Impact of the Soluble and Insoluble Fibers on the Human's Health

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Abstract

The scientific research show that some of the dietary fiber has a structural role in its plant sources, being insoluble in water. These are cellulose, hemicelluloses and lignin, and are found especially in green bean peas. Another part of the food fiber has a repairing role and are soluble in water (Mogoș, V.T., 1999, p.106). In this experiment we monitored the fiber and minerals from vegetables.

From the analysis performed on 12 vegetables (potatoes, cauliflower, broccoli, cabbage, tomatoes, cucumbers, red peppers, peppers, celery, parsley, peas, green beans) it was quoted that Na varies between 2 mg / 100g for peppers red up to 130 mg / 100g for celery, K ranges from 170 mg / 100g for cucumber to 900 mg/100g for parsnip. Like Mg, which are essential for good bone and heart health, they have significant limits of 300 mg/100g for parsnip and 70-75 mg/100g for cabbage and broccoli.

Key words: fiber, mineral, vegetables, digestibility
J.E.L. classification: M31

1. Introduction

The food fibers are polysaccharides of vegetable origin that may soluble or insoluble. An important part of the food fiber has a repairing role and are soluble in water. This category includes pectin, gums, mucilage and hemicelluloses. However, some people with various medical problems are recommended to have a low fiber diet for a certain period of time. Dietary fiber diet is effective for digestive tract irritation. Such a diet is beneficial in treatments for: abdominal cramps - ulcerative colitis - intestinal blockage - after surgery on the digestive tract. At the same time we studied the capacity of some vegetables such as: potatoes, cauliflower, broccoli, cabbage, tomatoes, cucumber, red pepper, peppers, celery, carrot, parsnip, green beans, beans.

A large number of food substances show anticancer properties. They include: food fiber, vitamins A, C, D, E, selenium, calcium, zinc, isothiocyanates, flavones, phenols, protease inhibitors, some amino acids. Food fibers are polysaccharides of vegetables origin that are not digested in the small intestine. That's why some degraded in the colon. Thus when dietary fiber absorbs water from the stomach, it makes us feel full, and thanks to this feeling of satiety, we eat less. here is the explanation for which recommending a healthy lifestyle is to consume at least two liters of water a day.

Every day you consume boiled or steamed vegetables and fruits by 30%. the rest of ideal quality consists of fresh and preserved fruits in sugar (https://academic.oup.com/nutritionreviews/article-abstract/67/4/188/1901012-Optimal nutrition for the consumer´s health.ro).

2. Theoretical background

The first category of insoluble dietary fiber favors intestinal peristalsis and occur in fecal bowel formation. The second category of soluble food fibers forms gels that sequester some of the substances present in the intestinal lumen. Both categories of fiber interfere with different mechanisms of anticancer protection, reducing the carcinogenic risk (Mogos, V.T., 1999, p. 106).

In this regard, we have identified a lot of vegetables as possible with high frequency in daily food consumption. We determined the amount of soluble food fibers, non-cellulosic polysaccharides - gums, mucilage, pectin, hemicelluloses and the amount of insoluble cellulose-cellulose polysaccharides - cellulose and lignin. Hydrophilic water retention capacity. Food fibers retain water by absorption, absorption, and to a lesser extent on the outer surface of the fiber matrix (free water). Among the factors that influence the ability of water retaining fibers, the most important are: the particle size and shape, as well as the composition and structure of the food fibers. Water retaining capacity for food fibers has values ranging from 2 to 8 g water /1 g fiber. (https://www.hindawi.com/journals/jchem/2017/9340427/abs/ Importance of food fiber, /Scientific Journal, Romania).

3. Research methodology

In the experimental study it followed the hydration of the total and insoluble fiber from various vegetable we eat in the daily diet, which are considered as basic food for the consumers. At the same time we investigated the behavior of hydrated fiber at different time intervals: after 6 hours, 12 hours and 24 hours. depending on the degree of hydration of the food fiber, the specific particle absorption surface increases, there by accelerating the intestinal transit. It is found that the beans (100%), the green beans, the peas, the tomatoes and the cauliflower (68% over 68%) have a very good absorption capacity on the fiber. It can be said that the digestibility of these vegetables is also higher than other vegetables because the surface formed by the food bowl particles increases by the absorption of water.

Also, it is found that after 24 hours the pH values have decreased, which means the occurrence of fermentative phenomena. This affects the digestibility of the food because the alcoholic fermentation produces carbonic acid, which can cause the discomfort, disrupting the normal and efficient functioning of the digestive tract.

During the experiment we studied some vegetables such as: potatoes, cauliflower, broccoli, cabbage, tomatoes, cucumber, red pepper, peppers, celery, parsnip, green peas, green beans.

