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Potency of Strawberry Extract (*Fragaria X Annanassa*) as Stain Removal Strips Against Extrinsic Stain on the Surface of the Teeth of Adolescents Aged 18-25 Years

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Abstract:- Extrinsic stain is a staining of teeth that is attached directly to the surface of the tooth. Disorders caused by stains are causing aesthetic problems that can have a considerable psychological impact, especially if they occur in the anterior tooth. Stains are difficult to clean just by brushing your teeth. Utilizing natural strawberry ingredients as Stain Removel Strips for an alternative to cleaning extrinsic stains on the surface of teeth. Objective: Proven administration of Stain Removal Strips strawberry extract (*Fragaria x Ananassa*) effectively cleans extrinsic stains on the surface of teeth. Method: This study used the Quasy experimental method with a pretest posttest design with control group. Research sampling was carried out by purposive sampling. The sample consisted of 20 people divided into 2 groups. The control group with 6% hydrogen peroxide strips and the intervention group with 40% strawberry extract stain removal strips twice a day with a duration of 30 minutes for 7 days. Results: The results showed that giving strawberry extract Stain Removal Strips was 40% effective in cleaning extrinsic stains on day 3 and day 7 against extrinsic stains on the tooth surface with values of p = 0.009 and p = 0.002 (p < 0.05) compared to the control group. Conclusion: Stain Removal Strips 40% strawberry extract has potential as an alternative to cleaning extrinsic stains on tooth surfaces.

Keywords:- *Strawberry Extract; Extrinsic Stain; Stain Removal Strips.*

I. INTRODUCTION

Riskesdas data in 2018 stated that the percentage of daily smokers aged 20-24 years was 27.3% with an average of 12 cigarettes per day [1]. Smoking habits can affect the formation of dental stains (tooth stains) [2]. A study showed 47 respondents aged 25 years and over as many as 62% had moderate extrinsic stains and 32% were known to have a smoking habit [3].

Extrinsic stains are dental stains that adhere directly to the tooth surface [4]. The problem caused by stains is aesthetic problems. Stains on teeth can cause aesthetic problems that can have a considerable psychological impact, especially if they occur on the anterior teeth [5].

Products for cleaning or removing extrinsic dental stains include: available in the form of solutions, gels, sheets or strips, and toothpastes containing chemicals. The more commonly used chemical is hydrogen peroxide. The adverse side effects of these materials on teeth are teeth become sensitive to stimuli, inflammation of the gums, sore throat, stinging of the mucosa, changes in the morphology and texture of the enamel surface such as increasing the porosity of the tooth enamel surface, demineralization and decreasing the concentration of protein, organic matrix, calcium, and phosphate, and even loss of calcium in the teeth [6,7,8].

Reducing the negative effects caused by chemicals requires natural ingredients that do not cause harmful negative effects on teeth and oral cavity. One of them is by utilizing strawberries, when compared to other fruits such as tomatoes and lemons, strawberries have superior teeth cleaning properties [9].

Strawberry fruit (Fragaria X annanassa) is a natural material that contains elegic acid and malic acid compounds which are equivalent to 35% carbamide peroxide in removing extraneous staining on the tooth surface. So it has the potential as an alternative material to remove stains on the tooth surface [10]. Based on the description of the problem, a study was conducted on the utilization of strawberry extract as stain removal strips with the aim of knowing its effectiveness in

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removing extrinsic stains on the surface of the teeth of adolescents aged 18-25 years.

II. METHODS

This study is a type of quasi experiment (pretest-posttest with control group design) with the target of adolescents 18-25 years old and considering the smoking history factor as a confounding variable. This study was conducted after obtaining a research permit and the issuance of Ethical Clearance from the Poltekkes Kemenkes Semarang with No. 0959/EA/KEPK/2023. This study was conducted in August 2023 in West Kandangan Village, Kandangan City, Hulu Sungai Selatan Regency, South Kalimantan Province.

This study was conducted in 2 groups, namely the intervention group giving 40% strawberry extract Stain Removal Strips and the control group giving 6% Hydrogen Peroxide Strips. Research observations were made on day seven and day three of extrinsic stains on 8 teeth, namely maxillary front teeth 1.2, 1.1, 2.1, 2.2, and mandibular 4.2, 4.1, 3.1, 3.2 which were seen on the labial surface. Measurement of extrinsic stains was carried out using the LSI (Lobene Stain Index) method. The total number of respondents was 20. During the study, there were no dropouts. In the manufacture of strawberry extract with a concentration of 40%, the ingredients needed are strawberries as much as 1 kg, 70% ethanol and water. as for the tools needed are blenders, ovens, scales, sieving materials, maceration containers and stirrers in the process of making extracts, filters, funnels, rotating vacuum evaporators, sterile containers, and aluminum foil which are all tools obtained at the chemical and biological analysis laboratory of Cendikia Nanotech Hutama Semarang. then the extract is processed into stain removal strips by requiring analytical scales, film molds, magnetic stirrers, hot plates, digital micrometers, micropipettes, ovens, weighing bottles, incubators, cutters, scissors, rulers, pH meters. at this stage the materials needed are: Strawberry extract (Fragaria x Ananassa), Glycerin, Polyvinypyrrolidone (PVP), Hydroxypropyl Methyl Cellulose (HPMC), Aquadest with the following formula:

