PJDRS

Padjadjaran Journal of Dental Researchers and Students

Journal homepage: https://jurnal.unpad.ac.id/pjdrs

p-ISSN: 2656-9868 e-ISSN: 2656-985X

Research Article

Differences in the use of super red dragon fruit extract and disclosing solution on plaque index using the HI BOGI application: cross-sectional study

Rina Putri Noer Fadilah[1*]
Hasna Fasya Rahmani[1]
Euis Reni Yuslianti[2]
Ari Prayogo Pribadi[3]

[1]Department of Public Health, Faculty of Dentistry, Jenderal Achmad Yani University Cimahi, Indonesia
[2]Department of Oral Biology, Faculty of Dentistry, Jenderal Achmad Yani University Cimahi, Indonesia
[3]Department of Epidemiology and Biostatistics, School of Public Health, Environmental Research Group of the Faculty of Medicine Imperial College London, United Kingdom

*Correspondence:
rina.putri@lecture.unjani.ac.id

Submission: 21 November 2023
Revision: 01 February 2024
Accepted: 27 February 2024
Published: 29 February 2024
DOI: 10.24198/pjdrs.v8i1.51176

ABSTRACT

Introduction: Oral health has an important role in a person's health, however, low public awareness of dental and oral health causes high cases of dental and oral disease in Indonesia, one of which is plaque buildup and caries. Plaque index assessment can be a measuring tool for dental and oral hygiene, namely Patient Hygiene Performance (PHP) by giving a disclosing solution which can stain dental plaque. Disclosing solution, a current synthetic chemical, has an unpleasant taste, sometimes causing allergic reactions, and has the potential to be carcinogenic, so alternatives are needed. Among alternatives of natural materials which can be used is dragon fruit juice, as it has natural anthocyanin content and can help color the plaque. The aim of this research was to determine differences in using synthetic disclosing solution and dragon fruit juice on plaque index using the Halo Indonesia with Dentists (HI BOGI) application. **Methods:** This type of research was cross-sectional. Technique Cluster *random sampling* used in this research involved 84 junior high school students in Cimahi (a city in West Java). **Results:** This research showed that the PHP index through the HI BOGI application obtained a greater average plaque index value when using disclosing *solution,* namely 1.437, compared to dragon fruit juice, namely 0.907, with p value = 0.000 (significance atp<0,05). **Conclusion:** There are differences between plaque index measurements using synthetic disclosing solution and red dragon fruit juice using the HI BOGI application for junior high school students in Cimahi.

KEYWORDS: index place,disclosing solution, dragon fruit juice, HI BOGI.

Perbedaan indeks plak memakai ekstrak buah naga dan disclosing solution dengan menggunakan aplikasi HI BOGI: studi cross-sectional

ABSTRAK

Pendahuluan: *Kesehatan mulut memiliki peranan penting dalam kesehatan seseorang, namun rendahnya kesadaran masyarakat akan kesehatan gigi dan mulut menyebabkan tingginya kasus penyakit gigi dan mulut di Indonesia, salah satunya penumpukan plak dan menimbulkan karies. Penilaian indeks plak dapat menjadi alat ukur kebersihan gigi dan mulut, salah satunya adalah* Patient Hygiene Performance *(PHP) dengan pemberian* disclosing solution *yang mampu mewarnai plak gigi. Disclosing solution kimia sintetis saat ini memiliki rasa yang kurang enak, kadang menimbulkan reaksi alergi, serta berpotensi karsinogenik sehingga diperlukan alternatif pengganti. Di antara alternatif bahan alam yang dapat digunakan adalah sari buah naga, dengan adanya kandungan alami antosianin dan dapat membantu mewarnai plak. Tujuan dari penelitian ini adalah untuk mengetahui perbedaan penggunaan disclosing solution sintetis dan sari buah naga terhadap indeks plak dengan menggunakan aplikasi Halo Indonesia Bersama Dokter Gigi (HI BOGI).* ***Metode:*** *Jenis penelitian ini adalah* cross-sectional. *Teknik* cluster random sampling *digunakan dalam penelitian ini dengan melibatkan siswa/i SMP di Kota Cimahi sebanyak 84 orang.* ***Hasil:*** *Penelitian ini menunjukkan indeks PHP melalui aplikasi HI BOGI didapat nilai rerata indeks plak pada menggunakan disclosing solution lebih besar yaitu 1,437 dibanding sari buah naga yaitu 0,907, dengan nilai p = 0,000 dengan p<0,05.* ***Simpulan:*** *Terdapat perbedaan antara pengukuran indeks plak menggunakan* disclosing solution *sintesis dan sari buah naga merah dengan memakai aplikasi HI BOGI pada siswa/i SMP di Kota Cimahi.*

KATA KUNCI: *Indeks plak, disclosing solution, sari buah naga, HI BOGI.*

Citation: Rina Putri Noer Fadilah, Rahmani HF, Yuslianti ER. Differences in the use of super red dragon fruit extract and disclosing solution on plaque index using the HI BOGI application: cross-sectional study. Padjadjara Journal of Dental Researchers and Students. 2024; 8(1): 15-22. DOI: 10.24198/pjdrs.v8i1.51176.