The absorption capacity of organic substances is very important for technological process when the food fibers are used as a support for different flavors.

the fermentable capacity of fiber it refers to their susceptibility to degradation in the colon by the action of fermentation bacteria. This property is important in terms of nutrition and less technologically.

Methods for determination of soluble, insoluble and total fibre content (gravimetric method)

Generally, fibre means plant material that resists the attack of digestive enzymes. This includes non-starch polyglucide, lignin and their associated substances.

After solubility in hot water, dietary fibre is divided into soluble fibre and insoluble fibre.

The principle of the method. Successive enzymatic hydrolysis of the sample with thermostable ά-amylase, protease and amylo-glucosidase for the removal of digestible material (starch, proteins), followed by precipitation of polyglucide from fibre. The residue obtained is dried and weighed, and its mass is corrected for the protein and ash content.

Equipment. For use, the crucibles are prepared as follows: calcined overnight at 495 ºC, Celita and ash are removed by vacuum, then immersed in Micro 2% washing solution for 1 hour. Rinse with water and ionized water and finally with 15 ml of acetone and air dry. Place about 1 g of Celite in the dry crucibles (to facilitate filtration) and then dry at 130 ° C until a constant mass. Cool for an hour and weigh. Fried crucibles (Buchner), filter vessel, with resistant walls, with a

useful volume of 1l, sealed with a rubber gasket; pressure source (vacuum): vacuum pump or vacuum cleaner capable of regulating the created depression; large capacity vibrating water bath (20-24 l) with lid, thermo regulable; balance, with a weighing accuracy of 0,1 mg; calcination furnace; oven, one set at 103 ° C and another at 130 ° C; PH-meter Testo 205.

Reagents. Ethanol 95% (v / v), ethanol solution 78% (v / v). Place 207 ml of water in a 1 l graduated flask and add 95% ethanol to the mark, acetone; enzymes: thermostable alpha-amylase (sigma a5426 or equivalent); protease (sigma P3910 or equivalent. Prepare a solution of concentration 50 mg / ml in fresh MES / TRIS buffer; amylo-glucosidase (AMG-Sigma A9913 or equivalent), deionized water; celite, acid washed, calcined (sigma C8656); Washing machine Micro 2% in deionized water, MES / TRIS buffer, 0.5 m each, pH 8.2 at 24 ° C. Dissolve 19.52 g of 2 (N-morpholino) ethanol sulphonic acid (MES) (Sigma M8250) and 14 , 2 tris (hydroxymethyl) aminomethane (TRIS) (Sigma T1503) in 1,7 l deionized water, adjust the pH to 8,2 with 0,6 n sodium hydroxide solution, dilute to 2 l with water. important to adjust the pH of the buffer solution to about 8,3 at 20 ° C and 8,1 to 27-28 ° C, hydrochloric acid, 0,561n solution Add 93,5 ml of 6n HCl to about 700 ml of water in a flask rated at 1l pH standards Buffer solutions 4,0, 7,0, 10,0.

Samples preparation. The fibre content is determined from the dry matter of the sample. For this, the sample is dried in an oven at 70 ºC. Depending on the initial mass, before drying and the final mass, after drying and cooling in the desiccator, the humidity of the sample is calculated. The dry sample is then ground so that it passes through a 0.3-0.5 mm mesh sieve. The dried and ground sample is kept in closed jars, in a desiccator, until the analysis begins.

Working method. 1. Enzymatic hydrolysis of non-fibre components. Weigh, in two 400 ml jars, 1 g of the sample to be analysed, to the nearest 0,005 g. Add 40 ml of the MES-TRIS buffer mixture (pH 8.2) to each flask, then insert a magnetic stirring rod and homogenize with a magnetic stirrer until the sample is completely dispersed. The purpose of homogenization is to facilitate the access of enzymes to samples. Continuing the homogenization (at low speed) we proceed to the thermo stating with alpha-amylase. For this purpose, 200 µl of thermostable alpha-amylase solution is added to each flask, the flasks are covered with aluminium foil and then they are introduced in the vibrating water bath at a temperature of 95 ... 100ºC, where they are kept for 35 min. The timing starts from the moment the balloons are introduced into the hot water bath. Sample balloons are cooled to 60ºC, the optimum temperature for the protease. A new thermostat takes place in the presence of the protease. To do this, add 100 µl of protease solution to each flask, cover with aluminium foil and place in a vibrating water bath heated to 60 ± 1 ° C, where it is kept for 30 minutes. Timing starts when the water bath temperature reaches 60ºC. Remove the flasks from the water bath and adjust the pH of the samples, aiming to bring values of 4.1-4.8 pH optimal for amylo-glucosidase activity. For this purpose, continuing stirring, add 5 ml of 0,561n hydrochloric acid solution to each sample. Check the pH, which should be 4.1-4.8. If necessary, adjust the pH by adding 5% sodium hydroxide solution or 5% hydrochloric acid solution. Once the optimal conditions of temperature 60ºC and pH (4.1 ... 4.8) for amylo-glucosidad are created, a third thermostat follows in the presence of this enzyme. For this, 300 µ amylo-glucosidase solution is added to the two flasks, while stirring is continued with the magnetic rod. Cover with aluminium foil and place in a vibrating water bath at 60 ° C for 30 minutes for enzymatic hydrolysis. The timing starts when the temperature in the water bath reaches 60ºC. With the samples thus prepared, the fibre are determined (Bordei, D., 2007).

