



PRELIMINARY STUDY REGARDING OPTIMIZATION OF KNOWLEDGE, ATTITUDES AND HEALTHY PRACTICAL SKILLS IN ORAL HEALTH, AT MIDDLE SCHOOL PUPILS, FROM RURAL AREAS

Adriana PETRUȘ-VANCEA, Lucia ȘTIRB

Abstract. The purpose of this preliminary study was to identify oral problems and promote a healthy lifestyle at gimnazial school pupils, from a Romanian disadvantaged area. We wanted to identify the progress made by pupils following theoretical or practical interventions. Thus, along with the theoretical notions transmitted, either in the optional course of Health Education, to 6th grade pupils, or in Biology lessons, to 7th grade pupils, the new factor brought was the reinventing of the visit method, by extending the documentary feature, with that of practical applicability, extremely useful for participants coming from rural environment. Theoretical elements have been presented to all pupils. Additionally, at the 5th grade pupils, we added a practical intervention, respectively a dental control made during a visit to the dentist. Both through theoretical and practical methods, pupils have made progress concerning intellectual and practical skills in oral hygiene, which are essential to a healthy and responsible behavior. The visit at the dentist's office, the identification of the oral diseases, the recommendation and the treatment offered contributed decisively awareness of the importance of oral disease prevention, but also to identifying concrete solutions, connected to food, regular visits and correct brushing.

Key words: education, oral health, disadvantaged area, visit, dentist

1. Introduction

Oral diseases are a global public health problem (WHO, 2017) estimated to affect 3.9 billion people (Marcenes et al., 2013) and dental caries affects 60-90% of children and more adults in developed countries. It is increasingly prevalent in developing countries and highly prevalent in some Asian or Latin American countries.

At a macro-social level, the education for health represents an evaluation criterion for that specific civilization. Pupils from primary and secondary school are receptive to this initiative (Nakre & Harikiran, 2013), and that is why Mafra et al. (2015) have performed in Portugal experimental science activities in primary school for enable cross-curricular learning. One of their study was the culture medium inoculation with children's dental plaque both before and after tooth brushing and after that, counted the colonies. Pupils understood that microorganisms can be responsible for the dental caries. These practical works were effective in ensuring young children can easily understand the dental caries causes and what can be done to prevent it.

If in the urban environment, in some countries there has been studied a plan to initiate teaching microbiology even in the primary schools (Mafra & Lima, 2009), in less advantaged environments, like the rural one, situation is different, as we will find out in the present preliminary study. Treatments for oral diseases are available in most of developed countries, but they can be expensive and not evermore accessible. Generally, in less developed and poor countries an adequate treatment is not available.

Blanco-López et al. (2016) present a case study to illustrate the design and implementation of a teaching sequence about oral hygiene, which was based on real-life situations, in line with the PISA

Received April 2020. Published online 28 May 2021.

Cite as: Petruș-Vancea, A. & Știrb, L. (2021). Preliminary study regarding optimization of knowledge, attitudes, and healthy practical skills in oral health, at middle school pupils, from rural areas. *Acta Didactica Napocensia*, 14(2), 1-13, <https://doi.org/10.24193/adn.14.2.1>

assessment framework for science and the tenets of a context-based approach to science education. There are often reported such teaching and learning activities of the exact sciences based on context (Fensham, 2009).

The biology teacher and discipline biology play an important role in achieving education for health. Craft et al. (1981) have reported that secondary school teachers ranked third after dentist and parents as an important teaching source and the biology was the most likely subject in which the information has been given. Coleman (1995) concluded that mainly biology, being perceived like an important source for boys, whilst girls identified friends and parents as being of the greatest importance source of documentations. It is important for the biology teacher, especially the young ones, to use different resources for information, and in Romania to even explore the new textbooks (Pop-Păcurar & Ciascai, 2010) and to use in their classes the active methods as those which stimulate a critical thinking or the modeling technique (Pop-Păcurar & Tirla, 2009).

Though in developed countries, like England, it is included in the England school curriculum at 8–9 years to facilitate improved oral hygiene and prevent tooth decay, Eley et al. (2019) reported that the children have gaps in oral hygiene knowledge. Teachers acknowledge oral hygiene as a priority which should be taught more frequently.

In this preliminary study, we wanted to help improve the way effective prevention and acknowledge measures are being used by children at school concerning the importance of oral health and the risk factors that might affect the health of the oral cavity and therefore of the entire organism.

2. Materials and methods

2.1. Study hypothesis

We started in this preliminary study from the hypothesis that the theoretical and practical interventions of oral health education in middle school classes, lead to the optimization of intellectual and practical skills of students in terms of oral hygiene.

2.2. Participants

This preliminary study has been performed on three classes, one of fifth grade (11-12 years), sixth grade (12-13 years) and seventh grade (13-14 years) from a middle school from a rural area, with a total 44 of pupils. The number of subjects studied is theoretically small, but it is worth mentioning that they represent the total number of children in that disadvantaged area. From a statistical perspective, this number may be a technical impediment, but from a biological and oral health point of view, this number represents a total, it represents some children, who are just as important even if they do not meet the standards of form of an article, respectively, represents, even, the fundamental problem that this preliminary study wants to highlight.

2.3. Instrument used

In order to evaluate qualitatively and quantitatively the results of all implicated pupils they were given an original evaluation questionnaire concerning the health education notions, especially oral hygiene, at the beginning of the school year 2017-2018 and at the end of the year, after processing the additional theoretical and practical interventions (see Table 1).

