Journal of IMAB - Annual Proceeding (Scientific Papers) 2008, book 2

POSSIBILITIES FOR CORRECTING THE CARIESOGENIC POTENTIAL OF CARBOHYDRATE FOODS AND DRINKS THROUGH THE CONSUMPTION OF KERNELS

Milena Peneva
Department of Children's dental medicine
Faculty of Dental medicine – Sofia

SUMMARY

Measuring the plaque pH after the intake of different foods is a method of determining the cariosogeneity of a given food as well as for determining the protective potential of other foods. In previous studies we have proven the protective effect of dairy products. It is assumed that kernels have a protective quality with regard to the enamel too. Hence the aim of the study - to check the possibilities of the kernels to correct the plaque pH after an intake of different carbohydrate foods.

For each experiment a group of 10 children was formed. For measuring the plaque pH the method of plaque sample was used. For each product tested the curve of Stephan was built.

On the one hand, the kernel's potential to increase the plaque pH decreases the time during which the enamel demineralises. On the other hand, the increase of the plaque pH makes it possible for the kernels to evince other positive qualities concerning the enamel. When the pH is increased the presence of calcium and phosphopeptides becomes an important factor since the remineralisation of the enamel is enhanced. A simultaneous effect is the antimicrobic attack against S. Mutans. The positive effect from the consumption of kernels makes it possible for us to recommend kernels as a food protecting against the development of caries.

The plaque biofilm deposited on dental surfaces is a complex factor for the development of the dental caries. During each intake of food carbohydrates are consumed which makes possible the metabolism of the microorganisms. As a result the production of acids intensifies which combined with the slow recovery of the initial values leads to a quick drop in the level of pH (1, 2, 6). The period has a duration of 45 minutes up to an hour depending on the character of the food (1, 2). During this period the acids cause a demineralisation of the enamel, the remineralisation qualities of the saliva being annihilated (9, 10).

Measuring the plaque pH after the intake of different foods is a method of determining the cariosogeneity of a given food as well as for determining the protective potential of other foods. In previous studies we have proven the protective effect of dairy products (2). It is assumed that kernels have a protective quality with regard to the enamel too (4, 5).

One of the explanations for the protective effect of kernels is their hard consistence. The hard consistence stimulates the act of chewing thus enhancing the production of saliva. This stimulated secretion provides saliva that is more diluted and more alkaline and, as a result, has a bigger buffer capacity. The hard particles obtained through chewing the kernels disrupt the plaque biofilm and allow the penetration of the saliva into the interior of the plaque. Thus the buffer effect of the saliva takes place and the pH increases (6, 9).

But it is not only the above effect kernels have. Kernels also have a protective effect that has to do with their chemical composition. Kernels contain relatively high quantities of calcium, a chemical element active in the process of remineralisation (7, 8). All kernels, namely peanuts, hazel nuts, almonds, cashou, etc. contain calcium. Even sesame contains big quantities of calcium. A teaspoonful of sesame contains 87 milligrams of calcium (11).

Kernels also contain chemical compounds such as isotiacinate and anacordic acids which have a clear antimacterial and anticeptic effect. It was originally thought that the two compounds attack two microorganisms only, one of which is S. Mutans. It was later found out that the compounds have a protective effect with regard to 20 microorganisms, though. Besides, kernels also contain a wide range of proteins, including phosphotine, which is the source of the phosphopeptides that stabilise the amorphous calcium phosphate and ensure the remineralisation of the enamel (11, 12).

Hence the aim of the study - to check the possibilities of the kernels to correct the plaque pH after an intake of different carbohydrate foods.

MATERIAL AND METHODS

48 children aged 6-16 were examined. The children had more than 6 teeth affected with caries. The value of the their saliva production (an average of 2,2 ml/min) and buffer capacity (ultimate pH 6,4) was normal. The saliva measured was stimulated and was obtained through chewing paraffin. For each experiment a group of 10 children was formed. For measuring the plaque pH the method of plaque sample was used. Samples from the plaque were taken by means of a sound and were dissolved in 1 ml of destilled water. There the samples were immediately subjected to dispersion by means of an ultrasonic tub. Twenty seconds following the taking of the sample the plaque pH was measured by means of a pH meter Schott, model CG 842.

The experiment was started by carrying out a professional oral hygiene. Two days before the investigation the oral hygiene at home conditions was made extra stringent. Two hours before the beginning of the experiment only the consumption of water was allowed.

At the start of the experiment a preliminary measument of the original plaque pH of each participant was carried out. After that 15 ml of carbohydrate drink or 6 gr of carbohydrate food was given to the participant. After a minimum degree of pH was reached 5 kernels of peanuts were immediately given to the participant. The plaque pH was measured on the second minute after the intake. 5, 10, 15, 20, 25, 30, 35 and 45 minutes after the intake the measurement was repeated. The values measured were recorded in a special card created for the pupose.

The method was singularly blind (for the person measuring the plaque pH).

