Drinks and teeth hygiene: a school-based survey of children's preferences of soft drinks and knowledge of dental health

Bebidas e higiene dental: un estudio en escolares sobre las preferencias de consumo de refrescos y nivel de la salud dental

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Abstract

The purpose of this study was to investigate children's preferences of soft drinks and their knowledge of the dental health problems caused by them. A sample from Larissa city in Central Greece was taken for this study, with a total of 600 students (305 boys and 295 girls) aged 9-12 years old. Results showed that in all age groups milk is children's first choice of preference. Parents and friends influenced youngest and oldest children choices, while taste was also very important for older children. Children seemed not to believe in advertisements, although younger children realize that advertisements try to make them buy products. Lastly this study confirms our hypothesis, that children's knowledge of the dental health effects of soft drinks is limited.

Key words: *dental erosion, survey, soft drinks, secondary school*

Resumen

El propósito de este artículo es investigar las preferencias de los escolares en su consumo de refrescos, y el conocimiento que éstos tienen sobre los problemas de salud dental que les puede producir este consumo. Para ello se tomó una muestra de 600 estudiantes (305 niños y 295 niñas), en una edad de 9-12 años, residentes en la ciudad de Larissa, situada en el centro de Grecia. Los resultados muestran que en todos los grupos la leche es la bebida preferida, y que la influencia de padres y amigos es muy importante, a la hora de elegir, en los niños menores de edad. Por el contrario en los niños mayores, el sabor es el factor más importante al decidir la bebida preferida. Los niños no parecen creer en los anuncios, aunque los más jóvenes se dan cuenta que la finalidad de los anuncios es hacerles comprar determinados productos. Finalmente, este estudio confirma nuestra hipótesis, que los niños tienen un conocimiento muy limitado de los efectos perniciosos de los refrescos, sobre su salud dental.

Palabras clave: *caries, encuesta, refrescos, escuela secundaria.*

INTRODUCTION

The importance of developing healthy nutritional habits from the early years of our life becomes obvious, since young individuals with healthy eating habits show decreased risk for immediate health problems, such as obesity, anaemia or dental problems (Vereecken, Henauw & Maes, 2005). Regarding the consumption of drinks, the majority of children tend to consume various kinds of drinks such as milk, fresh juices, fruit-flavoured drinks or carbonated beverages since the early years of their life. Although milk is considered to be healthy, juices, fruit-flavoured drinks and carbonated beverages contain mild acids, which can damage teeth. Unfortunately, most of the children are not familiar with the effects that the consumption of those acidic drinks can have on their oral health.

One of the most important dental diseases connected to acidic drink consumption is dental erosion, which results from the chemical action of acids on the tooth surface (Al-Malik *et al.*, 2002; Bartlett, 2005). Dental erosion is the progressive irreversible loss of dental hard tissue (enamel and dentine) due to chemical process that does not involve bacteria (WHO, 2003; Bartlett, 2005; Yip et. al., 2003; Moynihan, 2005). It is estimated that approximately 50% of 5-year-olds and 30% of 14-year-olds show dental erosion evidence (British Nutrition Foundation, 2004). According to Ganss *et al*. (2001) dental erosion is more likely caused by the individual's nutritional behaviour.

There are three types of tooth erosion: a) idiopathic erosion, b) extrinsic erosion and c) intrinsic erosion (Moss, 1998). According to Moss (1998) idiopathic erosion is the result of tooth contact with acids of unknown origin and it is an erosion-like pathology. Extrinsic elements include acidic food, beverages, or even liquid oral medicines (Moss, 1998; Nunn *et al*., 2001). Finally, intrinsic causes of dental erosion include endogenous acids or gastric acid (Jarvinen *et al*., 1991; Moss, 1998).

Erosion in 6-16 year olds is often seen in combination with high consumption of carbonated drinks and fruit juices (Attin *et al*., 2005), Furthermore, erosion is linked to the frequency, the method and the timing of drink consumption (Harley, 1999).

Various international studies indicate that dental erosion in children and adolescents is correlated to the consumption of soft drinks or fruit drinks (Jarvinen *et al*., 1991; Al-Dlaigan *et al.*, 2001; Al-Majed *et al*., 2002; Shaw & Smith, 2001; Dugmore & Rock, 2004; Jensdottir *et al.*, 2005; Luo *et al.*, 2005). Furthermore, it has been proven that modifying drinking habits could prevent erosion (Moazzez *et al.*, 2000).