The questionnaire contained items providing information regarding:

- 1) children's knowledge regarding oral hygiene and health;
- 2) capacity of self-evaluation of health;
- 3) skills and practical routine in cleaning the oral cavity;
- 4) attitudes toward food behavior of pupils;
- 5) how often do subjects use the dental health services?

There are few educational programs for health which after realizing their intervention also conduct an evaluation of its impact, among which we can mention: Laiho et al. (1993), Redmond et al. (1999), Frenkel et al. (2002), Mariño et al. (2004).

2.4. Research methodology

Concerning the research methods there have been used: investigation method and clinical method. The obtained results have been analyzed mathematically (percentage determination) and statistically (t-test: paired two sample for means) and presented through table and charts.

For fifth and sixth grade, from the curriculum, it has been added optional subject *Education for health* (EH), where we have introduced in chapter *Personal hygiene and food health* two supplementary theoretical activities, of 50 minutes each, concerning hygiene and maintaining the health of the oral cavity, as well as influence of nutrition over the oral health.

At the seventh grade at compulsory subject Biology, at the *Human Anatomy and Physiology* from the curriculum, there have been presented two supplementary theoretical information concerning the oral cavity hygiene, over 50 minutes duration each.

These theoretical activities mentioned before have been carried out at all subjects included in this preliminary study. Only at the fifth-grade pupils, we used a practical intervention, performed as a scientific volunteer action of their biology teacher and of the dentist, respectively a consult - visit to a dental office.

As it is known as a didactic method, the visit is an activity outside school which has the advantage of giving the possibility to direct observation of certain objects or phenomena, being at the foundation of the progressive scientific study as a result of the sensorial contact with the surrounding reality. In our situation, the theoretical activities have been followed by practical activities, using the didactic method “the visit”, but it was not just a documentation visit, like similar school activities, but a visit to the dentist’s, where pupils received a professional evaluation of their oral health, as well as a professional brushing, being the best option in reaching our objectives.

After establishing the objectives of our visit, we have identified and provided the necessary resources, human as well as material, for reaching the set objectives. Afterwards we informed the school management team and requested them a scientific counselor. When all these aspects have been set, pupils have been informed about the date, theme and objectives of the visit. We have informed the parents about the activities within this project and we have requested their written agree.

2.5. The design of research

Throughout the preliminary study, interventions concerning health education have been presented in Table 1:

Table 1. Preliminary study protocol.

Subjects studied	Intervention	Period	Application of the questionnaire
5 th grade pupils	1. optional course <i>Education for health</i> (theoretical notions) 2. a dentist consult (practical application)	2017-2018	I. 09/2017 II. 05/2018
6 th grade pupils	1. optional course <i>Education for health</i> (theoretical notions)	2017-2018	I. 09/2017 II. 05/2018
7 th grade pupils	1.compulsory subject <i>Human anatomy and physiology</i> (theoretical notions)	2017-2018	I. 09/2017 II. 05/2018

The questionnaire was applied before and after the intervention, to each class, carrying out a progress study of the pupils, depending on the nature of the intervention (theoretical and/or practical).

Many studies had used instructions to educate the population; some gave printed material to participants while a study by Vachirarojisan et al. (2005) held group discussions. Oral health promotion was provided in seven studies. Study by Vanobbergen et al. (2004) was based on the Ottawa Charter. Axelsson et al. (1994) or Pakhomov et al. (1997) used fluoride dentifrice as an additional intervention.

There are only few studies implying a practical part, all studies were effective in improving the knowledge (Nakre & Harikiran, 2013) and few of scientific volunteering from the companies.

3. Results and discussions

The questionnaire has been applied in two stages - September 2017 and May 2018 - over a group of 44 pupils from rural areas, from families with a medium and low standard of living, therefore realizing a study of progress. Due to the fact that there were observed progresses at all classes studied, no matter the intervention method applied (theoretical or practical), we chose to present the statistic processed data through the *t* test comparing total results at the initial test with the ones registered at the final test. Results concerning the first objective we sook, and that was observing the pupil's knowledge regarding oral hygiene and health, are being concentrated in Table 2 and Figure 1.

Table 2. Meaning of the difference between results obtained at the *initial* and *final* test, at all 44 pupils studied, no matter the applied intervention, aiming the evaluation of pupils' knowledge concerning oral hygiene and health.

Items	<i>t</i> test (p)	Significance
What do you understand by oral health?		
Oral cavity without cavities	0.25	ns
No pain	0.00	***
Taking care of our teeth	0.12	ns
No answer	-	ns
What can happen when oral hygiene lacks?		
Deposits on teeth surface may occur	0.09	*
Cavities may occur	0.01	**
Bad smelling breath	0.12	ns
Other diseases may occur in your body	0.04	**
What are the effects of a correct oral hygiene?		
Clean teeth	0.19	ns
No unpleasant smells	0.26	ns
No pain and gum bleeding	0.049	**
Influence of oral health over health of the entire organism.		
No connection	0.004	**
Strongly connected	0.01	**
No answer	0.03	**
How many types of dentition are there at humans?		
One dentition	0.10	ns
Two dentitions	0.11	ns
I don't know	0.11	ns
What are the teeth categories at humans and their role?		
Right answer	0.08	*
Partial answer	0.08	*
A role in grinding food	-	ns
A role in speech	-	ns

Note: p - significance value: $p < 0.01 =$ ***very significance; $p < 0.05 =$ **significance; $p < 0.1 =$ *significance tendency; $p \geq 0.1 =$ ns (not significance).

