Journal of The Korea Convergence Society e-ISSN 2713-6353
Vol. 13. No. 2, pp. 93-101, 2022 DOI : https://doi.org/10.15207/JKCS.2022.13.02.093

Changes in nutrients of some vegetables over the past 40 years -Focusing on the food ingredients table of the Korea Rural Development Administration-

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일부 채소류의 지난 40년간 영양성분 변화추이 - 농촌진흥청 식품성분표를 중심으로 -

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Abstract Based on the nutritional component analysis data of the Rural Development Administration, the change in the main nutrients of vegetables for 40 years from 1981 to 2021 was investigated. Nutrients that showed a decreasing tendency during the investigation period in fruit vegetables were calcium, iron, thiamine, riboflavin, and ascorbic acid, etc. In root vegetables, it tended to decrease in calcium, thiamine, riboflavin, niacin, and ascorbic acid, etc. In leaf vegetables, it tended to decrease in iron, niacin, and ascorbic acid, etc. In leaf and stem vegetables, it tended to decrease in energy, phosphorus, iron, thiamine, riboflavin, niacin, and ascorbic acid, etc. In particular, it has been confirmed that vitamin reductions such as thiamine, riboflavin, niacin, and ascorbic acid, which have important meanings in vegetable intake, have occurred in vegetables over the past 40 years.

Key words : Change in the nutritional content, Korean vegetables, The nutritional component analysis data of the KRDA, 40 years of change, Vitamin reduction

요 약 지난 40년동안 한국산 채소의 영양성분에 변화가 있었는지, 있다면 그 변화의 특수성을 파악하고자 농촌진흥청의 영양성분 분석 자료를 바탕으로 1981년부터 2021년까지 40년간 채소의 주요 영양소 변화를 조사했다. 과채류에서 조사기간 동안 감소 경향을 보인 영양소는 단백질, 지질, 칼슘, 철분, 티아민, 리보플라빈, 아스코르브산이었다. 뿌리채소에서는 에너지, 단백질, 지질, 회분, 칼슘, 티아민, 리보플라빈, 니아신, 아스코르브산이 감소하는 경향이 있었다. 잎채소에서는 에너지, 단백질, 지질, 인, 철, 니아신, 아스코르브산이 감소하는 경향이 있었다. 잎과 줄기 채소에서는 에너지, 단백질, 지질, 당류, 회분, 인, 철, 티아민, 리보플라빈, 니아신, 아스코르브산이 감소하는 경향이 있었다. 특히 식물성 섭취에서 중요한 의미를 갖는 티아민, 리보플라빈, 니아신, 아스코르브산 등의 비타민 감소가 지난 40년간 채소류에서 발생하였음이 확인됐다.

주제어 : 영양소 함량변화, 한국 야채류, 농촌진흥청 식품분석표, 40년간의 변화, 비타민 감소

*This study was conducted by research support from Semyung University 2020.
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Received January 3, 2022 Revised January 25, 2022
Accepted February 20, 2022 Published February 28, 2022

1. Introduction

It is questionable whether the content of nutrients in food is the same as in the past. In the past, when various conditions were insufficient than now, vegetables were smaller in size, harder, and more delicious, so I think the nutrient content was higher than now. This is based on the objective fact that the amount of pesticides currently used is higher than in the past[1] and that a large amount of production is produced in a relatively short time. Therefore, even if you eat the same amount of diet, the content of nutrients is insufficient compared to the past, so it is sometimes used as a basis for the need for auxiliary means such as health supplements. In fact, pesticide usage statistics in Korea began to be calculated in 1970, reaching 10,000 tons in the mid-70s and 20,000 tons in the mid-80s. It is true that pesticide use increased as it maintained about 25,000 tons in the 1990s and reached a high of 28,200 tons in 2001. Since then, it has decreased to 19,131 tons in 2011 and 16,000 tons in 2019. This decrease in pesticide use is interpreted as a result of an absolute decrease in the number of farmers[2].