Determination of insoluble fibres (IDF)

The previously obtained enzymatic hydrolysate is filtered. Filtration is done by crucible in a filter vessel for the two parallel samples. For filtration, crucibles containing Celite are weighed to the nearest 0,1 mg. Moisten the Celite layer with 3 ml of distilled water and then absorb the crucibles to bring the Celite closer to the crucibles. Wash the flasks in which the enzymatic hydrolysis was done with water, pass the wash water through the crucible, wash the two residues twice with 10 ml of distilled water preheated to 70°C. The filter residues are used for insoluble fibre (IDF) dosing. The mass of the two residues, R1 AND R2, is calculated, subtracting from the weightings made (residue + crucible with Celite) the country of the crucibles with Celite. In order to correct the fibre content, the incomplete hydrolysis of the proteins and the ash content of the

analysed sample shall be taken into account. For this purpose, one of the residues obtained, (R1) is analysed for protein and the second (R2) for ash. The protein analysis consists in determining the protein content by the Kjeldahl method of the R1 residue, and the ash analysis consists in calcining the R2 residue at 495°C.

Determination of soluble fibre (SDF)

The filtrates obtained are used to determine the insoluble fibres, which have been collected in 600 ml flasks, previously calibrated. These filters contain soluble fibres. The two filtrates are weighed, after which the soluble fibres are precipitated with 95% ethanol. For this, the filtrates are treated with 4 volumes of 95% ethanol preheated to 60°C relative to the mass of the filtrates. Allow to precipitate at room temperature for 60 minutes, then filter through a crucible. For filtration, the crucibles containing Celite are weighed to the nearest 0,1 mg, the celite layer is moistened with 15 ml of 78% ethanol, after which the crucibles are superimposed on an absorption to bring Celita as close to the crucible as possible. Filter, wash the two flasks with 78% ethanol to transfer quantitatively to the precipitate in crucibles. The mass of the residues (R1 and R2) is obtained by subtracting the crucible with Celite.

To correct the fibre content taking into account the incomplete hydrolysis of the P proteins and the ash content of sample A, after weighing, the protein content in the R1 residue is determined by the Kjeldahl method and the ash content in the R2 residue is determined by calcination at 495 ° C.

Determination of total fibre (TDF)

In the enzymatic hydrolysate obtained, the food fibre are precipitated with ethanol. For this purpose, 225 ml of 95% preheated ethanol at 60 ° C are added to each of the two hydrolysates (samples). The ratio of the volume of ethanol to the volume of the sample must be 4: 1. Cover the samples with aluminium foil, allow to precipitate at room temperature for 60 minutes, then filter. Celite crucibles are used. Filter, wash the flasks in which the precipitates were formed with 78% ethanol to quantitatively pass their contents into the crucibles, then using the vacuum, the residues are washed successively twice with 15 ml of the solutions: ethanol 78%, ethanol 95 %, acetone. The residues thus obtained are dried overnight in the oven at 103 ° C, cooled in the desiccator for about one hour and weighed. The mass of the residues (R1 and R2) is calculated by subtracting the country of the Celite crucibles. In order to correct the total fibre content, the incomplete hydrolysis (with protease) of the proteins and the ash content of the sample shall be taken into account. For this, in the residue R1 the proteins are determined according to the Kjeldahl method, and in the residue R2 the ash is determined, by calcination. In parallel with the analysis of the fibre content of the sample to be analysed, two control samples are made to observe the contribution of the reagents on the residues. The same procedure is followed with the difference that instead of 1 g of sample, 1 ml of distilled water is taken.

Calculation and expression of results. The soluble, insoluble and total fibre content is expressed as a percentage of the sample analysed. Regardless of the type of fibre determined by the ironing using the relation:

$$Fibre\ \% = \frac{\frac{R_1 + R_2}{2} - P - A - RM}{\frac{m_1 + m_2}{2}} * 100$$

R1 - mass of residue obtained from m1, g; R2 - mass of residue obtained in m2, g; m1 - mass of sample 1; m2- mass of sample 2; P- mass of protein in the residue R1, g; A- mass of g in residue R2: RM- residue of the control sample = 0 (Bordei, D., 2007).