At each of the three classes, a high percentage of pupils, between 25% and 33%, were not able to formulate, initially, a simple answer at the first item of the questionnaire, respectively *What do you understand by oral health?* (see Figure 1 A). A similar number of pupils have formulated answers using their simple observations: not to have any pain. On the other hand, the situation changes at the final test, when this answer is no longer present and the acknowledgment of cavity occurrence is high, up to 66% at the 5th grade pupils, who have been evaluated by the dentist (see Figure 1 A).

At the initial test, the pupils of the 6th grade and even 7th grade were concentrated on bad smelling breath, which may occur as a consequence of the lack of appropriate hygiene, which they might have observed from own direct experience, after the theoretical activities completed, they have strongly diversified their answers (questions having multiple answers), and awareness of dental cavities occurrence raised (see Figure 1 B). More than that, all 44 pupils, found out and became aware that dental problems lead to other diseases in one's organism. The fact that at the initial test, none of these subjects knew about this connection, proves a deep lack of knowledge in this area and draws attention

on the need of active involvement and concrete of the responsible institutions, in realizing education for health in rural environment. This need is also suggested by the answers received at *What are the effects of a correct oral hygiene?* none of the pupils knew initially that pain and bleeding gums are caused by a lack of oral hygiene (see Figure 1 C). In England, for example, there is e-Bug, an international educational resource for pupils aged 4–18 years which is about the healthy behaviours concerning microbes, prevention and hygiene, or infection and antibiotics (McNulty et al., 2011) and it is operated by Public Health England. The e-Bug resources include teacher packs containing interactive lessons which improve knowing in pupils (Hawking et al., 2013; Eley et al., 2018, 2019). Educational resources can be downloaded for free from the official site www.e-bug.eu.

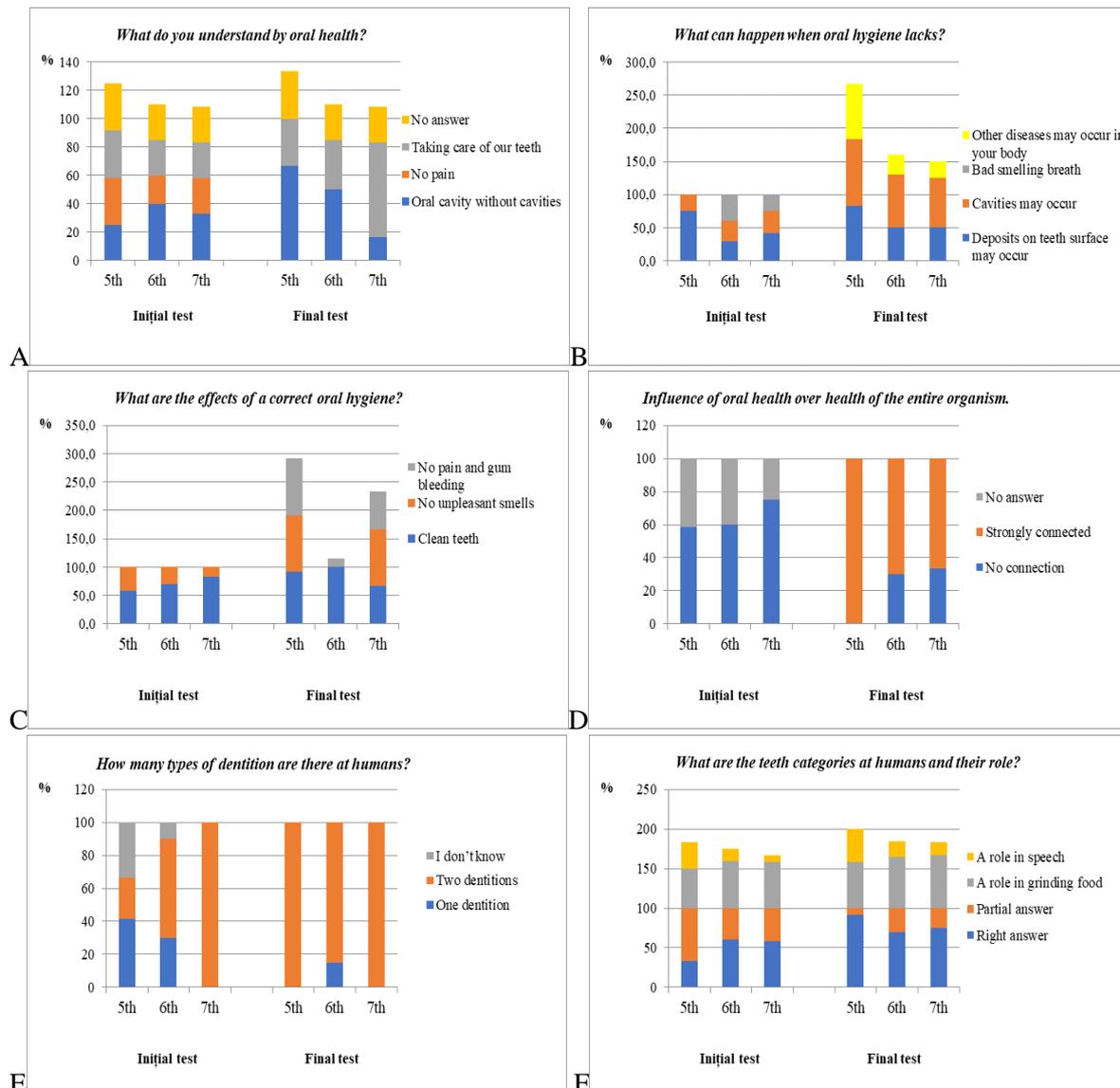


Figure 1. Pupils answers at the initial test, compared to the ones formulated in the final test, performed following *practical* interventions (5th grade) and only *theoretical* interventions (at 6th and 7th grade), aiming to evaluate pupils knowledge regarding oral hygiene and health (A-F).