The use of pesticides per unit area also increased to 8.3 kg/ha in 1986, 11.7 kg/ha in 1991, and 13.5 kg/ha in 2001, and then decreased to 10.6 kg/ha in 2011, 11.8 kg/ha in 2016, and 10.2 kg/ha in 2019. According to these two data, the idea that the use of pesticides has increased compared to the past is believed to be based on facts[1].

On the other hand, it can be assumed that the nutrient content decreases because it generates a large amount of consumption per unit area in a short period of time. Compared to 1981, fruit and vegetable production per unit area increased 2.4 times from 18.74 ton/ha to 45.39 ton/ha in 2020. However, there was no significant difference of 1.3 times for root vegetables from 40.19 ton/ha to 53.05 ton/ha, and 0.91 times for leaf vegetables from 60.25 ton/ha to 54.62 ton/ha[3]. In the case of root vegetables and leaf vegetables, it is questionable whether there is an increase in production per unit area.

Another hypothesis is that there may be changes in plant growth due to changes in global environmental factors such as temperature, amount of sunlight, and carbon. In fact, in North America, the hot spring temperature and rising carbon dioxide concentration were found to have accelerated plant growth, and in Eurasia, spring temperature, carbon dioxide concentration, and solar radiation increased in the direction of helping plant growth[4].

Compared to the past, the content of nutrients in foods has decreased, and anxiety that normal meals may not meet the amount of nutrients required has also contributed to the revitalization of the health food market. The production performance of health functional foods in 2020 was 3.3 trillion won, a significant increase from 2.95 trillion won in 2019 and 2.52 trillion won in 2018. The production of health functional foods has continued to grow with an average annual growth rate of 12% since 2016[5].

In the case of Korea, the Rural Development Administration recently publishes analysis data every five years for the content of nutrients in food[6]. The Ministry of Food and Drug Safety updates not only raw foods but also processed foods using various data as reference materials every year and converts them into a database[7]. These national standard food ingredient table databases are also widely used by companies and individuals in group meals, food manufacturing, and cooking and sales businesses. It is an analysis of nutrients such as food ingredients and food, and is national data used by the Korea Centers for Disease Control and Prevention to evaluate Korean health and nutrition status, the Korea Rural Economic Research Institute's food supply table, and a customized diet.

Is it necessary to take additional measures, such as increasing the amount of food consumed for health or eating health supplements, because the food we currently consume is different from when the production environment was different in the past? However, the difference in nutrients may be due not only to the difference in the times but also to the difference in food varieties, or to the difference in references or analysis institutions, and the difference in analysis methods[4,8]. Therefore, this study attempted to investigate the change in the content of the main nutrients of vegetables for 40 years from 1981 to 2021 based on the nutritional component analysis data of a national institution that judged that this difference is relatively small. Data published every five years from the second revised edition of 1981[9] when data can be obtained were analyzed. Since there were not many food items analyzed 40 years ago and items were simply analyzed by the Rural Development Administration and the Rural Nutrition Improvement Training Institute, the index is smaller than the data we can grasp today, but it was compared and analyzed based on the 1981 analysis data. We tried to find out whether there was a change in the nutritional content of Korea's food for 40 years and the specificity of the change, but we would like to find out the change in the nutrient content of vegetables that are considered to be the most different.

2. Materials and Methods

2.1 The subjects of the survey

Vegetables were divided into all vegetables, fruit vegetables, root vegetables, leaf vegetables, and leaf & stem vegetables. We looked at the changes in nutrients of 9 fruit vegetable crops such as eggplant and red pepper, 15 root vegetable crops such as carrots and deodeok, 21 leafy crops such as cabbage and perilla leaves, and 19 leaf and stem vegetable crops such as crown daisy and spinach every 5 years. In general, leaf vegetables and leaf & stem vegetables are classified into the same classification, but many food items correspond to this, so we divided them and examined them. Foods were compared raw, not dry or boiled.

These items have been analyzed since 1981, so we mainly did things that can observe changes over 40 years. Later, the analysis items were expanded and additionally included, but those without data in 1981 were excluded.