INTRODUCTION

Oral health plays an important role in a person's health, so that disturbed oral health can cause dental and oral diseases.[1,2] The high number of cases of dental and oral disease in Indonesia is due to low public awareness of dental and oral health.[3] Caries and periodontal disease have a high prevalence in Indonesia. Basic Health Research (Riskesdas) in 2018, obtained data that the proportion of dental and oral health problems in Indonesia is 57.6% and the prevalence of periodontal disease is 74.1%.[4] It is known from the results of this data that Indonesian people have dental and oral health problems which begin with the formation of plaque on the teeth, one of which is caused by food residue left in the gaps between the teeth and because the way of brushing teeth is not in accordance with the recommended method.[5] This is proven in the 2018 Riskesdas data for the 10-14 year old age group in Cimahi (a city in West Java) regarding correct tooth brushing behavior, in which 4.75% of the data results showed that they still lack public knowledge regarding correct tooth brushing which can cause plaque to form.[4]

Plaque on teeth is caused by colonial bacteria that are attached to the outer tooth enamel.[6,7] The process of cleaning one's teeth must be carried out as well as possible, namely brushing the teeth twice a day with the help of the correct time and technique for brushing teeth without leaving plaque on the teeth. A person who neglects oral hygiene can cause plaque to remain and continue to accumulate, causing caries.[8,9]

Plaque index assessment can be a tool for measuring dental and oral hygiene. One index for measuring plaque on teeth that is widely used in the community is *Oral Hygiene* Index Simplified (OHIS) which is evaluated visually and Patient Hygiene Performance (PHP) by giving disclosing solution which can stain the plaque on the teeth, for example synthetic disclosing solution that is widely sold on the market.[10] Synthetic disclosing solution is a red solution that can color plaque on teeth. Disclosing solution has an unpleasant taste and can cause allergic reactions in some individuals, due to the chemicals contained in it. Synthetic disclosing solution can also have the potential to be carcinogens if ingested over a period of continuous use, so an alternative is needed.[6,11]

Another alternative that can be used and is easy to find around us is dragon fruit. The results of previous research showed that the natural content of anthocyanins found in red-fleshed dragon fruit (*Hylocereus costaricensis)* has the largest amount of content compared to other types of dragon fruit which can color plaque so it is easier to see. It is very easy to find and tastes quite sweet and has an attractive color.[11] Therefore, this disclosing solution helps to see the dental plaque that is still left which is a necessity to see a person's oral hygiene.[12]

Another problem faced in Indonesia is the location of the community which is far from dental and oral health facilities/dentists. This was then attempted when the development of technology 4.0 was growing very quickly. One of the developments in the world of dentistry is presenting teledentistry which can enable remote consultations, especially for people who do not have access to a dentist. HI BOGI "Hello Indonesia with Dentists" is one of the applications of teledentistry development which involves the exchange of clinical information in which the dentists can carry out dental consultations and treatment planning because they can assess the oral hygiene status of teeth that can be accessed online and can also shorten the process without having to calculate an index manually and without carrying out direct examinations in clinics or hospitals.[13,14]

The difference between this study and the previous research is the use of intraoral photos of patients which can be assessed in the HI BOGI application. This research will continue to for measuring the differences in plaque wear index of synthetic disclosing solution and sari super red dragon fruit using the HI BOGI application of junior high school students in Cimahi. Based on information above, the aim of this research was measuring the differences in plaque wear index of synthetic disclosing solution and sari super red dragon fruit using the HI BOGI application,

METHODS

This research was cross-sectional analytical. The technique of *cluster random sampling* was used in this research to determine the sample of research subjects. With Cluster random sampling this research used samples from 3 sub-districts in Cimahi, namely: South Cimahi, North Cimahi, and Central Cimahi. Then, after obtaining data from junior high schools in each sub-district, random selection was carried out using the SPSS application, so that in each sub-district SMPN 2 Cimahi, SMPN 12 Cimahi, and SMPN 15 Cimahi were selected. The minimum sample size was obtained from the unpaired numerical analytical sample size formula for 2 groups with the formula for the combined standard deviation (S), Zα (alpha standard deviation), Zβ (beta standard deviation), and $x^1 - x^2$ (minimum difference between the means that was considered significant) values S=14.05 and Zα (1.96), Zβ (0.84) with $x^1 - x^2$ (10).[15] Calculation results with the formula obtained the minimum sample size of 31 people. And the results of the research were 84 people after selecting research subjects according to the inclusion and exclusion criteria.