In 2013, Nakre and Harikiran realized a meta-analysis of the publications that aimed assessing the effectiveness of oral health education programs. There were 40 articles selected on Medline, published after the year 1990 and they concluded that most successful oral health programs are labour intensive, involve significant others and have received funding and additional support. Estimating quantitatively the effect of diverse health educational methods, all studies signalled the improvement in knowledge, no matter what sample, design, interventional or organizational variables were used.

From 40 articles, 15 articles were reported through improvement in oral health related practices, 4 through change in attitude, 8 through improvement in gingival health, 11 through plaque reduction, 8 by decrease of bleeding on probing, 9 evaluated the increasing of caries frequency and 9 used other outcome variables to evaluate the effectiveness of the program (Nakre & Harikiran, 2013).

Creating theoretical activities led to optimization of knowledge in the field (see Figure 1 D-F). It is important that this knowledge transforms into a positive attitude and afterwards is applied through correct, scientific procedures. To be well-documented in dentistry with correct health information or knowledge alone does not necessarily lead to desirable health behaviours, but it is the first step to be taken.

The health self-evaluation capacity proved to be initially scarce, due to the lack of elementary scientific notions (see Table 3 and Figure 2 A-C), some pupils being very contempt by the aspect of their teeth, especially the young ones, and at the dentist consult resulting that all of them presented numerous dental problems, including cavities.

Table 3. Signification of the difference between the initial test and the final one, at all pupils studied, no matter the intervention used, aiming the analysis of self-evaluation capacity of pupils health.

Items	t test (p)	Significance
How do you evaluate your teeth and gums health?		
Satisfying	0.19	ns
Good	0.25	ns
Very good	0.10	ns
Excellent	0.09	*
Have you felt pain at the level of your oral cavity in the last six months?		
Yes	1.48	ns
No	1.48	ns
Is your contempt with the aspect of your teeth?		
No	0.12	ns
Satisfied	0.15	ns
Contempt	0.17	ns
Very contempt	0.03	**

Note: p - significance value: $p < 0.01$ = ***very significance; $p < 0.05$ = **significance; $p < 0.1$ = * significance tendency; $p \geq 0.1$ = ns (not significance).

This situation has been improved following the interventions, especially at the 5th grade pupils who received a professional brushing, after having identified bacterian plaque and highlighted using a solution of basic fuchsine 0,2-0,3 %, which colored the area with pink.

Skills and practical routine of cleaning the oral cavity, including the frequency of brushing, the way a correct brushing is made, choosing the toothbrush and other means used for oral hygiene have been optimized, after the theoretical interventions but especially the pupils who received a dentist consult, who have made a correct brushing together with the dentist (see Table 4 and Figure 3 A-D).\

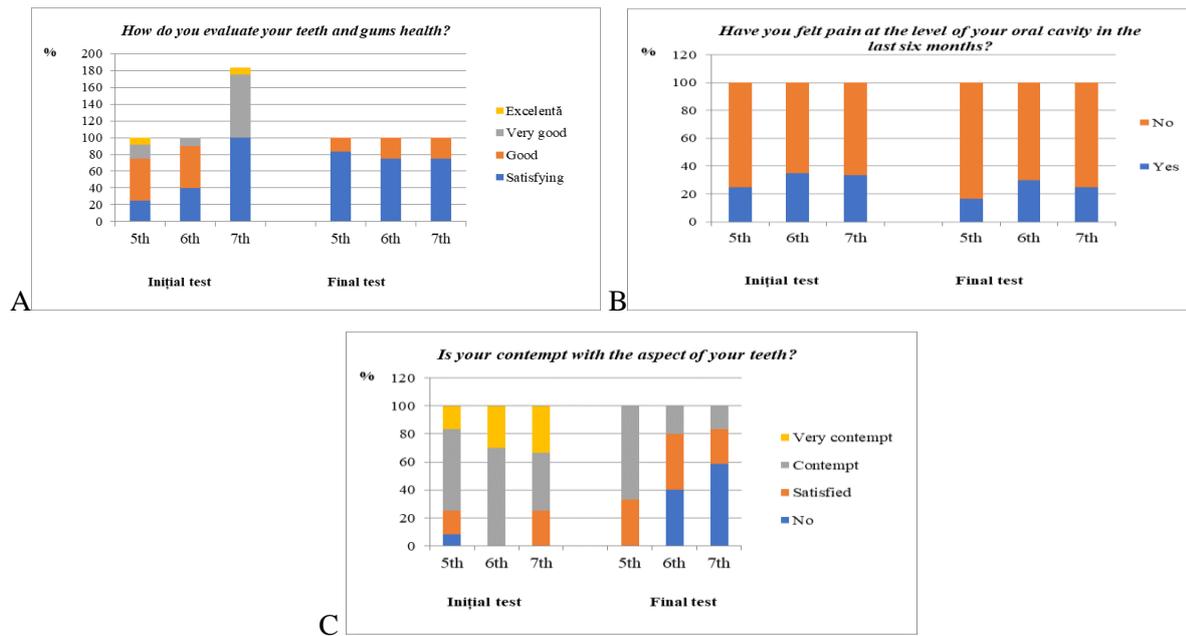


Figure 2. Analysis of self-evaluation capacity of pupils health made before and after practical interventions (at 5th grade) and theoretical (6th and 7th grade).