Regarding the effects of cola drinks, it has been found that individuals who consume such soft drinks show dental erosion (Van Eygen *et al*., 2005; Wongkhantee et. al., 2005). Seow & Thong (2005) found that the most acidic drinks had the greatest erosive effects on enamel. Apart from teeth erosion, cola drinks were found to lead in various undesirable results such as body weight increase or even carcinogenicity (Belpoggi *et al.*, 2006). Therefore children and adolescents should avoid consuming them.

The study presented in this paper aimed to investigate a) Greek primary school students' drinking preferences, b) the factors associated with their drink choice and c) their knowledge on the effect that those drinks have on their oral health.

METHOD

Sample

A sample from Larissa city in Central Greece was taken for this study. The study took place with a total of 305 boys (50,8%) and 295 girls (49,2%) aged 9-12 years old from 2 schools, 1 rural and 1 semi-rural in Larissa. From the sample of 600 children, 26 children were nine years old, 235 children 10 years old, 197 children 11 years old and 142 children 12 years old. Table 1 presents the demographic characteristics of the sample. The students were randomly selected from their classes.

Table 1
Age of the Participating Sample

Age	N (%)
9	26 (4,3%)
10	235 (39,2%)
11	197 (32,8%)
12	142 (23,7%)
Total	600 (100%)

Data collection

As this study was a school-based survey, a questionnaire for each student was prepared and administered to the students by the researchers. A consent form was sent out to the parents of all children, so that they were informed of their children's participation in this research. A discussion with the students regarding the purpose of the study was conducted with the researchers at the two schools, prior to the administration of the questionnaire. The procedure was completed within three weeks. The researchers were reading aloud the questions to the students and were giving them sufficient time to respond. The total test time was about 20 minutes.

The questionnaire used was based on a questionnaire that MAY & WATERHOUSE (2003) developed for their focus group study. The newly developed instrument consisted of 3 demographic questions i.e. about the educational background of the children's parents and 11 structured questions, such as knowledge questions i.e. about factual information, behaviour questions, opinion questions i.e. about children's preferences on beverages and soft drinks, and feeling questions i.e. on children's choice of drinks. The questionnaires were analysed using the SPSS statistical package.

RESULTS

The children were asked to state "what are their preferable beverages". In the question *"what do they like to drink more"* they could mention more than one beverage. Table 2 shows that milk was mentioned by 341 children, juice was mentioned by 189, fizzy drinks by 149 and fresh juice by 144. A chi square statistical test (x^2) (p= 0.05) between girls' and boys' preferences demonstrated that there is statistical difference in drink choice only among juices (x^2 =11.226, p= 0.001), where girls like juices more than boys. As presented in table 3 younger children, i.e. 9-year-olds prefer fizzy drinks, followed by milk, then juices and lastly fresh juices. Older children, i.e. 10, 11 and 12 years old have different preferences; they prefer milk, then juices, then fresh juices and lastly fizzy drinks. Chi square test revealed a significance difference between the age groups in the choice of fizzy drinks (x^2 =17.874, p= 0.000) and juices (x^2 =14.011, p= 0.003).

Table 2
Frequencies of the answers given to question 1 in relation to gender

		Boys	Girls
Drinks	Milk	188	153
	Juice	77	112
	Fizzy drink	88	61
	Fresh Juice	60	84

Question 1: What do you like to drink more?

Table 3
Frequencies of the answers given to question 1 in relation to age

		9 years old	10 years old	11 years old	12 years old
Drinks	Milk	11	135	117	78
	Juice	6	61	61	62
	Fizzy drink	14	49	42	44
	Fresh Juice	4	50	45	45

Question 1: What do you like to drink more?

When asked to identify *"what affects their choice of drink"*, where they could, once again, mention more than one factors, many children stated that they prefer a drink either because it tastes well (N=416), or because it is healthy and full of vitamins (N=400). Less important factors are family, friends, look, price and access.

