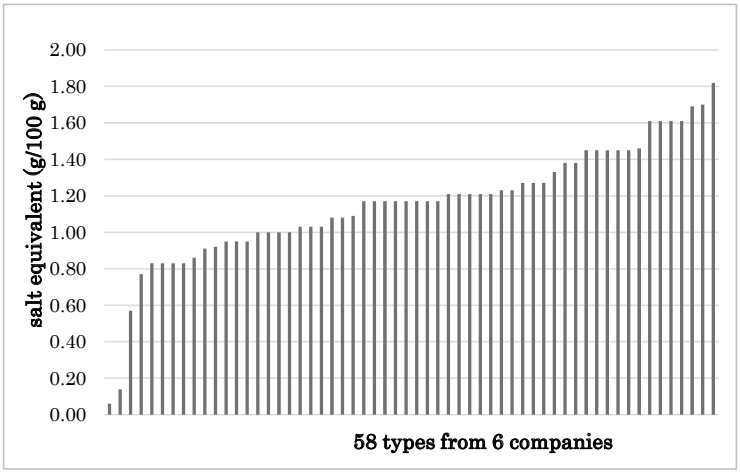

Figure 3 Salt equivalent of commercial potato chips (slicing)

Table 1 Nutrient content of commercial potato chips [median] (per 100 grams)

	all potato chips purchased (n=75)	potato chips (molding) (n=17)	potato chips (slicing) (n=58)
Energy (kcal)	492～576 [554]	510～569 [526]	492～576 [555]
Protein (g)	3.7～7.2 [5.5]	4.1～7.2 [6.4]	3.7～6.7 [5.4]
Lipids (g)	23.5～40.0 [34.9]	26.4～40.0 [29.8]	23.5～38.7 [35.0]
Carbohydrates (g)	48.4～63.7 [55.1]	48.4～62.5 [58.0]	50.7～63.7 [54.9]
Salt equivalent (g)	0.06～1.82 [1.17]	0.80～1.70 [1.34]	0.06～1.82 [1.17]

no significant difference in the energy or nutrient content between molding and slicing. The energy ratio was protein : lipid : carbohydrate = 4 : 54 : 42, being a food with a high energy ratio of lipids.

A negative correlation was noted between energy and protein (Figures 4 and 5), but a positive correlation was found between energy and lipids (Figures 6 and 7). In addition, a negative correlation was observed between energy and carbohydrates (Figures 8 and 9). The same relationship was observed for both molding