Table 4. Signification of the difference between the initial test and the final one, at all pupils, no matter the intervention used, aiming the analysis of skills and practical routine in cleaning the oral cavity.

Items	t test (p)	Significance
How many times do you have to clean your teeth?		
Once a day	0.06	*
Twice a day	0.04	**
After every meal	-	-
Whenever I remember	0.09	*
How do you make a correct brushing?		
With circular moves	0.02	**
From the base of the gum to the tip of the teeth	0.11	ns
From the tip of the teeth towards the gum	0.21	ns
With circular moves from the base of the gums to the tip of the teeth	-	ns
I don't know	0.03	**
How do you choose correctly the tooth brush?		
It must have the right dimension	0.02	**
It has to be not too strong and not too soft	0.34	ns
It has to be recommended by the dentist	0.03	**
I don't know	0.02	**
Do you use other means of dental hygiene?		
Yes	0.00	***
No	0.00	***

Note: p - significance value: p<0.01 = ***very significance; p<0.05 = **significance; p<0.1 = * significance tendency; p≥0.1 = ns (not significance).

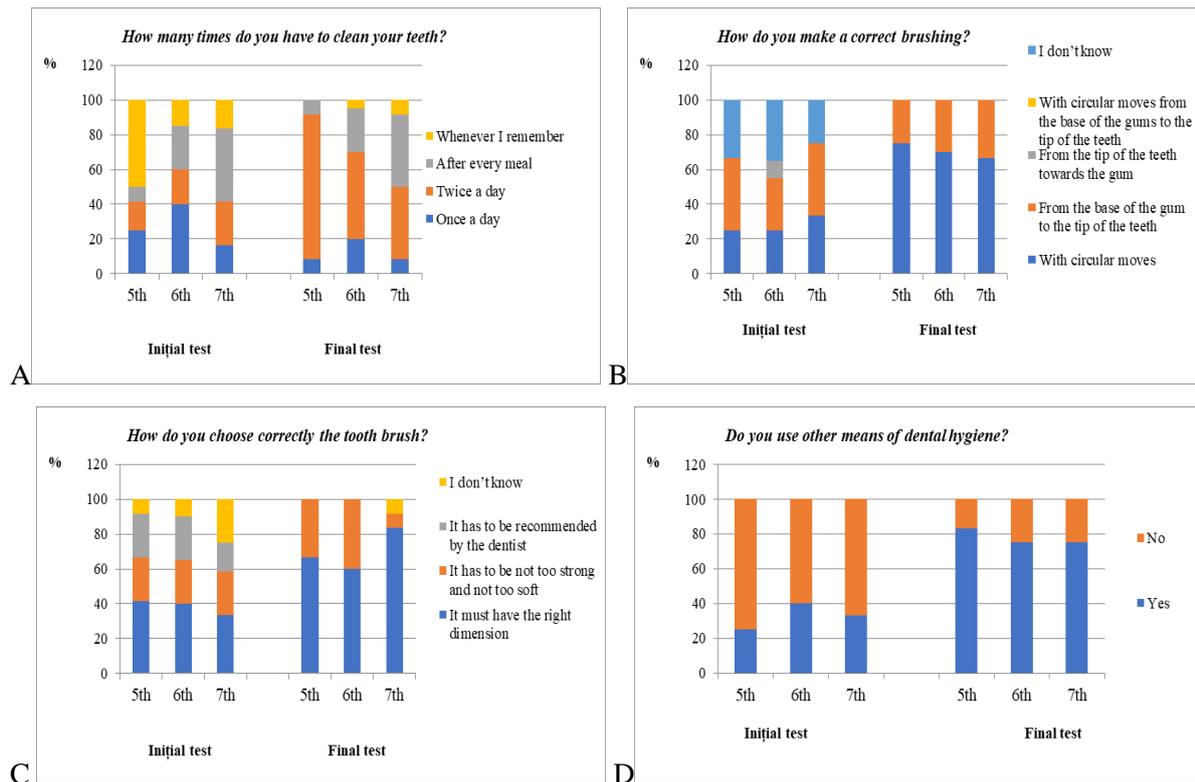


Figure 3. The initial and final evaluations for skills and routine for cleaning the oral cavity made before and after practical interventions (5th grade) and only theoretical (at 6th and 7th grade).

At the end of this preliminary study, the percentage of awareness of the fact that food influences the dental health increased, compared with the initial evaluation, especially at the younger subjects (see Table 5 and Figure 4 A). This fact has been mentioned even since 1992 by Webb, which used various methods to investigate possible causative links between diet and disease. If at the beginning 41% of the pupils of 5th grade, 10% of the pupils of 6th grade and 8% among the 7th grade affirmed that they don't consume any fruits, which is an alarming situation, at the end of the study, none of the subjects affirmed this a low rider more, high percentages being registered at whether consuming fruits once or twice a day (see Figure 4 B). At this point we can suspect that pupils have not been totally honest, increase being too high, and we consider that the material state of their families cannot secure this, especially during winter. On the other hand, pupils from the 6th and 7th grade, who were consuming milk twice a day, gave up this habit, reducing the amount to once a day (see Figure 4 B).

A slightly doubtful situation has been observed concerning consuming of sweets, where up to 50% of 6th graders declared at end of this preliminary study that they stopped consuming at all. Still, considering that 30% of the subjects declared at the beginning that they consume sweets only once a week, the situation from this point of view is a positive one. It is however possible that both declarations, initial as well as final, to have been subjective, being known among the Romanian children, a rather stereotype idea, the fact that sweets destroy teeth, on the other hand the material situation of the family would not allow them to buy sweets. The demand for dental care service has increased significantly at all subjects (see Table 6 and Figure 5 A and B), the reason being even a simple routine examination.