2.2 How to investigate

In this study, the Korea Food Composition Table published by the Rural Development Administration compared and analyzed the same crops in units of 5 years using 1981 (2nd revision)[9], 1986[10], 1991[11], 1996[12], 2001[13], 2006[14], 2011[15], 2016[16] and 2021 Food Composition Database (at the first half of 2021)[7]. Since the data were continuously analyzed by one institution for many years, it was judged that there were relatively few errors due to differences between varieties or experimental analysis methods.

2.3 Analysis method

The nutrients examined were calories, moisture, protein, lipids, carbohydrates, ash, calcium, phosphorus, iron, thiamine, riboflavin, niacin, and ascorbic acid, which have been analyzed and reported since 1981. Among the nutrients, vitamin A data were excluded from the annual comparison due to the omission of data for each item and the change in reference unit.

A simple regression analysis was performed using MS-Excel to change the nutrient content for each item of vegetables, and the obtained slope showed the trend of change in the content. The verification of the difference by vegetable classification group was also confirmed by a one-way variance analysis (ANOVA test, $p<0.05$) using MS-Excel.

3. Results and Discussion

Based on the food ingredients table published by the Rural Development Administration, changes in the nutrient content of vegetables were investigated for 40 years from 1981 to 2021.

For the vegetables analyzed in the second revision of the 1981 Food Ingredients Table, the results were presented by investigating the annual changes in calories, moisture, protein, lipids, carbohydrates, ash, calcium, phosphorus, iron, thiamine, riboflavin, niacin, and ascorbic acid.

The nutrient content of nine fruit vegetable foods such as eggplant and pepper was analyzed for 40 years from 1981 to 2021, and the trend was shown in Table 1. Energy decreased in crops such as egg plants and bell peppers, but increased in red peppers, green peppers, and sweet pumpkin, showing a slight increase overall. Nutrients showing a decreasing tendency in fruit vegetables were protein (-0.0068), lipid (-0.0004), calcium (-0.0947), iron (-0.0168), thiamine (-0.0011), riboflavin (-0.0018), and ascorbic acid (-0.0860). Increasing trends were energy (0.1054), moisture (0.054), sugar (0.0741), fiber (0.0220), ash (0.0006), phosphorus (0.0517), and niacin (0.0004). Changes in calcium (-0.0947), ascorbic acid (-0.0860, energy (0.1054), and sugar (0.0741) were large, but this was due to the large content level of these nutrients compared to other nutrients, so it would be right to identify it as an increasing or decreasing tendency.

Table 1. Changes in nutrient contents of fruit vegetables during 40 years

Food	Energy (kcal)	Moisture (%)	Protein(g)	Fat (g)	Carbohydrate(g)		Ash (g)	Calcium (mg)	Phosphous (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
					Non-fibrous	Fiber								
Egg plant	-0.3133	0.0207	-0.0033	-0.0097	-0.0249	0.0493	0.0069	-0.2567	-0.1333	-0.0076	-0.0066	-0.0040	-0.0007	-0.1967
Red pepper	0.8833	-0.1860	0.0151	0.0420	0.2543	0.1687	0.0172	0.0467	1.6033	-0.0065	0.0070	0.0088	0.0552	3.0372
Green pepper	0.3100	0.2813	-0.0291	-0.0112	0.1771	-0.3117	-0.0081	-0.1073	-0.7833	-0.0200	-0.0060	-0.0093	-0.0200	-0.6512
Cucumber ,imp	-0.0700	-0.0017	0.0076	-0.0035	0.0008	0.0067	-0.0018	-0.060	0.7200	0.0027	-0.0003	-0.0111	-0.0155	-0.4575
Cucumber ,native	0.1190	-0.0286	0.0157	-0.002	0.0374	-0.0029	0.0003	0.2286	-0.3429	-0.0006	0.0007	0.0005	-0.0058	-0.2137
Tomato	-0.0933	0.0597	-0.0306	-0.0048	0.0347	0.0374	-0.0156	0.1300	-1.3433	-0.0102	**-0.0024**	0.0000	0.0046	-0.0096
Sweet pepper	-0.1160	0.0113	-0.0133	-0.0097	0.0307	0.0640	0.0007	0.0933	-0.0800	0.0090	-0.0025	-0.0007	-0.0188	-2.1512
Squash, imp	0.0400	-0.0687	-0.0264	-0.0152	0.0946	0.0630	0.0030	0.1467	0.4013	-0.0063	-0.0003	-0.0021	0.0108	-0.0074
Pumpkin	0.1900	-0.0397	0.0031	0.0105	0.0620	0.1240	0.0030	-1.0733	0.4233	-0.1119	0.0003	0.0014	-0.0063	-0.1236
Mean	0.1054	0.0054	-0.0068	-0.0004	0.0741	0.0220	0.0006	-0.0947	0.0517	-0.0168	-0.0011	-0.0018	0.0004	-0.0860
S.D.	0.3088	0.1117	0.0167	0.0157	0.0797	0.1219	0.0082	0.3541	0.7723	0.0327	0.0036	0.0053	0.0206	1.2049