The subjects of this research were students of SMPN 2 Cimahi, SMPN 12 Cimahi, and SMPN 15 Cimahi with inclusion criteria, namely, students aged 12-15 years, students whose parents had permitted research, (informed consent), students with index teeth (teeth 16, 11, 26, 36, 31, and 46) that had completely erupted, students with android smartphone who had downloaded the HI BOGI application, and students who had no

history of food allergies. The exclusion criteria in this study were students who use fixed orthodontics, use prosthodontics, students with physical and mental limitations, students who cannot open their mouths wide, students with conditions of missing teeth in index teeth (teeth 16, 11, 26, 36, 31, and 46) and students with remaining tooth roots in index teeth (teeth 16, 11, 26, 36, 31, and 46).

This research was conducted in December 2022 for 2 weeks with 2 data collectors who played a role in carrying out the research, namely by selecting samples according to the inclusion criteria at SMPN 2 Cimahi, SMPN 12 Cimahi, and SMPN 15 Cimahi and distributing consent forms (informed consent*)* to students who were to be be approved by parents one day before the research began. The next day the researchers gathered junior high school students in one room who had been approved by their parents to take part in the research and were given oral hygiene education, knowledge about synthetic disclosing solution, super red dragon fruit juice as well as instructions for downloading the HI BOGI application. Red dragon fruit juice was obtained from super red dragon fruit which contains natural dyes, namely anthocyanin and betacyanin which can provide color to dental plaque.

All students were given the same action and each action was applied on different days in sequence. On the first and second days, students brushed their teeth first before instilling the two liquids. The first day's action was dripping, synthetic disclosing solution 5 drops under the tongue then instructing the patient to gargle for 30 seconds and spread using the tongue over the entire surface of the teeth. On the second day of action, 5 drops of super red dragon fruit juice were placed under the tongue, then the patient was instructed to rinse the mouth for 30 seconds and spread it using the tongue over the entire surface of the teeth. Then an intraoral photo of the patient was taken with the assistance of a cheek retractor and an input via the "HI BOGI" application. The researcher instructed the students to rinse their mouths to remove any remaining liquid of synthetic disclosing solution and super red dragon fruit juice.

Next, the researchers downloaded the "HI BOGI" application to assess teeth by measuring the PHP index (Patient Hygiene Performance) and a systematic examination of the tooth surfaces was carried out on: Labial surface of the upper right first incisor (tooth 11), Labial surface of the lower left first incisor (tooth 31), Buccal surface of the upper right first molar (tooth 16), Buccal surface of the tooth of the upper left first molar (tooth 26), the lingual surface of the lower left first molar (tooth 36) and the lingual surface of the lower right first molar (tooth 46).

The surface of the tooth being examined was divided into 5 parts as in Figure 3.1, namely vertically divided into mesial, middle and distal sides, and horizontally; the middle part of the tooth, divided into three, consisting of the lingual, middle and occlusal sides or 1/3 of the incisal. If there was plaque, a score of 1 was given and if there was no plaque given score 0. So the maximum score from examining 1 index tooth was 5.

The inspection was done on all index teeth in the "HI BOGI" application. The value of each tooth was measured by adding up the values of the 5 tooth parts as shown in Figure 1. Then the number of points for each tooth ranged from 1 to 5. Then updating the data and calculation results from 1 index tooth were input via the HI BOGI application as in picture 2.

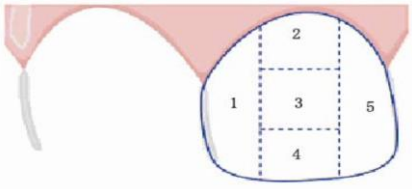

Figure 1. Five tooth sections (PHP index)

Figure 2. Display of the HI BOGI application when checking the PHP index.