Table 5. Signification of the difference between the initial test and the final one, at all pupils studied, no matter the intervention used, aiming the food behavior of the pupils.

Items	t test (p)	Significance
Do you think that food influences the dental health?		
Yes	0.03	**
No	0.03	**
How often do you eat these foods?		
Fruits one a day	0.60	ns
Fruits twice a day	0.22	ns
Fruits once a week	0.09	*
Fruits none	0.08	*
Juice one a day	0.01	**
Juice twice a day	0.02	**
Juice once a week	0.11	ns
Juice none	0.09	*
Sweets once a day	0.90	ns
Sweets twice a day	0.02	**
Sweets once a week	0.33	ns
Sweets none	0.07	*
Milk and dairy products once a day	0.02	**
Milk and dairy products twice a day	0.09	*
Milk and dairy products once a week	0.29	ns
Milk and dairy products none	-	ns

Note: p - significance value: p<0.01 = ***very significance; p<0.05 = **significance; p<0.1 = *significance tendency; p≥0.1 = ns (not significance).

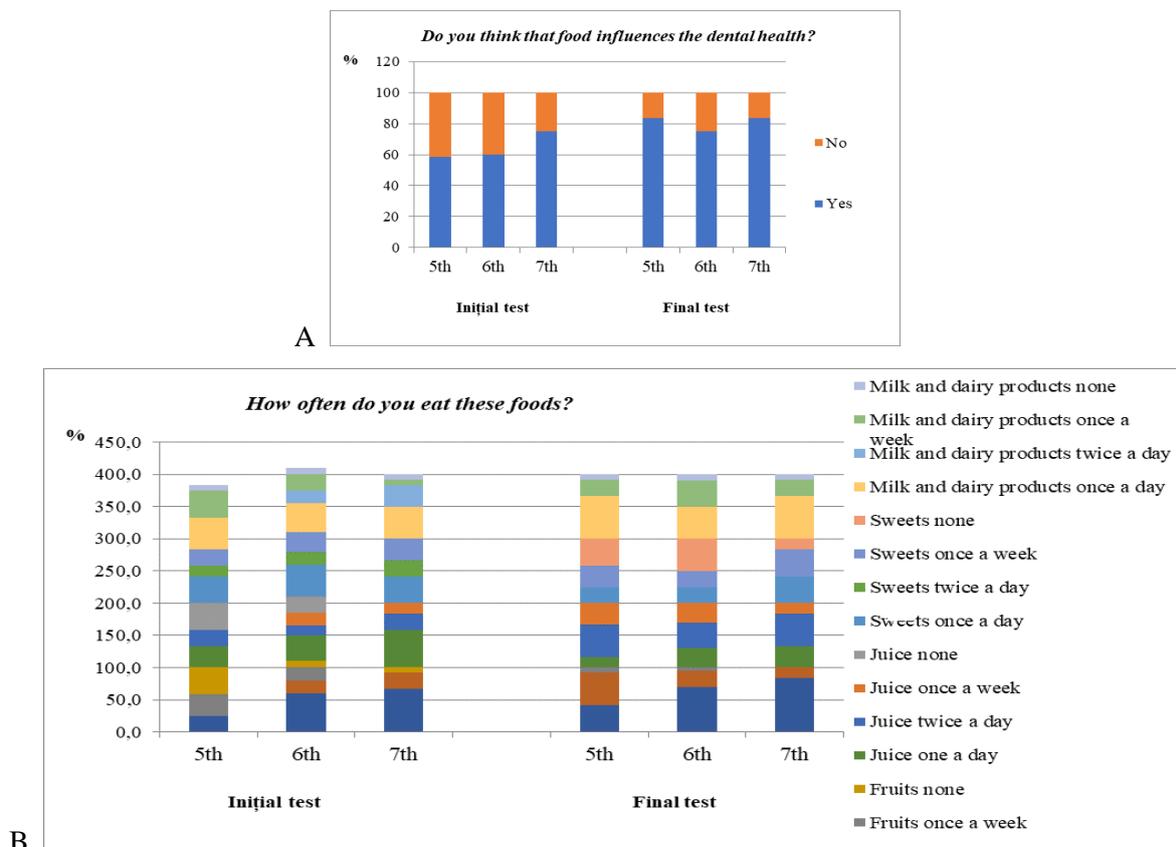


Figure 4. The initial and final evaluations of pupils food behavior, made before and after practical interventions (5th grade) and only theoretical (at 6th and 7th grade).

Table 6. Signification of the difference between the initial test and the final one, at all 44 pupils studied, no matter the intervention used, aiming the subjects demand for dental care services.

Items	t test (p)	Significance
How many times have you visited the dentist in the last 12 months?		
Once	0.40	ns
Twice	0.11	ns
I don't know	0.21	ns
None	0.05	*
Mention the reason why you visited the dentist.		
Extraction	0.09	*
Examination	0.06	*
Pain	0.21	ns
Unnatural position of the teeth	0.40	Ns

Note: p - significance value: $p < 0.01 = ***$ very significance; $p < 0.05 = **$ significance; $p < 0.1 = *$ significance tendency; $p \geq 0.1 = ns$ (not significance).