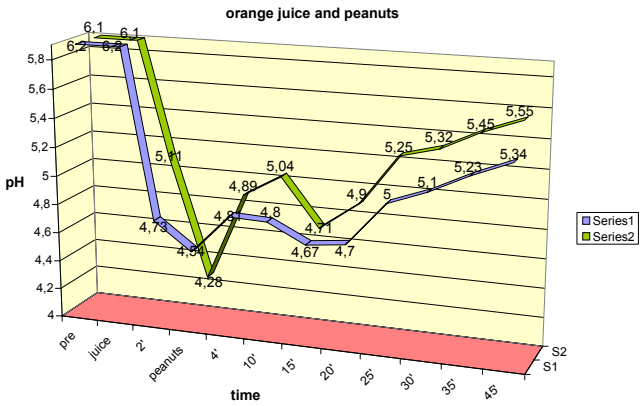
For each product tested the curve of Stephan was built. To build the curve the following values were recorded: the minimal value of pH, the critical time (pH under 5,5), time for recovery to the original level of pH.

For the purpose of statistical analysis the average values of pH were determined in the case of each measurement, standard deviation and standard error. By means of the average values obtained the curve of movement of the plaque pH was built. The comparison between the average values for a given stage of the experiment was conducted through the T-test of Student – Newman, the analysis of variations - through ANOVA. It was assumed that probability is 95%. Differences with $p<0,05$ were assumed to be reliable. Each difference with $p>0,05$ was assumed to be accidental.

RESULTS AND DISCUSSION

The first examination conducted concerned the correction of the plaque pH through the intake of peanuts after the consumption of orange juice.

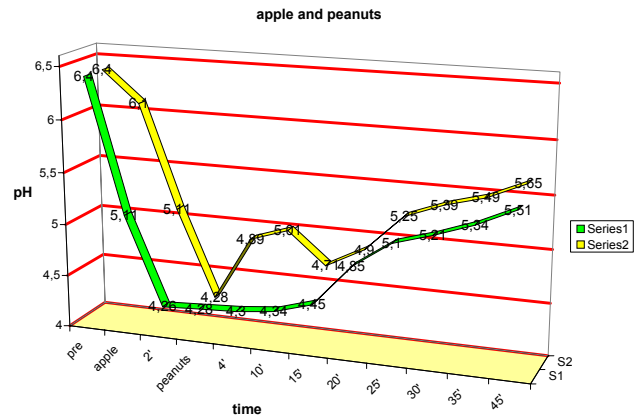
Diagram № 1. Correction of plaque pH through intake of kernels after consuming orange juice



*Series 1 – orange juice
*Series 2 – peanuts

It is seen from the diagram that after reaching the minimal pH of 4,54 following the consumption of orange juice the intake of kernels only for two minutes brings about a sharp increases in the pH. On the fiftienth minute there is a minimal decrease followed by a sharp increase and only on the 35th minute after the intake of the kernels the pH goes beyong the critical value. In the case when only orange juice is taken this value cannot be reached even on the 45th minute. The experiment shows that kernels can be used for the correction of the acid environment in the plaque after an intake of fruit juice.

Diagram № 2. Correction of plaque pH through intake of kernels after having an apple

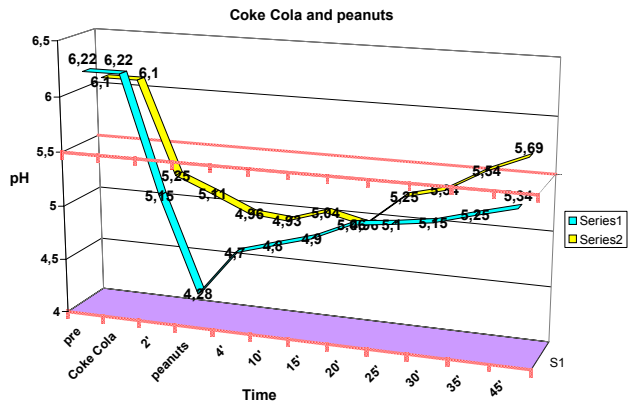


*Series 1 – apple
*Series 2 – peanuts

The second experiment involved the intake of kernels that followed the consumption of an apple. In this case too the kernels were taken when a minimal pH of 4.25 was reached. The quick increase observed followed by a minimal

decrease and then by a gradual increase here too demonstrates the reliable potential of kernels to increase the values of pH for each examination each five minutes. The quicker reaching of the critical pH and its subsequent increase is indicative of the good potential for correction of the plaque acidness through the intake of kernels.

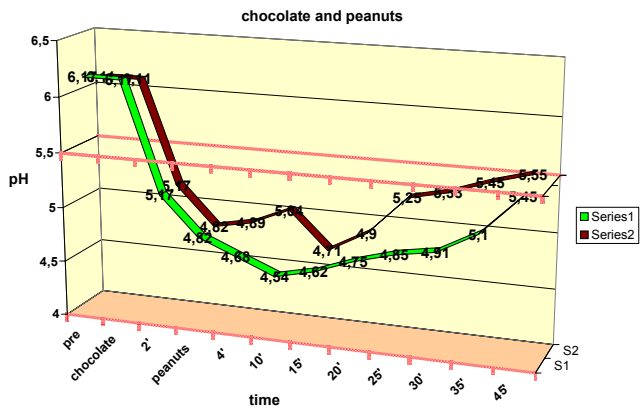
Diagram № 3. Correction of the plaque pH through intake of kernels after having a coke



*Series 1 – Coke Cola
*Series 2 – peanuts

The consumption of Coka Cola evinces a quick and drastic drop in the plaque pH followed by a slow recovery. The correction through the intake of kernels demonstrates an effect similar with the effect cheese has. The increase of the plaque pH starts immediately and the minimal value is exceeded in a much quicker way, after which the processes of remineralisation begin.