If the tooth being examined in a segment was not present, then the tooth was replaced with the following conditions: If the first molar was not present, the assessment was carried out on the second molar which had completely erupted; if the first and second molars were absent then the assessment was carried out on fully erupted third molars, but if the first, second and third molars were missing then there was no assessment for that segment. If the upper right first incisor was missing, it could be replaced by a left incisor. If the left lower incisor was missing, it could be replaced with the right lower first incisor, but if the left or right first incisor was missing, then the segment was not assessed.

Figure 3. Display of the HI BOGI application when the PHP index data was updated

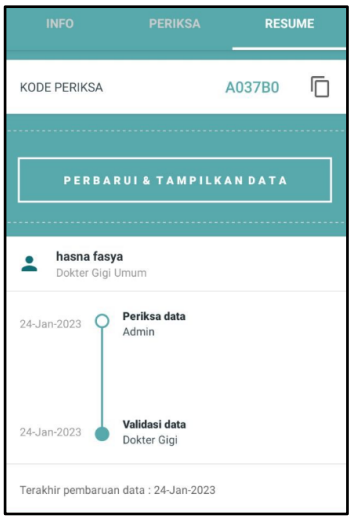

Figure 4. HI BOGI application display when updating PHP index calculation data

Teeth were considered absent in situations such as missing teeth due to extraction, teeth with remaining roots, teeth with jacket crowns, whether made of acrylic or metal, tooth crowns that were missing or damaged by more than half of the surface examined due to caries or fracture, as well as teeth whose eruption had not yet reached half the height of the clinical crown. Assessment could be carried out if there were at least two teeth that could be examined. The PHP calculation was updated to determine the average PHP index of research subjects on the page resume as shown in figure 3. The data were updated & displayed as shown in figure 4. The average value generated was based on the criteria assessment of oral hygiene level based on the PHP index (Personal Hygiene Performance*)* that was:

Table 1. PHP index score category[16]

Score	Category
0	Very good
0,1 - 1,7	Good
1,8 - 3,4	Currently
3,5 – 5	Bad

Data from all actions on research subjects were collected, then analyzed using software SPSS (Statistical Package for the Social Science). The data normality of plaque index data on junior high school students

using super red dragon fruit juice and synthetic disclosing was tested using a test called *KolmogorovSmirnov.* And the results of the data normality test were not normal so that the results were not analyzed parametrically. The Mann Whitney test was used to determine the differences between 2 groups that were unrelated/had no influence on each other.

RESULTS

Assessment of the dental plaque index in this study was measured using the PHP index (Patient Hygiene Performance) which was assessed through the HI BOGI application and then processed using the data software SPSS (Statistical Package for the Social Science). The research subjects who met the inclusion and exclusion criteria in this study were 84 students, with details of 25 students from SMPN 2 Cimahi, 27 students from SMPN 12 Cimahi, and 26 students from SMPN 15 Cimahi. The characteristics of research subjects based on gender can be seen in table 2 and the characteristics of research subjects based on age can be seen in table 3 below:

Table 2. Characteristics of respondents based on gender

Gender	Number of respondents	Percentage (%)
Woman	57	67.9
Man	27	32.1
Total	**84**	**100.0**

Based on table 2, it shows that there were 57 more respondents (67.9%) female, compared to 27 respondents (32.1%) male.

Table 3. Characteristics of respondents based on age

Age (years)	Number of Respondents	Percentage (%)
12	20	23.8
13	34	40.5
14	25	29.8
15	5	6.0
Total	**84**	**100.0**

Based on table 3, it shows that 20 respondents were aged 12 years (23.8%); for 13 years old, there were 34 respondents (40.5%); for 14 years old, there were 25 respondents (29.8%), and for 15 years old there were as many as 5 respondents (6.0%). Plaque index measurements were carried out by administering drops of synthetic disclosing solution and super red dragon fruit juice, and taking intraoral photos with cheek *retractor* assistance, then uploaded on the HI BOGI application. Mean plaque index value of each treatment, standard deviation (SD) and minimum-maximum *(min-max)* can be seen in Table 4.

Table 4. Mean value, standard deviation, min-max of dental plaque index of disclosing solution synthetic and super red dragon fruit juice.

Group	Rates	SD	Min-Max
Disclosing solution synthetic	1.437	0.784	0.00 – 3.17
Super red dragon fruit juice	0.907	0.614	0.00 – 2.33

Table 4 shows that the average plaque index at synthetic disclosing solution was greater, namely 1.437 and super red dragon fruit juice was 0.907 color difference from synthetic disclosing solution and super red dragon fruit juice which can be seen in Figure 5

A B

Figure 5. Application of coloring materials, A). Super red dragon fruit juice, B). Disclosing solution synthetic

Next, a normality test was carried out using the *Shapiro Wilks* test to find out whether the data was normally distributed or not, it can be seen in Table 5.