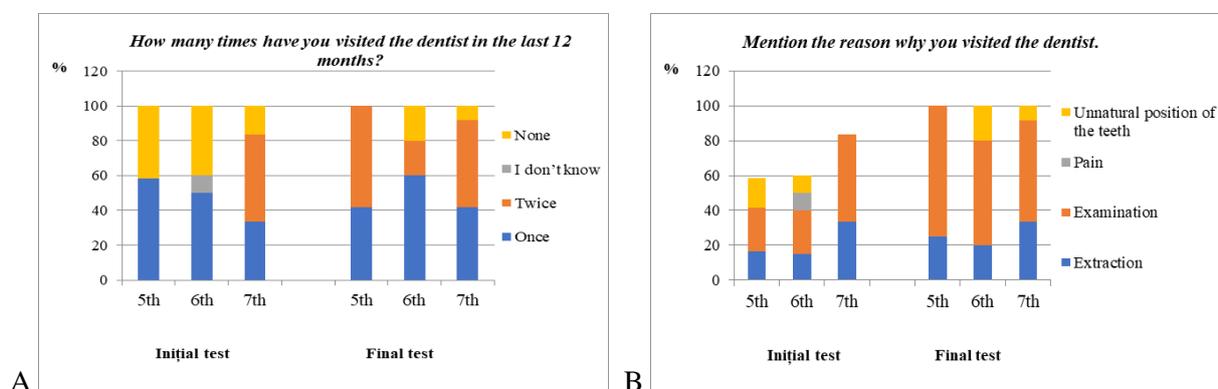


Figure 5. Subjects demand for dental care services, before and after practical interventions (5th grade) and only theoretical (at 6th and 7th grade).

Oral disease prevention should be a primary objective of society that hopes to ensure a good life quality. Prevention in the community level is the most value effective approach and has the extreme impact. The most cost-effective proceeding is oral health education. Education for oral health may be efficient in extending the knowledge for a short term and in some way, in optimizing habits like tooth brushing and eating healthy.

4. Conclusions

1. It is considered that it is imperative to teach the optional discipline of the curriculum, called *Health education*, to the middle school classes in the rural area, because the knowledge and prevention of diseases level rises substantially at pupils following this discipline.
2. Introducing additional information to school syllabus, strictly connected to oral cavity hygiene and obtaining awareness of the existing connection between food and oral health, but also between oral health and the wellbeing of the whole organism, as part of compulsory Biology course, at the chapters *Human anatomy and physiology*, have been extremely useful, leading to optimizing skills for a healthy food behavior, but also ensuring hygiene and health of the oral cavity.
3. Using the *visit* method with practical applicability, at the 5th grade had as result, on one hand enriching the scientific language and on the other hand, forming some skills and practical routines compulsory for a healthy responsible behavior, especially from oral health perspective.
4. No matter the form of the intervention applied, theoretical or practical, they led to a general progress, in matters of education for oral health of pupils from rural areas.

5. Education for health has influenced not only the immediate level of wellbeing of the pupil, but also his entire family. From the verbal feedback received from parents, children through their methods of optimizing the state of health, through their attitudes and opinions have actioned on their parents, convincing them to accompany them more often for an oral examination, so that they would also understand the oral health problems, being able in this way to influence positively the health of the entire community.

6. We hope that this preliminary study will contribute to our information and awareness of the situation in disadvantaged areas, both from the perspective of poverty and education, as well as intervention needs, either individual, but preferably collective, from the competent authorities.

References

- Axelsson, P., Buischi, Y.A., Barbosa, M.F., Karlsson, R., & Prado, M.C. (1994). The effect of a new oral hygiene training program on approximal caries in 12-15-year-old Brazilian children: Results after three years. *Advanced in Dental Research*, 8(2), 278–284. DOI:10.1177/08959374940080022201
- Blanco-López, A., Joaquín Franco-Mariscal, A., & España-Ramos, E. (2016) A competence-based approach to the design of a teaching sequence about oral and dental health and hygiene: A case study. *Journal of Biological Education*, 50(2), 196-206. <https://doi.org/10.1080/00219266.2015.1058838>
- Coleman, E. (1995). Health-related knowledge: where does it come from? *Journal of Biological Education*, 29(2), 139-146. <https://doi.org/10.1080/00219266.1995.9655433>
- Craft, M., Croucher, R., & Dickinson, J. (1981). Health education in schools: response of biology teachers to a dental health curriculum module. *Journal of Biological Education* 15(4), 285-288. <https://doi.org/10.1080/00219266.1981.9654400>
- Eley, C.V., Weston-Price, S., Young, V., Hoekstra, B., Gadhia, T., Muirhead, V., Robinson, L., Pinem, C., & McNulty, C.A.M. (2019). Using oral hygiene education in schools to tackle childtooth decay: a mixed methods study with children and teachers in England. *Journal of Biological Education*. <https://www.tandfonline.com/doi/pdf/10.1080/00219266.2019.1585380?needAccess=true>, available in April, 2020
- Eley, C.V., Young, V.L., Hayes, C.V., Parkinson, G., Tucker, K., Gobat, N., & McNulty, C.A.M. (2018). A mixed methods pilot of beat the bugs: A community education course on hygiene, self-care and antibiotics. *Journal of Infection Prevention* 19 (6), 278–286. doi:10.1177/1757177418780990
- Fensham, P.J. (2009). Real world contexts in PISA science: implications for context-based science education. *Journal of Research in Science Teaching*, 46(8), 884-896. 10.1002/tea.v46:8
- Frenkel, H., Harvey, I., & Needs, K. (2002). Oral health care education and its effect on caregivers' knowledge and attitudes: A randomised controlled trial. *Community Dentistry and Oral Epidemiology*, 30(2), 91–100. DOI:10.1034/j.1600-0528.2002.300202.x
- Hawking, M.K., Lecky, D.M., Verlander, N.Q., & McNulty, C.A.M. (2013). Fun on the farm: evaluation of a lesson to teach pupils about the spread of infection on school farm visits. *PLoS One* 8(10), e75641. DOI:10.1371/journal.pone.0075641
- <https://www.e-bug.eu/>, available in Mars, 2020.
- Laiho, M., Honkala, E., Nyysönen, V., & Milen, A. (1993). Three methods of oral health education in secondary schools. *Scandinavian Journal of Dental Research*, 101 (6), 422–427. DOI:10.1111/j.1600-0722.1993.tb01142.x
- Mafra, P., & Lima, N. (2009). The microorganisms in the portuguese national curriculum and primary school textbooks. Current research topics in applied microbiology and microbial biotechnology. In: *Proceedings of the International Conference on Environmental, Industrial and Applied Microbiology* (BioMicroWorld 2007), Seville, Spain, Hackensack: World Scientific. <http://hdl.handle.net/1822/11169>