Table 4 shows that boys choose a drink mostly because of its taste, in contrast to girls who choose it because it is healthy. The second factor that affects girls' choice of drink is its taste, while boys choose a drink because it is healthy. Next factor in line for both sexes is whether the drink quenches their thirst, while the fourth factor is family. Friends affect both sexes, but they affect more boys than girls. Moreover, access, look and price influence more boys than girls. The factors in which there is statistical difference between boys and girls are the drink's price (x^2 =9.524, p= 0.002) and how healthy is the drink (x^2 =10.224, p= 0.001). In relation to their age, table 5 shows differences amongst 9 and 10 year olds, whereas 11 and 12 years have similar preferences. Statistically significant differences amongst the age groups are seen in family (x^2 =17.981, p= 0.000) and taste (x^2 =14.584, p= 0.002) choosing criteria.

Table 4
Frequencies of the answers given to question 2 in relation to gender

		Boys	Girls
Factors	Family	137	102
	Friends	57	42
	Look	34	17
	Taste	210	206
	Price	26	8
	Access	42	21
	Healthy	184	216
	Drinkable	140	149

Question 2: What affects your choice of drink?

Table 5
Frequencies of the answers given to question 2 in relation to age

		9 years old	10 years old	11 years old	12 years old
Factors	Family	10	118	62	49
	Friends	6	37	25	31
	Look	2	20	14	15
	Taste	20	142	146	108
	Price	3	15	11	5
	Access	3	20	25	15
	Healthy	12	163	136	89
	Drinkable	14	102	99	74

Question 2: What affects your choice of drink?

Regarding the effect of advertisement in their drinking choices, students where asked *"whether there are any particular advertisements they like for fizzy drinks, milk or any other soft drink"*. Table 6 shows that the majority of children (68%) do not like a particular advertisement, while some children like advertisements of drinks, beverages and milk. The children's answers were based on the music and the colour of the advertisements, their favourite hero and whether they had nice slogans. When asked whether *"they believe that advertisements are true"* the vast majority of the children (77,2%) answered that they do not believe in advertisements, while 16.2% sometimes and 6,7% always believe in them (see table 7). Finally, more than half of the children (57,5%) are not influenced by advertisements on their choice of drink. Conversely, 25,8% are sometimes influenced and 16,7% are always influenced by advertisements (see table 8).

Table 6
Percentage analysis of the answers given to question 3

	N(%)
No	408 (68,0%)
Fizzy drink	59 (9,8%)
Milk	66 (11,0%)
Juice	67 (11,2%)
Total	600 (100%)

Question 3: Are any particular advertisements you like for fizzy drinks, milk or any other soft drink?

Table 7
Percentage analysis of the answers given to question 4

	N(%)
No	463 (77,2%)
Yes	40 (6,7%)
Sometimes	97 (16,2%)
Total	600 (100%)

Question 4: Do you believe that what you see on the advertisements is true?

Table 8
Percentage analysis of the answers given to question 5

	N(%)
No	345 (57,5%)
Yes	100 (16,7)
Sometimes	155 (25,8%)
Total	600 (100%)

Question 5: Do advertisements help you to choose your soft drink?

Regarding their drinking habits, most of the children (54,7%) reported that they would never change their favourite drink, while 45,3% of them would change it for a variety of reasons, e.g. because something better came up in the market, because it is bad for their health or because their mother does not like the product (see table 9). Table 10 shows that 57,8% of children would not change their favourite soft drink, while 42% would change their favourite drink for a variety of reasons.

Table 9
Percentage analysis of the answers given to question 6

	N(%)
Nothing	328 (54,7%)
Something (explanation was given)	272 (45,3%)
Total	600 (100%)

Question 6: What could stop you from drinking your favourite fizzy drink, milk, juice or any other soft drink?

Table 10
Percentage analysis of the answers given to question 7

	N(%)
I do not know	1 (0,2%)
No	347 (57,8%)
Yes, (I would change)	252 (42,0%)
Total	600 (100%)

Question 7: Would you change your favourite drink and if yes why?

Students' knowledge on which drinks are healthy or not, was assessed. It is apparent from table 11 that the majority of children (94,5%) believe that some soft drinks are healthy and some are not, while only 5,3% believe that all drinks are good for their health. In question 9 (see table 12) students could mention more than one beverage in each category. Of the 600 children 488 (81%) believe that milk is the healthiest soft drink, followed by fresh juice (68,3%) and other juices (46,5%). When asked, 515 children (85,8%) of children answered that they believed that fizzy drinks are not healthy and 25,0% believed that juices are harmful.