Determination of free calcium content. Calcium ions initially react with murexid, used as an indicator, with which they form a complex combination of purple-red colour. By titration with EDTA, murexide is removed from the complex combination, and EDTA reacts with calcium ions to form the Ca-EDTA complex. The end of the reaction is indicated by the change, in the alkaline environment, of the colour of the indicator from red-purple (the colour of the Ca-murexid complex) to purple (the characteristic colour of the free murexid).

Reagents. Sodium hydroxide, 1n solution; murexid, granules; EDTA (sodium salt of ethylenediaminetetraacetic acid), solution. Dissolve 3.722 g of crystallized disodium EDTA in 800 ml of water. Add 0.86 g of NaOH and dissolve everything by diluting to 1000 ml. The solution is standardized against another solution of a calcium salt which is prepared by dissolving 1.2486 sodium carbonate in a minimum amount of 5n HCl and diluting to 500 ml of double-distilled water. 1ml of this solution contains 1mg of calcium.

Working method. Weigh 3 g of the sample, mix with 25 ml of distilled water, shake well and leave to stand for 15 to 20 minutes to dissolve the free calcium. Filter on filter paper and through a Gooch filter to the water tube. The filtrate obtained is made up to 50 ml in a volumetric flask with distilled water. From this volume take 20 ml, bring to a pH higher than 12 (at this pH the magnesium precipitates) by adding 1n NaOH solution, about 1 ml, checked with pH indicator paper. Extract 10 ml with a pipette and place in a 100 ml conical flask, add with a spatula, 0,2 g of murexide and titrate with a 0,01 m solution of EDTA until purple turns.

Calculation and expression of results. The free calcium content is expressed in mg per 100 g of sample and is calculated by the relation:

$$Calcium\ free\ \left(\frac{mg}{100g}\right) = \frac{100}{m} * \frac{V_1 * V_2 * V_4}{F * V_3 * V_t} * 10^{-2} * 40 * \frac{M_1}{M_2} * T$$

In which: m-mass of the sample taken into analysis, g; V1- volume of distilled water used for the solubilization of free salts, ml (V1 = 25 ml); F- volume of the filtrate obtained, ml; V2- volume of the solution to which the filtrate is initially brought, ml (V2 = 50 ml) V3- volume of solution to be used for titration, ml (V3 = 20 ml) V4- volume of solution brought to pH greater than 10 ml (V4 = 22 ml), Vt- effective volume of the solution to be analysed, used for titration, ml (Vt = 10 ml, 40-molecular mass of calcium g / mol;M1- concentration of EDTA titration solution of 2 * 10^{-2}m; M2-concentration of the EDTA titration solution used in the analysis, (0.01m);T- volume of 0.01 m EDTA solution used for calcium titration in the presence of murexid, ml. (Bordei, D., 2007)

The volumes of EDTA used for titration were; T1 = 0.3 ml, T2 = 0.18 ml, T3 = 2.14 ml, T4 = 0.39 ml, T5 = 0.06 ml, T6 = 0.07 ml, T7 = 0.16 ml, T8 = 0.11 ml, T9 = 0.51 ml, T10 = 0.5 ml, T11 = 0.18 ml, T 12 = 0.06 ml, and the Ca content calculated for the 12 samples was Ca green beans = 39.2 mg, Ca peas = 25.2 mg, Ca parsley = 299.6 mg, Ca celery = 54.6 mg, Ca peppers = 8.4 mg, Ca red pepper = 9.8 mg, Ca cucumber = 22.4 mg, Ca tomato = 15.4 mg, Ca cabbage = 71.4 mg, Ca broccoli = 70 mg, Ca cauliflower = 25.2 mg, Ca potatoes = 8.4 mg.

Determination of free magnesium content

The principle of the method. Magnesium ions form a complex combination with EDTA. An extra drop of EDTA solution gives eriochrome T a blue color.

Reagents. Ammonia buffer solution. Mixture in 3:17 ratio of 0.2m ammonium hydroxide solution and 0.2m ammonium chloride solution; eriochrome black T, solid mixture (one part indicator + 500 parts NaCl or NaNO3); EDTA solution 0.01m.

Working method. Weigh 3 g of the sample, mix with 25 ml of distilled water, shake well and leave to stand for 15 to 20 minutes for magnesium extraction. Filter on filter paper and through a Gooch filter to the vacuum tube with water. The filtrate obtained is brought to 50 ml in a volumetric flask with distilled water. From this volume 20 ml are taken, it is brought to a pH higher than 10 by the addition of ammonia buffer (NH3, 1m + NH4Cl 0.2m in ratio 3:17) approximately 2ml, checking with pH indicator paper. Extract 10 ml with a pipette and place in a 100 ml conical flask, add approximately 0,3 g of solid eriochrome T indicator black mixture until the solution turns red and titrate with 0,01 m EDTA solution until turning the color to blue.