Table 5. Data normality test results

Group	SD	p value (<0.05)
Disclosing solution synthetic	84	0.007
Super red dragon fruit juice	84	0.018

Description: Test *Kolmogorof-Smirnov* with p<0.05

Table 5 shows the results of the significance of the normality test data using the *Kolmogorof-Smirnov* test. The data result was 0.007 for group data of synthetic disclosing solution, and 0.018 for the super red dragon fruit juice group. It can be concluded that the dental plaque index data in the two groups were not normally distributed (p<0.05). So non-parametric analysis was carried out using *Mann Whitney* test to find out the difference with the results that can be seen in Table 6.

Table 6. Plaque index differences using disclosing solution synthetic and super red dragon fruit juice

Group	Mean± s.d	p value <0.05)
Disclosing solution synthetic	1.437±0.784	0.000
Super red dragon fruit juice	0.907±0.614	

Description: test *Mann Whitney with* p≤0.05 (There is a significant difference)

The results of data analysis in Table 6 show that there was a significant difference between plaque index measurements using synthetic disclosing solution and super red dragon fruit juice with p=0.000 (p<0.05).

DISCUSSION

Research results in accordance with the inclusion and exclusion criteria were obtained from a total of 84 junior high school students from 3 sub-districts in the city of Cimahi, namely South Cimahi SMPN 15 Cimahi, North Cimahi SMPN 12 Cimahi, and Cimahi Tengah SMPN 2 Cimahi, and showed that synthetic disclosing solution and super red dragon fruit juice can be used as plaque detection materials on surfaces tooth. Based on table 6, the results of *Mann Whitney* non-parametric statistical analysis by giving synthetic disclosing solution and super red dragon fruit juice was proven to have a significant difference in the plaque index of junior high school students in Cimahi with a value of p=0.000 (p<0.05).

This study used plaque index values of synthetic disclosing solution using the HI BOGI application on junior high school students in Cimahi of good category with an average plaque index score of 1.437 using the PHP index assessment criteria, namely (0) in the very good category, (0.1–1.7) in the good category, (1.8–3.4) moderate category, (3.5–5.0) poor category found in table 1. This can occur because synthetic disclosing solution contains the basic compound *fuchsin* which is usually used as a bacterial stain on teeth because it can bind atoms in one molecule due to chemical bonds with plaque containing bacteria and glycoproteins so that it can bind glycans with covalent bonds.[12,17]

Prananta *et al.,*[18] mentioned basic *fuchsin* in synthetic disclosing solution contains chromophores which can provide color because they have positive ion charges which can bind negative ions in bacteria, and auxochromes which can bind substrates to strengthen the color intensity.[18] Synthetic disclosing solution has various preparations, namely liquid, gel, and tablets which can create plaque stain in bright red color synthetic disclosing solution. However, other alternative materials are required because synthetic disclosing solution are chemical-based dyes, thus it can cause dangerous carcinogens if swallowed over a period of continuous use because the solvent contains alcohol, it also has an unpleasant taste and can stain the mucosa for a long time.[12,18–21] Based on the requirements for tooth coloring materials, the use of coloring materials is very important to help see plaque on the surface of the teeth as an effective cleaning process because the plaque on the surface of the teeth can be seen perfectly. The required conditions fulfilled as a plaque coloring agent are as follows: (1) it can color plaque selectively so that it does not affect the clean tooth area and the area around the teeth; (2) it does not change the color of the area around the teeth such as the tongue, cheeks, lips; (3) it must not affect taste; (4) it does not have harmful effects if swallowed; (5) does not cause allergic reactions.[20,22]

Another option that can be used as a dental plaque coloring agent is super red dragon fruit (*Hylocereus costaricensis*). In this study, a type of super red dragon fruit was used. According to research by Yuslianti *et al.,*[23] super red dragon fruit has a redder color than the other types and has a high *anthocyanin* content as an antioxidant and antibacterial.[23] Dragon fruit contains ingredients that are beneficial for the body, contains a natural source of antioxidants and has natural pigments anthocyanin and betacyanin which can color plaque safely and are not dangerous if swallowed. Mangiri *et al.,*[24] stated that betacyanin has functional groups that can interact with anions that can produce color changes.