Table 11
Percentage analysis of the answers given to question 7

	N(%)
I do not know	1 (0,2%)
No	32 (5,3%)
Yes	567 (94,5)
Total	600 (100%)

Question 8: Do you believe there are healthy and unhealthy soft drinks?

Table 12
Percentage analysis of the answers given to question 9

	Healthy	Unhealthy	I do not know
Milk	488	0	114
Juice	279	150	171
Fizzy drinks	10	515	75
Fresh Juice	410	0	190

Question 9: Which soft drinks are healthy and which are unhealthy?

When children were asked to name teeth diseases, they gave a lot of different answers. A rather high percentage (35,3%) of the children knew nothing about dental health and could not name any teeth disease. The most frequent disease that children were aware of was caries, followed by gingivitis and plaque. A few children mentioned that teeth simply erode and therefore acquire holes. tables 13 and 14 present the children's answers in relation to their gender and their age respectively. From the data presented in table 13 it is apparent that girls know more than boys about teeth diseases. Regarding the age effect, it was found that older students are more aware of teeth diseases than younger ones. Age was found to have statistical significance on children's answers and thus knowledge of teeth diseases (x^2=46.476, p=0.000). Intriguing, though, is the fact that 56,1% of the 10 year old children knew nothing about teeth diseases, followed by a percentage of 46,1% from 9 years old, 21,1% from 12 years old and 19,3% from 11 years old.

Parents' educational background was found to be an important factor on children's education and lifestyle. Children's decisions and knowledge are connected with their parents' knowledge. More precisely, it was found that children's answer *"I do not know any teeth diseases"*, was dominated by children whose parents have only finished either elementary or middle school. Statistical analysis showed that fathers' knowledge predominated on children's choices (x^2=12,880, p=0,005).

Table 13
Frequencies of the answers given to question 10 in relation to gender

	Boys	Girls
Caries	92	109
Gingivitis	14	11
Caries & Gingivitis	62	62
Caries & Plaque	3	7
Gingivities & Plaque	1	1
Caries, Gingivities & Plaque	7	14
Erosion & holes	1	4
I do not Know	125	87

Question 10: Could you name some teeth diseases and what causes them?

Table 14
Frequencies of the answers given to question 10 in relation to age

		9 years old	10 years old	11 years old	12 years old
Teeth Diseases	Caries	7	63	81	50
	Gingivitis	1	8	4	12
	Caries & Gingivitis	2	26	67	29
	Caries & Plaque	1	3	1	5
	Gingivities & Plaque	1	1	1	2
	Caries, Gingivities & Plaque	1	3	5	12
	Erosion & holes	2	1	1	2
	I do not Know	12	132	38	30

Question 10: Could you name some teeth diseases and what causes them?

Finally, children were asked what *"could help them stop consuming the drinks that damage their teeth"*. Table 15 shows that 31,5% would continue to drink their favourite drink irrespective of the damage caused to their teeth. 18,8% of children mentioned that one reason for stopping them drinking drinks would be teeth erosion, whereas 17,7% of them mentioned that the dentist could check their teeth and decide for them and 13% mentioned that they could ask their parents. Meanwhile, a small percentage of 7,3% did not know if something could help them stop drinking drinks that affect their teeth.

Table 15
Percentage analysis of the answers given to question 11

		N(%)
Teeth Diseases	Dentist	106 (17,7%)
	Family	78 (13,0%)
	Erosion of teeth	113 (18,8%)
	Something else	70 (11,7%)
	Nothing	189 (31,5%)
	I do not know	44 (7,3%)
	Total	600 (100%)

Question 11: What could help you to stop consuming the drinks that damage your teeth?

DISCUSSION

There is little information concerning the factors that influence children's choice of drinks in the dental literature, therefore a survey with a sample of 600 Greek children (ages 9, 10, 11 and 12 years old) was conducted for this study.