- Mafra, P., Lima, N., & Carvalho, G.S. (2015). Experimental activities in primary school to learn about microbes in an oral health education context. *Journal of Biological Education*, 49(2),190-203. <https://doi.org/10.1080/00219266.2014.923485>
- Marcenes, W.N.J., Kassebaum, E., Bernabe, A., Flaxman, M., Naghavi, A., Lopez, A., & Murray, C.J. (2013). Global burden of oral conditions in 1990–2010: A systematic analysis. *Journal of Dentistry Research*, 92 (7), 592–597. doi: 10.1177/0022034513490168
- Mariño, R., Calache, H., Wright, C., Schofield, M., & Minichiello, V. (2004). Oral health promotion programme for older migrant adults. *Gerodontology*, 21(4), 216–225. DOI:10.1111/j.1741-2358.2004.00035.x
- McNulty, C.A., Lecky, D.M., Farrell, D., Kostkova, P., Adriaenssens, N., Koprivová Herotová, T., Holt, J., Touboul, P., Merakou, K., Koncan, R., Olczak-Pienkowska, A., Avô, A.B., Campos, J., & e-Bug Working Group (2011). Overview of e-Bug: an antibiotic and hygiene educational resource for schools. *The Journal of Antimicrobial Chemotherapy*, 66 (5), v3–12. DOI:10.1093/jac/dkr119
- Nakre, P.D., & Harikiran, A.G. (2013). Effectiveness of oral health education programs: A systematic review. *Journal of International Society of Preventive & Community Dentistry* 3(2), 103–115. doi:10.4103/2231-0762.127810
- Pakhomov, G.N., Moller, I.J., Atanassov, N.P., Kabackchieva, R.I., & Sharkov, N.I. (1997). Effect of an amine fluoride dentifrice on dental caries used in a community-based oral health education program. *Journal of Public Health Dentistry*, 57(3),181–183. DOI:10.1111/j.1752-7325.1997.tb02971.x
- Pop-Păcurar, I., & Ciascai, L. (2010). Biology school textbooks and their role for students' success in learning sciences. *Acta Didactica Napocensia*, 3(1), 1-10. <https://eric.ed.gov/?id=EJ1056119>
- Pop-Păcurar, I., & Tirla, F-D. (2009). Models role within active learning in biology. A case study. *Acta Didactica Napocensia*, 2(2), 42-50. http://journaldatabase.info/articles/models_role_within_active_learning.html
- Redmond, C.A., Blinkhorn, F.A., Kay, E.J., Davies, R.M., Worthington, H.V., & Blinkhorn, A.S. (1999). A cluster randomized controlled trial testing the effectiveness of a school-based dental health education program for adolescents. *Journal Public of Health Dentistry*, 59(1), 12–17. DOI:10.1111/j.1752-7325.1999.tb03229.x
- Thornton, M., & Terry, J. (1994). Now rinse please: investigating the antimicrobial activity of mouthwashes. *Journal of Biological Education* 28(3), 181-184. <https://doi.org/10.1080/00219266.1994.9655389>
- Vachirarojpisan, T., Shinada, K., & Kawaguchi, Y. (2005). The process and outcome of a programme for preventing early childhood caries in Thailand. *Community Dentale Health*, 22 (4), 253–259. <https://www.ncbi.nlm.nih.gov/pubmed/16379164>
- Vanobbergen, J., Declerck, D., Mwalili, S., & Martens, L. (2004). The effectiveness of a 6-year oral health education programme for primary schoolchildren. *Community Dentistry and Oral Epidemiology*, 32 (3),173–182. DOI:10.1111/j.1600-0528.2004.00151.x
- Webb, G. (1992). A critical survey of methods used to investigate links between diet and disease. *Journal of Biological Education*, 26(4), 263-271. <https://doi.org/10.1080/00219266.1992.9655284>
- World Health Organisation (2017). *What is the burden of oral disease?* http://www.who.int/oral_health/disease_burden/global/en/, available in Mars 2020.

Authors

Adriana PETRUȘ-VANCEA, University of Oradea, Faculty of Informatics and Science, Biology Department (Romania). E-mail: adriavanc@yahoo.com

Lucia ȘTIRB, Middle School no. 1, Buciumi Locality (Romania). E-mail: luciasstirb@yahoo.com

Acknowledgement

We would like to thank doctor Covaciu Cristina-Elena, from Vaida Dent SRL dental office from the city of Zalau, Salaj county, for the scientific volunteering she made, for the dental evaluations made, professional brushing and recommendations offered for free to 5th grade pupils comprised in this preliminary study and we hope to support us in continuing it.