The results of research on junior high school students in the city of Cimahi show that super red dragon fruit juice can provide coloring because it has a strong red color, obtained from natural coloring pigments, namely anthocyanin and betacyanin as shown in Figure 5(a). This can happen because anthocyanins have a sugar component in the form of polysaccharides and a non-sugar component, namely anthocyanidin. The polysaccharides contained in anthocyanins can bind to the polysaccharides in dental plaque so that they can make dental plaque colored.[6,21]

In this study, the plaque index value using super red dragon fruit juice obtained an average result of 0.907 which is in table 6 with a good category according to the PHP index assessment criteria in table 1. Because betacyanin and anthocyanin are dyes that can be used as natural food colorings that are safe for human health compared to synthetic coloring and has better effect than chemical based synthetic disclosing solution because it does not cause harm if swallowed. These results are similar to Mega 2018's research which stated that the *anthocyanin* and betacyanin content found in beets can be used as a natural coloring agent.[12,21,25,26]

Synthetic disclosing the solution is known to have shortcomings in terms of safety because it has the potential to be a carcinogen if swallowed and used continuously, the color lasts a long time, and the taste is unpleasant, while super red dragon fruit juice has advantages in terms of safety because it has a sweet taste that does not cause danger or allergic reactions if swallowed.[12,18,21] Sefyana *et al.*,[27] explained that this can occur due to differences in the attachment of colors between synthetic disclosing solution and super red dragon fruit juice on dental plaque that unites with the environment of the oral cavity where there is saliva. Mega *et al.*,[7] research also stated that these differences could be caused by several different factors in the structure of the tooth surface, causing differences in staining results.[7]

Magdalena dkk.,[24] suggested that the implementation of teledentistry has become the trend of the latest examinations in dentistry in developed and developing countries. This was proven to be exploitable in this research by taking intraoral photos which were input via the HI BOGI application as teledentistry for PHP index assessment and became a means for diagnose of dental hygiene on junior high school students in the city of Cimahi. When the oral cavity had been applied with synthetic disclosing and super red dragon fruit juice, 5 photos using a camera cell phone were taken, namely the upper jaw, lower jaw, right view of the teeth, left view of the teeth and front view of the teeth. Then, the results of the intraoral photos obtained were stored in the HI BOGI application and could be evaluated according to the PHP index assessment which only assessed index teeth, namely teeth 11, 16, 26, 31, 36 and 46.

HI BOGI (Hello Indonesia with Dentists) has many features, namely teledentistry, telesurvey, toothbrush alarm, oral dental health e-poster, and there are videos as a medium for promoting oral dental health, especially for people whose conditions are far from the reach of health services.[28] Fadillah's research *et al.,*[13] revealed that the HI BOGI application can improve the promotion of oral health. In this case, it is stated that the HI BOGI application is effective as an educational tool online. There are several disadvantages of the HI BOGI application, namely the need for training in using the application before use, limited use in downloading the application because it is only available on cell phone based on Android, and needs to be added with scrolling features to make it easier to search for data.

Based on the results of the data analysis that had been carried out, this shows that there is a significant difference between the results of the plaque index values using synthetic disclosing solution and super red dragon fruit juice in junior high school students in Cimahi using the HI BOGI application, which is in table 6. With the results of the average plaque index, synthetic disclosing solution had a higher mean of 1.437 than dragon fruit juice with a result of 0.907, and both were included in the good category with a score range of (0.1-1.7) as in the figures listed in table 1.

The difference in the average plaque index in the group of synthetic disclosing solution and super red dragon fruit juice was 0.53, which means there was a significant difference between measuring the plaque index value using synthetic disclosing solution and super red dragon fruit juice using the HI BOGI application for junior high school students in Cimahi. There were several limitations in this research, namely, it was hampered by students downloading applications because not all of them had Android-based cell phones and had quotas on each cellphone, so some students took turns lending their cellphones to each other, which made the research time become longer.

CONCLUSION

There are differences between plaque index measurements using synthetic disclosing solution and red dragon fruit juice using the HI BOGI application for junior high school students in Cimahi. This research provides implications, that the synthetic disclosing solution and super red dragon fruit juice can be used as a plaque detection agent on the surface of teeth. However, super red dragon fruit juice is safer to use because it has natural dyes, namely betacyanin and anthocyanin, which can color dental plaque compared to chemical-based synthetic dyes. HI BOGI was also proven to be able to be utilized in this research by taking intraoral photos which were input via the HI BOGI application as teledentistry which is a means to diagnose the dental hygiene of junior high school students in the city of Cimahi.