The slope obtained by simple regression analysis.

Table 2. Changes in nutrient contents of root vegetables during 40 years

Food	Energy (kcal)	Moisture (%)	Protein(g)	Fat (g)	Carbohydrate(g)		Ash (g)	Calcium (mg)	Phosphous (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
					Non-fibrous	Fiber								
Wild garlic	-0.1433	0.0423	-0.0347	-0.0049	0.0497	0.0357	0.0132	-3.1766	-0.4733	0.5306	0.0006	-0.0002	-0.1437	-0.3900
Carrot	-0.2200	0.0513	-0.0139	-0.0080	0.0014	0.0660	-0.0025	-0.4467	0.1633	-0.0318	-0.0009	-0.0003	-0.0118	-0.2033
Dodok	0.3500	-0.1883	-0.0051	-0.1013	0.5021	0.0317	-0.0104	-1.8633	0.8267	-0.0313	-0.0016	-0.0019	-0.019	0.1772
Doraji	-2.5534	0.7397	-0.0067	-0.0018	-0.5411	-0.0303	-0.0078	-2.6234	-0.8533	-0.0852	-0.0022	-0.0049	-0.0597	0.0684
Yam,short type	-1.0048	0.2486	-0.0303	-0.0025	-0.1743	0.0486	-0.0203	-0.6857	-0.0857	-0.0017	0	-0.0011	0.0080	-0.2331
Yam	2.3500	-0.6600	0.0303	0.0223	0.6276	0.0043	0.0006	-0.4857	0.9429	-0.0014	0.0014	-0.0006	-0.0057	-0.0354
Yam,long type	-1.6762	0.4536	-0.0411	0.0009	-0.3593	0.0400	-0.0441	-0.2714	0.0929	0.0070	-0.0019	-0.0007	0.0011	-0.2309
Garlic	-0.7300	0.1220	0.1030	-0.0123	-0.1552	0.0737	-0.0042	-0.6667	2.7966	-0.0137	-0.0059	-0.0081	0.0121	0.2513
Japanese radish root	0.1167	-0.0130	-0.0047	-0.0023	0.0493	-0.017	0.0047	0.0233	-0.2167	-0.0023	0.0002	0.0002	-0.0187	-0.4667
Korean radish large root	-0.3767	0.1260	-0.0381	-0.0002	-0.0542	0.0017	-0.0005	-1.1500	0.2067	-0.0077	0.0018	-0.0002	-0.1109	-0.8646
Ginger root	-0.7400	0.1623	-0.0334	-0.0192	-0.0515	0.0157	-0.0026	-0.0933	0.5367	-0.0055	-0.0001	0.0005	-0.1107	-0.0317
Onion	-0.6800	0.1630	-0.0228	-0.0097	-0.0968	0.0493	-0.0093	-0.0900	-1.3733	0.0020	-0.0016	-0.0035	0.0010	-0.0395
Lotus root	0.8167	-0.2447	-0.0080	-0.0007	0.2799	0.0600	0.0078	0.1400	0.2167	-0.0041	0.0013	0.0020	0	0
Burdock	-0.5900	0.1453	0.0036	-0.0069	-0.0909	0.0790	0.0069	-0.7433	0.1700	-0.0203	-0.0053	-0.0015	-0.1381	-0.0458
Red beets	0.2100	0.0173	0.0195	-0.0021	0.0801	-0.0323	0.0021	-0.6533	-0.3067	-0.0748	0.0016	0.0001	-0.0059	-0.1932
Mean	-0.3247	0.0777	-0.0055	-0.0099	0.0044	0.0284	-0.0044	-0.8524	0.1762	0.0173	-0.0008	-0.0014	-0.0430	-0.1598
S.D.	1.1093	0.3122	0.0365	0.0268	0.2970	0.0366	0.0138	0.9750	0.9395	0.1446	0.0023	0.0025	0.0576	0.2844