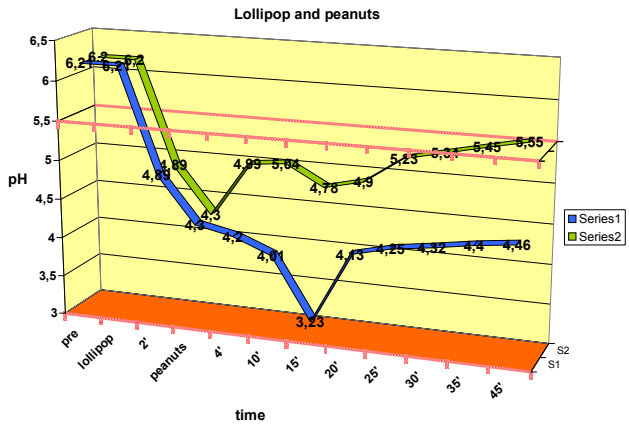
Diagram № 4. Correction of the plaque pH through intake of kernels after having chocolate



*Series 1 – Chocolate
*Series 2 – Peanuts

Similar was the picture after consuming chocolate followed by a correction of the plaque pH through the intake of peanuts. In this case too the kernels succeeded in causing a sharp rise in the level of pH and in a verifiably quicker way brought about exceeding the critical value.

Diagram № 5. Correction of plaque pH through intake of kernels after having a lollipop



*Series 1 – lollipop
*Series 2 – peanuts

The most obvious positive effect of kernels is in the case of their being taken after having a lollipop. The aggressive drop in pH after the intake of a lollipop is avoided through the consumption of kernels. The plaque pH does not drop that drastically and reliably exceeds the critical value.

On the one hand, the kernel's potential to increase the plaque pH decreases the time during which the enamel demineralises. On the other hand, the increase of the plaque pH makes it possible for the kernels to evince other positive qualities concerning the enamel. When the pH is increased the presence of calcium and phosphopeptides becomes an important factor since the remineralisation of the enamel is enhanced. A simultaneous effect is the antimicrobic attack against S. Mutans. The positive effect from the comsumption of kernels makes it possible for us to recommend kernels as a food protecting against the development of caries.

CONCLUSIONS:

1. Kernels have a good potential for correcting the acid plaque pH after an intake of carbohydrate foods and drinks;

2. Kernels can be used the way dairy products are used to end carbohydrate nutrition when tooth brushing is impossible;

REFERENCES

1. Пенева М. Кариесогенен потенциал на въглехидратните храни и напитки. Dental Review, 2, 2008, 51-59.

2. Пенева М. Протективни възможности на млечните продукти спрямо развитието на кариозен процес. Dental review, 3, 2008, 55-62

3. Bacalho B et al. Volatile compounds of cashew apple (Anacordium occidentale 7) Z Naturforsh. 2001, 56,1-2, 35-39.

4. Food and Drug Administration, Anticaries drug products for over-the-counter human use; use of intraoral appliance models for compliance with biological testing requirements; request for information and comments, *Federal Register* 2001, 66:52418-52420. .

5. Food and Drug Administration, Final monograph on anticaries drug products for over-the-counter human use, *Federal Register* 1995, 60:52474-52510.

6. Jansen M. Telemetric Methods using ion-specific electrodes. Adv Dent Res, 1987,1,92-98.

7. Harris N., F. Garcia-Godoy. Primary Prevantive Dentistry, 6th Edition, Pearson, 2004.

8. Hancock R. Host defence (cationic) peptides: what is their future clinical potential? Drugs 57, 1999, 469—473.

9. Palmer C. Nutrition, Diet, and Oral Conditions. Harris N. Primery Preventive Dentistry, 4th Edition, Appleton&Lange, 1994, 361.

10. Palmer C. Importmant Relationships Between Diet, Nutrition, and Oral Health, Nutrition in Clinical Care, 2008, 4, 4 — 11.

11. Segura R, C Javierre, M Lizarage, E Ros. Other relevant components of nuts: phytosterols, folate and minerals. British Journal of Nutrition, 2006, 96, S36-S44 Cambridge University Press, 10, 1017, B YN20061862

12. Sgan-Cohen H, E Newbrun, R Huber, G Tenenbaum, M Sela. The effect of Previous Diet on Plaque pH Response to Differant foods. J Dent Res 1988, 67, 11, 1434 — 1437.

Adress for corespondense:
Milena Peneva
Department of Pediatric Dentistry, Faculty of Dental Medicine,
1, Georgi Sofiiski str., 1431 Sofia, Bulgaria
E-mail: milenapeneva@mail.bg