Calculation and expression of results. The magnesium content is expressed in mg per 100 g of product. In the calculation it is taken into account that on titration, EDTA reacts with Ca ions. The relation is used:

$$Magnesium\ free\ (mg/100g) = \frac{100}{m} * \frac{V_1 * V_2 * V_4}{F * V_3 * V_t} * 10^{-2} * 24 * \frac{M_1}{M_2} * (T' - T)$$

in which: m-mass of the sample taken into analysis, g; V1- volume of distilled water used for the solubilization of free salts, ml (V1 = 25 ml); F- volume of the filtrate obtained, ml; V2- volume of the solution to which the filtrate is initially brought, ml (V2 = 50 ml) V3- volume of solution to be used for titration, ml (V2 = 20 ml) V4- volume of solution brought to pH greater than 10 ml (V4 =

22 ml)Vt- effective volume of the solution to be analysed, used for titration, ml (Vt = 10 ml), 24 - molecular mass of magnesium g / mol; M1- EDTA titration solution concentration OF 2 * 10 ^ (-2) m; M2- concentration of the EDTA titration solution used in the analysis, (0.01m); T'- volume of 0.01 m EDTA solution used for calcium titration in the presence of murexid, ml. T- volume of EDTA solution used for titration of magnesium in the presence of eriochrome black T, ml. The volumes of EDTA 0.02 m used for titration were: T1 = 0.3 ml, T2 = 0.18 ml, T3 = 2.14 ml, T4 = 0.39 ml, T5 = 0.06 ml, T6 = 0.07 ml, T7 = 0.16 ml, T8 = 0.11 ml, T9 = 0.51 ml, T10 = 0.5 ml, T11 = 0.18 ml, T 12 = 0.06 m and the volumes of EDTA 0.01 m T'1 = 0,7 ml, T'2 = 0,65 ml, T'3 = 2,72 ml, T'4 = 0,73 ml, T'5 = 0,2 ml, T'6 = 0,21 ml, T'7 = 0,26 ml, T '8 = 0,24 ml, T'9 = 1,3 ml, T'10 = 1,35 ml, T'11 = 0,37 ml, T'12 = 0,37 ml.

In the experimental study we followed the hydration of the total and insoluble fiber from the various food. At the same time we investigated the affinity of fiber hydrated at different time intervals: after 6 hours, 12 hours and 24 hours. Depending on the degree of hydration of the food fiber, the specific particle absorption surface increases, thereby accelerating the intestinal transit. the pH measurements for the suspensions obtained were made with a pH meter TESTO 204. in terms of optimal digestibility of food and, implicitly, digestive comfort can also be appreciated by the level of fermentation of consumed food. That is why we have experimentally followed the degree of fermentability of vegetables and fruits containing glucose, fructose, invert sugar, as well as other more or less soluble polyglucide from the category of food fiber. Then we determined inverted sugar and glucose after 6 hours and 12 hours using the Schoorl method.

Determination of iron content. Spectrophotometric method. Extraction of iron from the hot sample in the presence of chloric hydroxylamine and its reaction Fe(2+) with di sulfonic bathophenanthroline with which it forms a coloured compound, the absorbance of which is measured spectrophotometrically.

Equipment. Spectrophotometer, water bath.

Reagents. Extraction solution. An amount of 50 g of hydroxylamine hydrochloride is dissolved in an amount of water. Add 100 ml of concentrated hydrochloric acid and 100 g of trichloroacetic acid, stir and make up to 1000 ml with water; chromogenic solution. 300 mg bathophenanthroline di sulfonic acid (BPDS) is dissolved in 10… 15 ml of water in a 1000 ml volumetric flask. Add to the mark with 3m sodium acetate solution. Store in dark bottles. iron stock solution, containing 1000 µg Fe / ml in 1% HCl (Sigma chemicals), standard iron solution. Dilute 1 ml of iron stock solution with extraction solution to 100 ml (10µg Fe / ml).

Working method. The sample, weighing 1 g, weighed to the nearest 0,1 mg, was placed in a test tube (16x100 mm), 10 ml of extraction solution was added and stirred. Close the tube with a stopper and shake vigorously. Remove the stopper and weigh the tube by noting its mass. The tube is then placed in a boiling water bath for 15 minutes, after which it is cooled to room temperature by placing it in a cooling vessel for 15 minutes. After cooling, wipe with a dry cloth and weigh again. It is brought to the initial table by adding water. Close the tube with a stopper and shake. Filter in a clean, dry tube through Whatman paper no. 1001. Take 1 ml of the filtrate, place in another tube, add 3 ml of chromogenic solution, mix, leave to stand at room temperature for 15 minutes, then read the absorbance on the spectrophotometer at 535 nm. In parallel, a control sample is made, adding to 1 ml of filtrate of the analysed sample, 3 ml of 3 m solution of sodium acetate (without chromogenic solution). The absorbance of the control sample is subtracted from the absorbance determined spectrophotometrically of the analysed sample.