The slope obtained by simple regression analysis.

Table 2 shows the changes in the nutrients of the 15 crops of root vegetables.

Carrots have tended to decrease in all nutrients except moisture, sugar, fiber, and phosphorus over the past 40 years, while yam has tended to increase in all nutrients except moisture, calcium, iron, riboflavin, niacin and ascorbic acid. There were many differences in nutrients that increased or decreased for each vegetable, but overall, they increased in moisture (0.0777), sugar (0.0044), fiber (0.0284), phosphorus (0.1762), and iron (0.0173). Energy (-0.3247), protein (-0.0055), lipid (-0.0099), ash (-0.0044), calcium (-0.8524), thiamine (-0.0008), riboflavin (-0.0014), niacin (-0.0430), and ascorbic acid (-0.1598) showed a decreasing tendency. It is noteworthy that root vegetables showed a decrease in minerals and vitamins such as calcium (-0.8524), thiamine (-0.0008), riboflavin (-0.0014), niacin (-0.0430), and ascorbic acid (-0.1598).

Table 3 shows the changes in the nutrients of 21 crops of leaf vegetables such as napa cabbage and perilla leaves.

In the case of cabbage, which is one of the most consumed foods, moisture (0.0340), sugar (0.0050), ash (0.0020), iron (0.0067), thiamine (0043), and niacin (0.0013) increased. Energy (-0.1133), protein (-0.0073), lipid (-0.0067), fiber (-0.0189), calcium (--1.1500), phosphorus (-1.1367), riboflavin (-0.0017), and ascorbic acid (As a whole, the leaf vegetables increased in moisture (0.0303), sugar (0.0374), fiber (0.0350), ash (0.0025), calcium (0.9692), thiamine (0.0014), and riboflavin (0.0004). Energy (-0.1526), protein (-0.0055), lipid (-0.0157), phosphorus (-0.2788), iron (-0.0012), niacin (-0.0266), and ascorbic acid (-0.3880) tended to decrease.-0.7567) tended to decrease.