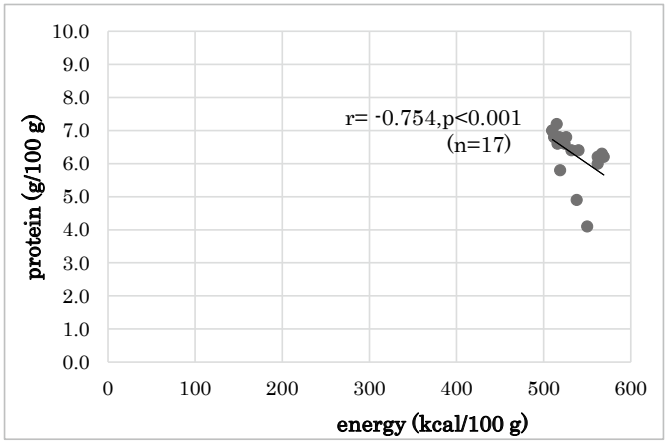

Figure 4 Correlation between energy and protein of molding

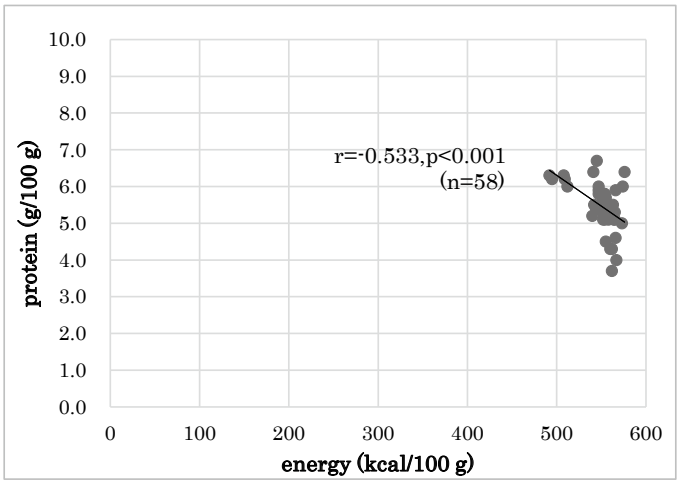

Figure 5 Correlation between energy and protein of slicing

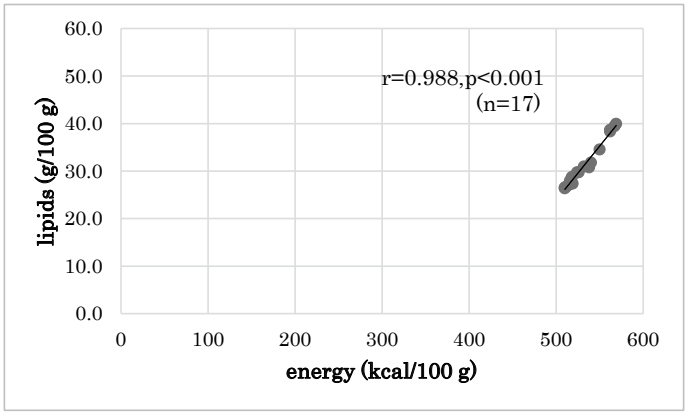

Figure 6 Correlation between energy and lipids of molding

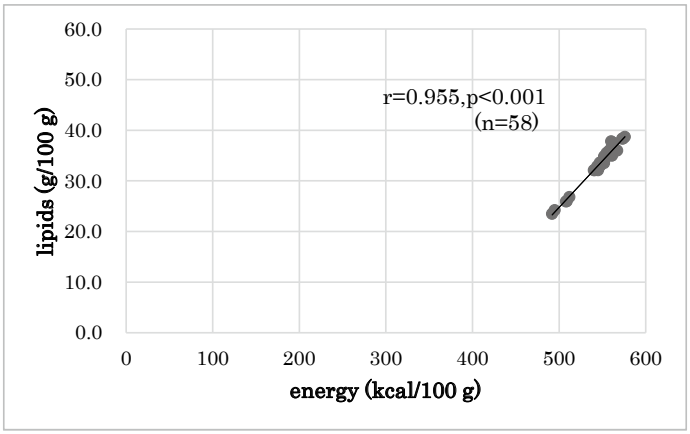

Figure 7　Correlation between energy and lipids of slicing

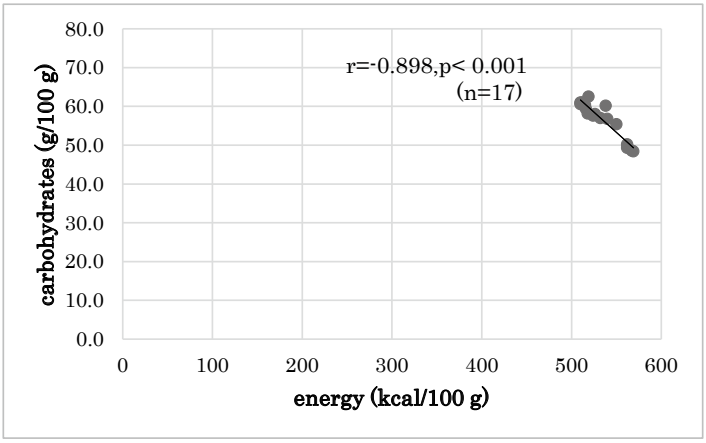

Figure 8　Correlation between energy and carbohydrates of molding

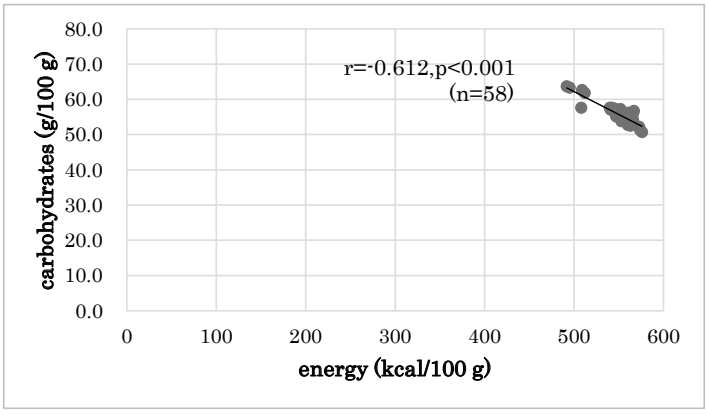

Figure 9　Correlation between energy and carbohydrates of slicing

and slicing. This is because frying in oil during manufacturing increases the content of oil and amount of energy. The increase in lipids is due to the frying method.

In addition, a negative correlation was observed between the amounts of lipids and carbohydrates (Figures 10 and 11).