Standard curve. The concentrations of: 0, 1, 2, 3, 4, 5, 8, 10 µg Fe / ml are taken. For this we take 0, 0,1; 0.2; 0.3; 0.4; 0.5; 0.6; 0.8; 1.0 ml of standard iron solution (10µg Fe / ml) is made up to 1 ml with extraction solution. The mixtures are placed in tubes, 3 ml of chromogenic solution are added each, homogenised, allowed to stand at room temperature for 15 minutes and then the absorbance on the spectrophotometer at 535 nm is read.

In the standard curve, in the abscissa, pass the quantities of iron (0, 1, 2, 3, 4, 5, 10µg and in the abscissa the absorbance.

Calculation and expression of results. The iron content is expressed in mg / kg product or in mg / g product. Depending on the absorbance of the analysed sample, the corresponding iron content is read from the standard curve. The relation is used:

$$Fe\left(\frac{mg}{kg}\right) = \frac{C * d}{10^3} * 1000$$

In which: C- the amount of iron extracted from the standard curve, µg; d-dilution performed (d = 10); 10^3- transforming factor of µg in mg; or with the data obtained for the standard curve, a regression relation is established in which one enters with the absorbance read at the spectrophotometer for the analysed sample and its iron content is obtained (bordei, D., 2007).

The results obtained for the studied vegetable samples were: sample 1-beans verve -C1 = 0.1, sample 2-peas C2 = 0.5, sample 3-parsley C3 = 0.6, sample 4-celery C4 = 0.1, sample 5-peppers C5 = 0.07, sample 6-red pepper C6 = 0.08, sample 7-cucumber C7 = 0.03, sample 8-tomato C8 = 0.06, sample 9-cabbage C9 = 0.15, sample10-broccoli C10 = 0.2, sample11-canopy C11 = 0.1, sample12 potatoes - C12 = 0.1.

The results were: Fe1= 0.1x10=1mg, Fe2=0.5x10=2mg, Fe3=0.6x10=6mg, Fe4=0.1x10=1mg, Fe5=0.07x10=0.7mg,Fe6=0.08x10=0.8mg,Fe7=0.03x10=0.3mg,Fe8=0.06x10=0.6mg, Fe9=0.15x10=1.5mg , Fe10=0.2x10=2mg , Fe11=0.1x10=1 mg , Fe12=0.1x10=1 mg.

$$Cu\left(\frac{mg}{kg}\right) = \frac{Cx\ Vx\ 1000}{mxV1x\ 10^3}$$

The results for Cu were: Cu 1= 0.6x2 =1.2 mg, Cu 2=0.125x2=0.25 mg, Cu 7=0.03 x 2 =0.06 mg, Cu 8= 0.05x2= 0.1 mg, Cu 9= 0.75 x2 = 1.5 mg, Cu 10 = 0.5 x 2= 1.0 mg, Cu 11=0.07 x 2 = 0.14, Cu 12=0.08 x2 =0.16 mg. For sample 3,4,5,6 the results were zero.

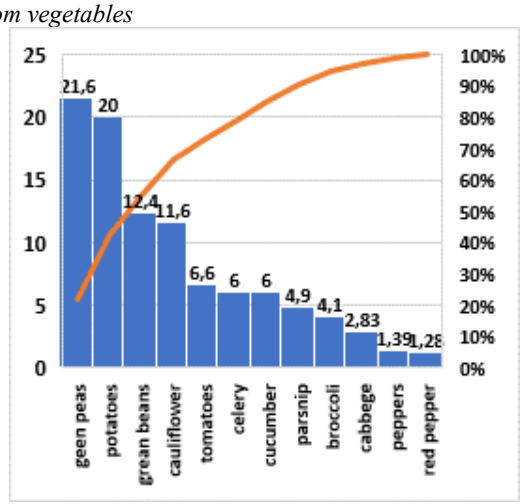
4. Findings

Our experiments are showing that the vegetables used daily in the diet of consumers can bring both benefits and disadvantages to human nutrition.

The highest fiber content was at potatoes (20%), then peas (21.6%), 11.6-12.4% for cauliflower and green beans. Between 4.1-8.9% fiber are ranging broccoli, tomatoes, celery, carrot, beans. The smallest fiber content recorded for the red pepper and the peppers (1,3-1,4%) (figure 1). It is found that the beans (100%), the green beans (100%), the peas (97%), the tomatoes (71%) and the cauliflower (over 68%) have a very good absorption capacity on the fiber.