Table 3. Changes in nutrient contents of leaf vegetables during 40 years

Food	Energy (kcal)	Moisture (%)	Protein(g)	Fat (g)	Carbohydrate(g)		Ash (g)	Calcium (mg)	Phosphous (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
					Non-fibrous	Fiber								
Mustard leaf	−0.3400	0.0640	0.0023	−0.0063	−0.0143	−0.0423	−0.0067	−0.500	−0.3467	0.0120	0.0120	−0.0024	−0.2703	3.2034
Sweet potato leaf	0.0433	0.0420	0.0005	−0.0037	0.0013	0.1195	0.0093	2.7534	0.4867	0.0779	0.0044	0.0065	−0.0020	−0.0394
Coriander	−0.7933	0.2027	0.0537	−0.0257	−0.1233	−0.1143	−0.0107	−2.4700	−2.3166	0.6657	−0.0070	0.0048	0.0307	−1.0533
Red pepper leaf	−0.3900	0.1100	0.0246	−0.0132	0.0192	−0.0027	−0.0255	−0.9033	−0.0467	0.0575	−0.0120	−0.0006	0.0109	−4.7980
Beets	−0.4533	0.0853	−0.0031	−0.0157	−0.0318	0.0337	0.0039	−0.4600	−1.3667	−0.1210	−0.0022	−0.0031	0.0123	−0.7780
Perilla leaf	0.1900	−0.0377	0.0241	−0.0020	0.0924	0.0983	−0.0012	3.7466	−1.4433	−0.4771	0.0056	0.0058	−0.0093	−0.7660
Cauliflower	−0.1310	0.0119	−0.0205	−0.0330	0.0669	0.0688	0.0032	−0.0738	−1.3119	0.0134	0.0038	−0.0052	−0.0110	0.4788
Broccoli	0.1024	−0.0171	−0.0434	−0.0229	0.1282	0.0593	−0.0029	0.7143	−1.1429	0.0200	0.0006	−0.0143	0.0034	−0.6180
Bud of aralla	−0.3667	0.1033	−0.0456	−0.0242	0.0501	−0.0033	−0.0079	−0.6933	−0.7968	−0.1301	0.0040	0.0024	0.0284	0.4373
Japanese radish leaves	0.0133	0	0	0	0.0280	0.0027	0	0	0.6667	0	0	0.0032	0	0.3967
Korean radish leaves	−0.6467	0.1560	−0.0030	−0.0090	−0.1197	−0.0241	0.0180	3.3600	1.0800	0.1710	0.0045	−0.0039	−0.2790	0.5800
Napa cabbage	−0.1133	0.0340	−0.0073	−0.0067	0.0050	−0.0189	0.0020	−1.1500	−1.1367	0.0067	0.0043	−0.0017	0.0013	−0.7567
Red cabbage	0.0467	−0.058	−0.0346	−0.0461	0.1960	0.0723	0.0064	−0.0200	−0.5100	0.0017	0.0017	0.0013	−0.0255	−0.7694
Lettuce, imp	−0.2133	0.0483	−0.0273	−0.018	−0.0057	−0.0187	−0.0037	−0.3233	−0.1967	−0.0717	0.0006	−0.0038	−0.0127	0.1700
Lettuce, native	−0.0024	0.0012	0.0118	−0.0028	0.0275	0.0671	0.0125	0.1333	0.3429	−0.0422	−0.0001	0.0025	0.0007	−0.1770
Mallow	−0.2500	−0.0530	−0.0481	−0.0608	0.1669	0.1083	0.0353	4.8466	1.6733	−0.1084	0.0002	0.0037	0.0027	0.4349
Cabbage	−0.0300	−0.0890	0.0009	−0.0131	0.0738	0.0952	0.0015	0.6800	−0.0033	−0.0084	−0.0022	−0.0112	0.0106	−0.2503
Bamboo shoot	0.0867	0.0253	−0.0035	−0.0085	0.0693	0.0163	−0.0083	0.0133	−0.6167	−0.0202	−0.0026	0.0031	−0.0144	−0.1060
Chwi	0.3024	−0.0167	−0.0022	−0.0016	0.1293	0.0476	−0.0070	2.0190	−0.1452	−0.0096	0.0005	0.0072	0.0072	0.1978
Kale	−0.4467	0.1183	−0.0578	−0.0137	−0.0494	0.0914	0.0128	2.3800	−0.9067	−0.0598	0.0078	−0.0019	−0.0422	−4.2358
Pumpkin leaf	0.1867	−0.0943	0.0630	−0.0021	0.0764	0.0777	0.0221	6.3000	2.1834	−0.0016	0.0046	0.0150	0.0008	0.3019
Mean	−0.1526	0.0303	−0.0055	−0.0157	0.0374	0.0350	0.0025	0.9692	−0.2788	−0.0012	0.0014	0.0004	−0.0266	−0.3880
S.D.	0.2906	0.0792	0.0313	0.0156	0.0827	0.0597	0.0131	2.1953	1.0913	0.1955	0.0051	0.0064	0.0841	1.6322

The slope obtained by simple regression analysis.