4. Discussion

4.1 Commercial potato chips

Potato chips show a positive correlation between energy and lipids and a high negative correlation with carbohydrates.There was a negative correlation for proteins, but this was stronger for carbohydrates. This is because proteins make up a small proportion and lipids and carbohydrates make up the majority, so there is a strong negative correlation between lipids and carbohydrates. Many commercially available potato chips are foods with high fat and salt contents, so they have been regarded as inappropriate foods for many patients who require a diet. Furthermore, potato chips contain acrylamide, which is a harmful chemical substance. In addition, there is report[4] that the risk of death rises with an increasing frequency of ingesting french fries.

However, some manufacturers are selling low-salt and salt-free products, and it is becoming an ingestible food for those who only need to reduce salt in their diet. However, many people who need to reduce salt also need to limit their energy intake, and in that case, it may not be an appropriate food.

On the other hand, some people who need to reduce salt also need to secure appropriate energy. In that case, it is a food that can reduce the salt intake and provide appropriate energy by adjusting the intake.

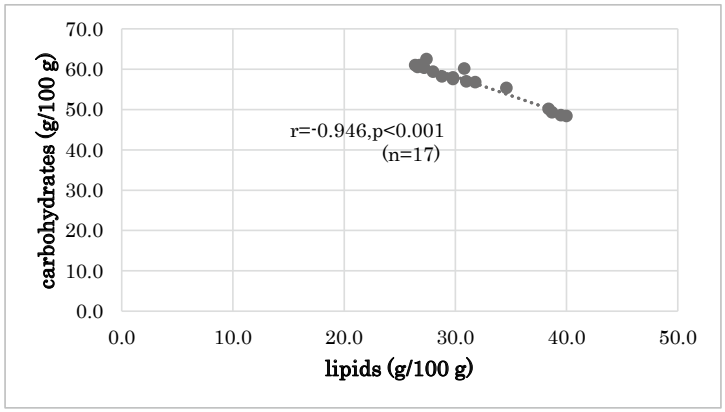

Figure 10 Correlation between lipids and carbohydrates of molding

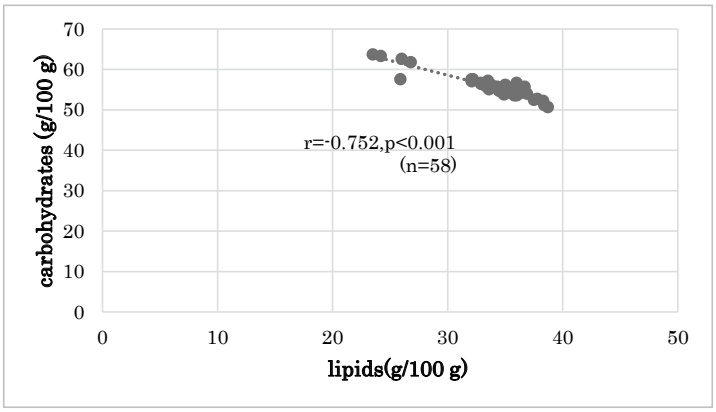

Figure 11 Correlation between lipids and carbohydrates of slicing

Furthermore, since it is a food low in protein, it may be possible to use it as a supplement for chronic kidney disease, etc., if efforts to educate patients to understand the component values are advanced.

However, potatoes are foods that contain a lot of potassium. In the case of chronic kidney disease, some stages cause hyperkalemia, which requires potassium restriction. Potassium is not labeled on product bags because nutrition labeling is not required, but according to Food Composition Tables, it is 900 mg for molding and 1200 mg for slicing per 100 g.

If we ingest 100 g of slices, we will ingest 1200 mg of potassium. If we consume one commercially available bag (about 60 g), it will be 720 mg. Taking this alone at one time is problematic for some diseases. According to Ego[5], if we soak about 20 g of sliced potatoes in 200 mL of water for 30 minutes, we will lose about 25% of the potassium. Therefore, it is possible that differences in the washing method with water, washing time, etc., in the manufacturing process affect the potassium content.

According to Ego[5], after immersing sliced potatoes in water, adjusting the heat so that they do not boil in 100 mL of deionized water and simmering them in water for about 10 minutes reduced the amount by about 60% compared with when they were soaked in water. From this, it is considered possible to reduce potassium by modifying the cooking process. Furthermore, it can be expected that acrylamide will be reduced[6] by such a cooking process. Therefore, for patients familiar with dietary restrictions since childhood, it is possible to take it occasionally as one of the supplementary food options. At present, there are no commercially available potato chips with an adjusted potassium content. A salt and potassium-reduced product with an unaffected taste is desired.

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