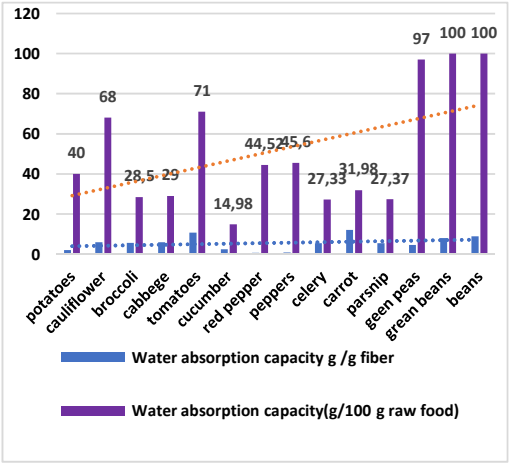
It can be said that the digestibility of these vegetables is also higher than other vegetables because the surface formed by the food bowl particles increases by the absorption of water, and the action of gastric acid expands at the same time, thus reducing the digestion time of the food (figure 2).

Figure no. 1 The fiber percent of gross weight from vegetables



Source: (own contribution)

Figure no 2. The water absorption capacity of fiber from vegetables

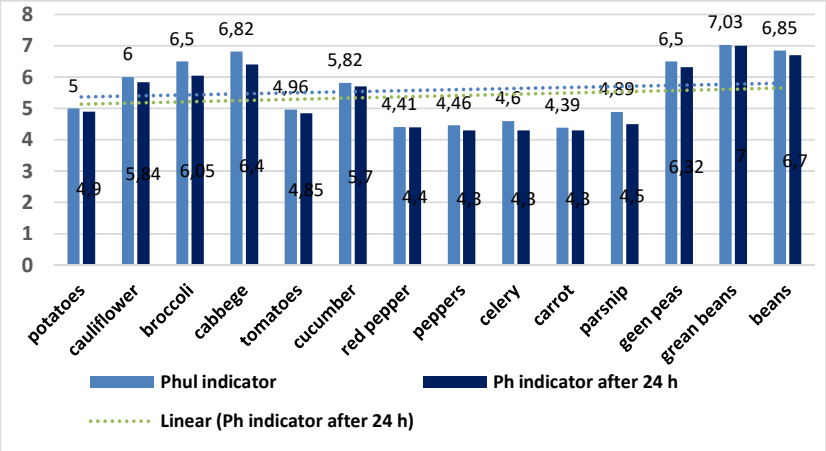


Source: (own contribution)

Considering the choice of the healthiest vegetables for the consumer, one can say that they are the best for an accelerated digestion. At the same time, vegetables such as parsnip (27.37%), celery (27.33%), cabbage (29%), broccoli (28.5%) and cucumber have a lower hydration capacity, so a lower digestibility (figure 2). In terms of pH dynamics in fresh vegetables, pH evolution was tested after 24 hours. It is found that after 24 hours the pH values have decreased, which means the occurrence of fermentative phenomena. This means that the pH decrease affects the digestibility of the food because the alcoholic fermentation produces carbonic acid, which can cause grain-intestinal discomfort, disrupting the normal and efficient functioning of the digestive tract (https://www.hindawi.com/journals/jchem/2017/9340427/abs/ Importance of food fiber, /Scientific Journal, Romania).

It can also be mentioned that some vegetables with a pH of 6,05-7 can be associated with acidity food rich in protein, while others with an acidic pH of 4,39-5 (the potatoes, cauliflower, tomatoes, capers, carrot, parsley) are not exactly the most suitable for being consumed in association with meat products, for example (figure 3).

Figure no. 3.PH dynamics in vegetables



Source: (own contribution)

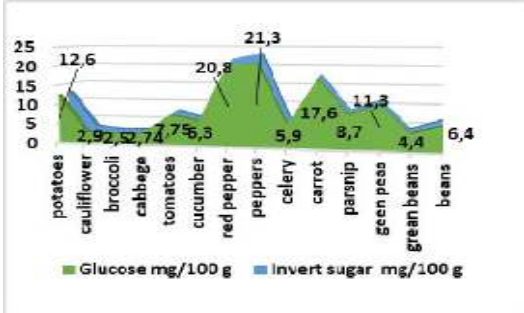
Comparing the glucose content with the invert sugar content from the vegetables, it was found that the red pepper and peppers had the largest content of glucose, then the carrot and potatoes, green beans.

In a smaller proportion of glucose is in the tomatoes, parsnip, cucumber and celery.

The lowest glucose content is found in cauliflower, broccoli and cabbage (2.52-2.9mg / 100g). It is noted that the invert sugar content of peppers is 21.3mg / 100g versus 20.8mg / 100g of glucose, the difference of 0.5mg/100g is the fructose content. So, the pepper content of glucose is by 97.65%, while the fructose content is just 2.35% (figure 4).