Table 4 shows the changes in the nutrient content of 19 crops of leaf & stem vegetables such as crown daisy and spinach. In the case of green onions, only moisture (0.1220) and fiber (0.0047) increased. Energy (-0.4433), protein (-0.0085, lipid (-0.0088), sugar (-0.0533), ash (-0.0080), calcium (-2.0966), phosphorus (-0.5567), iron (-0.0009), thiamine (-0.0004), riboflavin (-0.0013), niacin (-0.0135), and ascorbic acid (-0.5272) are reduced.

As a whole, the leaf & stem vegetables increased in moisture (0.0794), fiber (0.0333), and calcium (0.1807). Energy (-0.0188), protein (-0.0188), lipid (-0.0104), sugar (-0.0038), ash (-0.0072), phosphorus (-0.2125), iron (-0.0446), thiamine (-0.0024), riboflavin (-0.0010), niacin (-0.0120) and ascorbic acid (-0.2550) showed a decreasing tendency.

Looking at all vegetables by group, there was a decrease in all nutrients except moisture, carbohydrates, and calcium. Protein, lipid, ash, phosphorus, iron, thiamine, riboflavin, niacin, and ascorbic acid were decreasing, especially vitamins that can be seen as important nutrients in vegetable intake. In calcium, there was a tendency to increase, but it differs from group to group, because calcium in fruit and root vegetables was decreasing and calcium content in leaf vegetables increased significantly.

When examined through ANOVA test $p<0.05$ to see if there was a difference in changes in nutrients by group in fruit vegetables, root vegetables, leaf vegetables, and leaf and stem vegetables, there was a significant difference only in calcium ($p=0.0237$), and all other nutrients showed no difference by classification. It seems that this is because calcium content was showing a relatively strong tendency to increase only in leaf vegetables.

Table 5. The Mean of changes in nutrient contents during 40 years.

Food	Energy (kcal)	Moisture (%)	Protein(g)	Fat (g)	Carbohydrate(g)		Ash (g)	Calcium (mg)	Phosphous (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
					Non-fibrous	Fiber								
Fruit veg.	0.1054	0.0054	−0.0068	−0.0004	0.0741	0.0220	0.0006	−0.0947	0.0517	−0.0168	−0.0011	−0.0018	0.0004	−0.0860
Root veg.	−0.3247	0.0777	−0.0055	−0.0099	0.0044	0.0284	−0.0044	−0.8524	0.1762	0.0173	−0.0008	−0.0014	−0.0430	−0.1598
Leaf veg.	−0.1526	0.0303	−0.0055	−0.0157	0.0374	0.0350	0.0025	0.9692	−0.2788	−0.0012	0.0014	0.0004	−0.0266	−0.3880
Leaf & stem veg.	−0.3288	0.0794	−0.0188	−0.0104	−0.0038	0.0333	−0.0072	0.1807	−0.2125	−0.0446	−0.0024	−0.0010	−0.0120	−0.2550
Total	−0.2090	00525	−0.0096	−0.0106	0.0226	0.0311	−0.0022	0.1585	−0.1060	−0.0119	−0.0006	−0.0008	−0.0216	−0.2500

The slope obtained by simple regression analysis.