Author Contributions: Researcher contribution "Conceptualization, F.R.N; and R.H.F.; and Y.E.R methodology, F.R.N; and R.H.F.; and Y.E.R software, F.R.N; and R.H.F.; and Y.E.R; validation, F.R.N; and R.H.F.; and Y.E.R; formal analysis, F.R.N; and R.H.F.; and Y.E.R; resources, F.R.N; and R.H.F.; and Y.E.R; data curation, F.R.N; and R.H.F.; and Y.E.R; writing—preparation of initial draft, F.R.N; and R.H.F.; and Y.E.R writing-review and editing, F.R.N; and R.H.F.; and Y.E.R; visualization, F.R.N; and R.H.F.; and Y.E.R; supervision, F.R.N; and R.H.F.; and Y.E.R; project administration, F.R.N; and R.H.F.; and Y.E.R; funding acquisition, F.R.N; and R.H.F.; and Y.E.R. All authors have read and approved the published version of the manuscript."
Ethical approval: This research has received ethical approval from the Padjadjaran University Research

Ethics Commission (KEP Unpad) with No: 139/UN6.KEP/EC/2023.
Funding: Funding uses the researcher's independent funds
Data Availability Statement: Availability of research data will be given with permission from all researchers via email correspondence with due regard for ethics in research
Conflict of Interest: We hereby declare that there is no conflict of interest in the scientific articles we write.