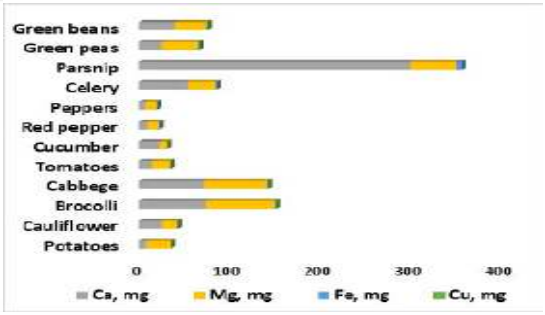
The importance of minerals in human metabolism makes the studied vegetables very important for optimal nutrition, especially in terms of micronutrient content. The dynamics of vegetable minerals indicate that they contain K in very large quantities, and the other micronutrients have a small, even very small weight. However, micronutrients such as magnesium are a mineral beneficial to our health, being considered the enemy of stress. It is found both extracellularly and intracellularly, being the fourth most important mineral in the body besides calcium, iodine, potassium and sodium. It is also responsible for multiple enzymatic reactions, for maintaining cell balance, for stimulating specific processes, such as myocardial contraction (figure 5). Iron is a trace element present in every cell in the human body. 85% of the amount of iron in the body is found in hemoglobin, the human body containing 2.3 grams of iron at women and 3.5 g at men.

Figure no. 4 The glucose analysis compared to invert sugar from vegetables



Source :(own contribution)

Figure no.5 Dynamic micronutrients in legumes



Source :(own contribution)

The experimental results for vegetables are presented in table 1 and 2.

Table no. 1 Experimental results for vegetables total fiber, %

Vegetables	R1, g	R2, g	P, g	A, g	Total fiber %
potatoes	0.249	0.200	0.021	0.00413	20
cauliflower	0.0919	0.090	0.028	0.00593	11,6
broccoli	0.5160	0.5009	0.033	0.00496	4,1
cabbage	0.032	0.0283	0.018	0.00653	2,83
tomatoes	0.041	0.0407	0.011	0.0047	6,6
cucumber	0.051	0.0407	0.013	0.00286	6
red pepper	0.030	0.026	0.013	0.00215	1,28
peppers	0.034	0.0208	0.011	0.00242	1,39
celery	0.148	0.014	0.014	0.0074	5,96
parsnip	0.282	3,34	0.011	1.751	4,9
green peas	0.447	0.164	0.084	0.00563	21,6
green beans	0.202	0.096	0.02	0.005	12,4

Source: (own contribution)

Table no. 2 Experimental results for minerals of vegetables

Vegetables	Ca, mg	Mg, mg	Fe, mg	Cu, mg
green beans	39,2	36,96	1	1,2
green peas	25,2	39,6	2	0,25
parsnip	299,6	51,04	6	
celery	54,6	29,92	1	
peppers	8,4	12,32	0,7	
red pepper	9,8	13,32	0,8	
cucumber	22,4	8,8	0,3	0,06
tomatoes	15,4	20,24	0,6	0,1
cabbage	71,4	69,52	1,5	1,5
broccoli	70	74,8	2	1
cauliflower	25,2	16,72	1	0,14
potatoes	8,4	27,28	1	0,16

Source: (own contribution)

5. Conclusions

1. During the digestive tract, through bile acids, the soluble fiber associate with cholesterol preventing its absorption into body and contributed to maintaining low cholesterol levels in the blood.

2. Insoluble fiber has a high-water absorption capacity, functioning as a rapidly expanding sponge, having an important role in regulating intestinal transit. they regulate digestion and stimulates intestinal muscles without aggression, increasing peristalsis and thus contributing to the faster and more efficient removal of food debris while changing the intestinal flora.

3. the benefits of fiber are associated with their mechanical action in the body. They are the ones that emphasize the transit of intestinal contents (especially insoluble fiber) through the digestive system, helping to eliminate blocked toxins in the intestines.

4.Comparing the glucose with the invert sugar contents from the vegetables, which assure the fermentation of vegetable, it was found that the red pepper and peppers had the largest content of glucose, then the potatoes and green beans.

5. The potatoes, cauliflower, tomatoes, capers, carrot are not exactly the most suitable for being consumed in association with meat products, for example, because they are an acid pH and they not assure a good digestion.

6. The dynamics of minerals indicate that legumes contain Ca and Mg in large quantities and the other micronutrients as Fe, Cu in small quantities. Micronutrient such as magnesium is a mineral beneficial to our health, being considered the enemy of stress. It is found both extracellularly and intracellularly, being the fourth most important mineral in the body besides calcium, iodine, potassium and sodium, being responsible for multiple enzymatic reactions, for maintaining cell balance, for stimulating specific processes, such as myocardial contraction. (figure 5). Iron is a trace element present in every cell in the human body. 85% of the amount of iron in the body is found in hemoglobin and magnesium.

6. References

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