Results showed that in all age groups, milk is children's first choice of preference, followed by juice, fizzy drinks and lastly fresh juices. Yet, in their study, HARNACK *et al*., (1999), found that soft drinks displace milk and fruit juice in children's diets and that soft drink consumption was inversely associated with consumption of milk and fruit juice. It was also useful to see that mainly boys drink more milk and fizzy drinks in comparison to girls who prefer juices and fresh juices. In their study, MILOSEVIC *et al.,* (2004) have also found than boys drunk more soft drinks than girls. Taking age into consideration, children's drinking preferences are not the same. Nine and ten year olds prefer less juices and fresh juices in comparison to older children who prefer these types of drinks. Younger children prefer fizzy drinks, a finding that disagrees with other studies (British Soft Drinks Association, 2000; WALKER *et al*., 2000), which found that children under 10 consume more fruit flavoured drinks and children older than 10 years old prefer fizzy drinks.

The importance of taste in children's choice of drinks agrees with work carried out by SHEPHERD (1999), which concluded that an individual's liking for a sensory attribute in a particular food is often the determining factor in food choice. Taste has also been found to be of great importance in other previous studies (MAY & WATERHOUSE, 2003; GRIMM *et al.,* 2004). Another strong factor on children's choice is whether a drink quenches their thirst.

The strong influence of parents on young children agrees with work of MAY & WATERHOUSE (2003) and DIBB (1993), who found that prior to children's entrance to school, their diet is very much influenced by their experiences within the family. DEBIASE (1991) found that eating habits and preferences are established by early childhood. MAY's & WATERHOUSE's study comes to the same conclusion. More precisely, they found that 8 and 9 year old children tried all of their parents' soft drinks. MOREOVER, another study has shown that children whose parents drink loads of soft drinks, are more willing to consume more soft drinks from children whose parents do not drink a lot (GRIMM *et al.,* 2004). In addition, the present study has found that children best like the foods they have been exposed to most frequently (DIBB, 1993). On the contrary, MAY &WATERHOUSE (2003) found that if children had a drink too often they were tired of it.

Friends have been found to affect children's choices in this study, which disagrees with MAY's & WATERHOUSE's findings who suggested that children of all age groups were not affected by their friends' choices. The researchers (MAY & WATERHOUSE, 2003), however, have observed that younger children, 8-9 years old, like to act the same as their friends whilst this is not the case with older children. In the present study, younger children were found to be more influenced by their friends. However, it must be mentioned that the influence of peer groups is often subconscious and older children may not realize how much influence their friends have upon them (MAY & WATERHOUSE, 2003).

In terms of advertisement, the results agree with the National Food Alliance (1996), which found that children understand the intent of advertisements when they reach middle school, although younger children realize that advertisements try to make them buy products. MAY & WATERHOUSE (2003) have the same view.

The present study confirms hypothesis, that children's knowledge of the dental health effects of soft drinks is limited. The same finding is supported by MAY & WATERHOUSE (2003), who support that children's knowledge of the dental health effects was confused and it appears that more education is needed in this area. Despite the fact that most children acknowledge that not healthy soft drinks like fizzy drinks exist, they did not know exactly the effects of these drinks on their teeth. Older children, however, did mention the most common teeth diseases like caries and gingivitis, but did not know what causes these diseases. As far as the term "teeth erosion" is concerned, children did not seem to know it. This is different than MAY & WATERHOUSE (2003) research findings, where it was found that children in their study that took place in Newcastle, England did know that term.

The present study also found that dentists and parents could increase children's knowledge of harmful effects of erosive drinks and therefore change their behaviour. Furthermore, a sufficient number of children stated that they could stop drinking soft drinks if they could see that their teeth started eroding.

CONCLUSIONS

It may be concluded from this study that children prefer milk from other soft drinks, because they think it is healthy, but soft drinks' taste plays an important role on their decision when choosing other drinks. Children could separate healthy from unhealthy and harmful soft drinks, but have no knowledge of the harmful effects of these drinks on their teeth. Children's point of view can change depending on their age and parents educational background.

Health education programmes, which can be specific for each age group, should be created in Greece to enable behavioural changes on the children's choices of soft drinks. This study gathered information on children's choice of drinks, the factors that affect them and their knowledge of dental diseases. We believe this is a preliminary study and more research studies should follow in this area.

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