4. Summary and Conclusion

It can be seen that the nutrient content of food achieves the basis of a healthy diet of the people. This is because even if the same amount of food is consumed, a large amount or insufficient amount of nutrients can be consumed. In order to know if there is a difference in the content of nutrients in the food we consume compared to the past, we investigated the change in the nutrient content of some vegetables for about 40 years from 1981 to 2021. It was based on the analysis data of the Rural Development Administration's food ingredient table with continuous analysis data. Through simple regression analysis, the increase or decrease of change was confirmed, and the difference by nutrient and vegetable group was examined. Nutrients showing a decreasing tendency over the past 40 years in fruit vegetables were protein (-0.0068), lipid (-0.0004), calcium (-0.0947), iron (-0.0168), thiamine (-0.0011), riboflavin (-0.0018), and ascorbic acid (-0.0860). It was energy (0.1054), moisture (0.054), sugar (0.0741), fiber (0.0220), ash (0.0006), phosphorus (0.0517), and niacin (0.0004) that showed increasing tendencies. In root vegetables, it increased in moisture (0.0777), sugar (0.0044), fiber (0.0284), phosphorus (0.1762), and iron (0.0173). Energy (-0.3247), protein (-0.0055), lipid (-0.0099), ash (-0.0044), calcium (-0.8524), thiamine (-0.0008), riboflavin (-0.0014), niacin (-0.0430), and ascorbic acid (-0.1598) showed a decreasing tendency. In leaf vegetables, it increased in moisture (0.0303), sugar (0.0374), fiber (0.0350), ash (0.0025), calcium (0.9692), thiamine (0.0014), and riboflavin (0.0004).

Energy (-0.1526), protein (-0.0055), lipid (-0.0157), phosphorus (-0.2788), iron (-0.0012), niacin (-0.0266), and ascorbic acid (-0.3880) tended to decrease. In leaf and stem vegetables, overall, it increased in moisture (0.0794), fiber (0.0333), calcium (0.1807), and so on. Energy (-0.3288), protein (-0.0188), lipid (-0.0104), sugar (-0.0038), ash (-0.0072), phosphorus (-0.2125), iron (-0.0446), thiamine (-0.0024), riboflavin (-0.00010), niacin (-0.0120), and ascorbic acid (-0.2550). Most of the cases did not show a certain increase or decrease even in the same classification, but it was identified as an average trend.

Looking at all vegetables, an increase could be observed in moisture, carbohydrate, and calcium content, but the rest of the nutrients showed a tendency to decrease. It is difficult to say that increasing the content of moisture or carbohydrates has a relatively significant nutritional significance in vegetables. During the survey, the content of fruit and root vegetables decreased on average, and the increase in calcium content was noticeable in leaf vegetables such as sweet potato leaves, perilla leaves, Korean radish leaves, mallow, and pumpkin leaves. The explanation of this can be first suspected of the increase in the use of calcium compounds such as fertilizers, but the exact cause seems to require further research.

The rest of the nutrients showed an overall decline. Energy, protein, lipids, ash, phosphorus, iron, thiamine, riboflavin, niacin, and ascorbic acid showed a decreasing tendency.

There are differences in each food item and group, but it is noteworthy that most nutrients tend to decrease. In particular, vitamins are a very important nutrient in vegetable intake, and a decrease in vitamins has been observed in all groups except for some leaf vegetables. If leaf vegetables and leaf & stem vegetables are grouped together, it is the result of a tendency to decrease in all groups. ascorbic acid was also decreasing in all vegetable groups. Since the recommended amount of each nutrient, the content of each food, and the intake of each food are all different, it is difficult to estimate how much nutrients actually consumed decrease, but the objective decrease in nutrient content was confirmed. Considering the importance of vitamins as major substances in human body's strong antioxidant factors, protein, and mineral metabolism, this reduction seems to need to be paid attention. Of course, there are various sources of vitamins in addition to vegetables, such as fruits, so it is difficult to say that the decline in this study is directly related to changes in nutritional intake or the need to take additional nutritional supplements. Meanwhile, according to a study by R. J. Marles 8, who reviewed numerous papers, there was no evidence that the mineral content of vegetables, fruits, and grains decreased compared to the past. Some high-yield varieties have mineral dilution effects, but daily intake is sufficient. However, this is a comparison of different analysis methods, varieties, and regions. These changes in nutrients are also found by crop varieties, cultivation areas, ripening, sample size, sample collection methods, analysis methods, or statistical processing methods [6]. Since this study continuously investigated the data analyzed by a state agency using the same analysis method, the error seems to be relatively small. It can also be guessed as a result of global warming that has been investigated in recent studies[17] The association between global warming and food poisoning has been studied[18], but studies on changes in nutrients in food are still insufficient. In the future, it seems that more in-depth research should be involved as the cause of this reduction in nutrients.

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