REFERENCES

1. Kemenkes RI. Peraturan Menteri Kesehatan RI Nomor 89 tentang Upaya Kesehatan Gigi dan Mulut tahun 2015. h.1
2. Ratih Iadk, Yudita Wh. Hubungan Tingkat Pengetahuan Tentang Cara Memelihara Kesehatan Gigi Dan Mulut Dengan Ketersediaan Alat Menyikat Gigi Pada Narapidana Kelas II B Rutan Gianyar Tahun 2018. J Kes Gigi. 2019;6(2):23–6.
3. Subekti A, Ekaningtyas Ea, Benyamin B. Hubungan Plak Gigi, Laju Aliran Saliva, Dan Viskositas Saliva Pada Anak Usia 6-9 Tahun. J Kes Gigi. 2019;6(1):72. DOI: 10.31983/jkg.v6i1.4448
4. Kesehatan badan penelitian dan pengembangan. Laporan Nasional Riskesdas. Balitbangkes; 2018. p.204.
5. Kebersihan H, Dan G, Plak I, Ph Dan. Hubungan kebersihan gigi dan mulut di beberapa panti asuhan di kota semarang. 2020; 8: 66–75.
6. Said F, Rahmawati I. gel ekstrak buah naga super merah (hylocereus costaricensis) dan ubi jalar ungu sebagai alternatif pewarna (disclosing solution) Alami plak gigi super red dragon fruit (hylocereus costaricensis) and purple sweet potato extract gel as natural alterna. 2021;8(2):148–51.
7. Mega N, Kusmana A, Nugroho C, Kamelia E, Miko H. efektifitas larutan buah bit dan larutan buah naga merah sebagai bahan identifikasi plak gigi pada mahasiswa tingkat 1 jurusan keperawatan gigi poltekkes kemenkes tasikmalaya. Arsa (Actual Res Sci Acad. 2019;4(3):24–30.
8. Basuni, Cholil, Putri Dkt. Gambaran indeks kebersihan mulut berdasarkan tingkat pendidikan masyarakat di desa guntung ujung kabupaten banjar. Dentino J Ked Gigi. 2014; 2(1):18–23.
9. Menjaga kesehatan gigi dan mulut sejak dini [Internet]. Dinas Kesehatan. 2021 [Cited 2022 Jun 27]. Available From: Https://Dinkes.Surakarta.Go.Id/Menjaga-Kesehatan-Gigi-Dan-Mulut-Sejak-Dini/
10. Cm M. Public Health Dentistry. Vol. 63, New Zealand Dental Journal. 1967. 183–184 P.
11. Yusuf Ali, Isnanto Endang Purwaningsih. Efektivitas sari buah jamblang dan sari buah naga super merah terhadap plak indeks pada tahun 2019. J Ilm Kep Gigi. 2020; 1:5.
12. Mangiri Bs, Yani S, Anitasari S. Sari buah naga super merah (hylocereus costaricensis) sebagai pewarna alami plak gigi. j mater kedokt gigi. 2018;7(1):28. DOI: 10.32793/JMKG.V7I1.278
13. Putri R, Fadilah N, Pribadi Ap, Aji Rw, Kusaeri R. Effectiveness Of The Novel Teledentistry "Hi Bogi" An Android -Based Oral Health Application On Increasing Oral Health Knowledge In Elementary School Children. 33. DOI: 10.24198/pjd.vol33no1.15894
14. Astoeti Te, Widyarman As. Teledentistry Fkg Usakti Final. 2020. p.63
15. M. Sopiyudin Dahlan, Dr. Me. Besar Sampel Dalam Penelitian Kedokteran dan Kesehatan, Seri 2 Edisi 4, S. Jakarta: Penerbit Salemba Medika; 2016. p.68
16. Marya CM. Dental Incidents. A Textbook Of Public Health Dentistry. Marya Cm E, Editor. New Delhi: Jaypee Publishers; 2011. p.540
17. Chowdhary Z, Mohan R, Sharma V, Rai R, Das A. Disclosing Agents In Periodontics: An Update. J Dent Coll Azamgarh. 2015;1(1):103–10.
18. Prananta Hi, Purwanto P, Misrohmasari Eaa, Probosari N, Dwiatmoko S. Perbedaan Indeks Plak Setelah Pengolesan Ekstrak Daging Buah Naga Merah (Hylocereus Costaricensis) Dan Larutan Pengungkap. Stomatognatic - J Kedokt Gigi. 2019;16(1):21. DOI : 10.19184/stoma.v16i1.19957
19. Penda PAC, Kaligis SHMJ. Perbedaan Indeks Plak Sebelum Dan Sesudah Pengunyahan Buah Apel. E-Gigi. 2015;3(2). DOI : 10.35790/eg.3.2.2015.9631
20. Fasoulas A, Pavlidou E, Petridis D, Mantzorou M, Seroglou K, Giaginis C. Detection Of Dental Plaque With Disclosing Agents In The Context Of Preventive Oral Hygiene Training Programs. Heliyon . 2019; 5(7): E02064. DOI: 10.1016/J.Heliyon.2019.E02064
21. Ilmiah J, Gigi K, Sari E, Jamblang B, Sari Dan, Ali Y, Et Al. Naga Super Merah Terhadap Plak Indeks Pada Tahun 2019 Pewarna Merah Untuk Makanan Dan Pewarnaan Bakteri . Eritrosin Merupakan Senyawa Pewarna Alami . Produktivitasnya Pun Tergolong Tinggi . Di Indonesia , Buah Naga Sudah. 2020;1(1):1–5.
22. Hakim A. Perbandingan Daya Tembus Pewarna Antara Disclosing Solution (Larutan Pengungkap) Buatan Pabrik Dengan Ekstrak Daging Buah Naga Merah (Hylocereus Costaricensis). Vol. 2, Skripsi. 2018. 7 P.
23. Yuslianti Er, Widyasari R, Farid Km. Potensi Ekstrak Etanol Kulit Buah Naga Super Merah (Hylocereus Costaricensis) Untuk Menghambat Bakteri Enterococcus Faecalis Atcc 29212 Dalam Perawatan Saluran Akar Gigi. 2021; DOI: 10.24198/pjdrs.v 51i.28952
24. Sycinska-Dziarnowska M, Paradowska-Stankiewicz I. Dental Challenges And The Needs Of The Population During The Covid-19 Pandemic Period. Real-Time Surveillance Using Google Trends. Int J Environ Res Public Health. 2020;17(23):1–11. DOI: 10.3390/IJERPH17238999
25. Naga B, Nizori A. Karakteristik Ekstrak Kulit Buah Naga Merah (Hylocereus Polyrhizus) Dengan Penambahan Berbagai Kosentrasi Asam Sitrat Sebagai Pewarna Alami Makanan. J Teknol Ind Pertan. 2020;30(2):228–33. DOI: 10.24961/j.tek.ind.pert.2020.30.2.228
26. Fatmasari, D., S. Musthofa, dan B. Santoso. 2014 Efektifitas Buah Bit *(Beta Vulgaris)* sebagai *Disclosing Solution* (Bahan Identifikasi Plak). Odonto Dent J. 1(2):6-9.
27. Purbaningtyas E, Yuliani F, Ananda Ap, Sari R. Purbaningtyas/ Yuliani/ Ananda/ Sari. Odonto Dent J. 2020;7(1):31–9.
28. Fadhilah Rpn. A New Way Life Better With Hi Bogi [Internet]. 2022 [Cited 2022 Jun 26]. Available From: https://Www.Unjani.Ac.Id/2022/01/22/Webinar-Admisi-Series-Vol-1-Hadir-Kembali-Dengan-Mengusung-Tema-A-New-Way-Life-Better-With-Hi-Bogi/