Table 1. Formula of Strawberry Extract Stain Removal Strips

Material	Usability	Formula
Strawberry extract	Active substance	4 grams
HPMC	Polymers	2.1 grams
Glycerin	Plasticizer	1.5 grams
PVP	Polymers	0.9 grams
Aquadest	Solvent	30.0 grams

III. RESULTS AND DISCUSSION

Before testing the effectiveness of the stain removal potential of strawberry strips, organoleptic tests and pH tests were carried out to determine the physical assessment and acidity of the strawberry strips developed. Based on this study, the color produced is golden brown, with a distinctive aroma of strawberry, and a sticky chewy texture (table 2). This is due to the content of PVP, where PVP is hygroscopic, which can bind water, so that the resulting 40% strawberry extract Stain Removal Strips are slightly moist and sticky [11]. Organoleptic results show that strawberry extract Stain Removal Strips are physically stable.

Table 2: Organoleptic Test Results of Strawberry Extract Stain Removal Strips.

Variables	Color	Aroma	Texture	Taste
Stain Removal Strips 40% strawberry extract	Golden brown	Typical (strawberry aroma)	Chewy (sticky)	Acid

pH measurement is an important physicochemical parameter in topical preparations because pH is related to the effectiveness of the active substance, the stability of the active substance and preparation, and comfort during use. Surface pH is measured to determine the amount of pH that will be exposed to the teeth when Stain Removal Strips 40% strawberry extract is applied, so that potential side effects can be estimated. The surface pH of the 40% strawberry extract Stain Removal Strips was measured using a universal pH indicator, and the pH of the 40% strawberry extract Stain Removal Strips in this study was 4 (Table 3). The critical pH limit of tooth enamel is between 5.2 and 5.5 [12]. Tooth enamel will erode when it reaches a critical pH of 5.5 This pH is a pH that is considered critical to cause enamel solubility so that erosion occurs [13]. Thus, the pH resulting from this study is still below the critical pH so it is necessary to control the pH within the critical pH range.

Table 3. pH test of Strawberry Extract Stain Removal Strips

Variables	Results
Stain Removal Strips 40% strawberry extract	4

Stains are a problem often experienced by smokers and caffeine addicts. Stains can damage the aesthetic value of teeth. Stain can unite with plaque and tartar. In this study, the characteristics of the majority of respondents were 25 years old with a smoking frequency of ≤6 cigarettes per day (Table 4), this is because at that age the formation of smoking habits was initiated by the influence of socialization in the community. Continuous repetition will make this behavior persistent and become a habit that is considered normal as you grow older in adulthood. So that from the smoking habit, a stain will form on the surface of the teeth. Reinforced from previous research says the average age of respondents 25 years and over as many as 62% have extrinsic stains in the moderate category and known smoking frequency in the mild category [3].

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Table 4. Distribution of Respondents by Frequency of Smoking in a Day

Frequency of Smoking in a Day (cigarettes)	Group			
	Intervention		Control	
	n	%	n	%
≤6	5	50	7	70
7-12	3	30	1	10
>12	2	20	2	20

From the use of 6% hydrogen peroxide strips in the control group and the use of 40% strawberry stain removal strips developed, the average value of changes in the value of stains on respondents was obtained. In the intervention group, namely the use of 40% strawberry extract Stain Removal Strips, which means a decrease in extrinsic stains before treatment has a mean of 1.104 and after day 3 has a mean of 0.625 and day 7 with a mean of 0.199. In the control group, the decrease in extrinsic stains before treatment had a mean of 0.321 and after day 3 had a mean of 0.158 and day 7 with a mean of 0.068 (Figure 1).

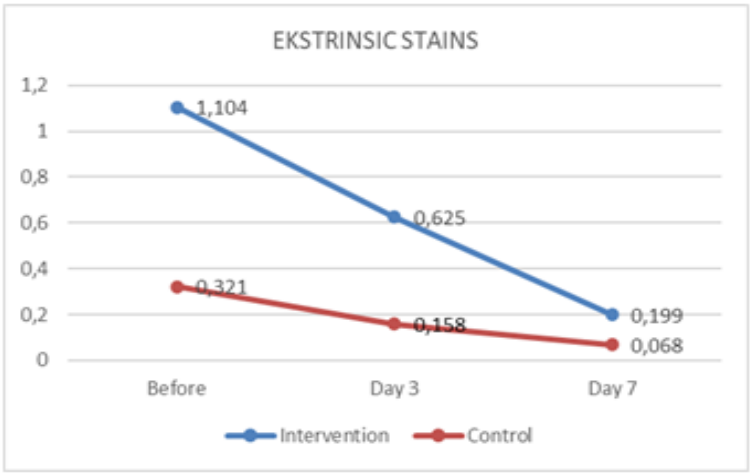

Fig 1. Mean Reduction of Extrinsic Stains in Control and Intervention Groups.

Based on these data, the effectiveness of giving 40% strawberry extract Stain Removal Strips and 6% Hydrogen Peroxide Strips on extrinsic dental stains was tested. It is known from the results (table 5), that the results of the paired data test of the extrinsic stain variable of the intervention group on day 3 and day 7 with a P-Value of 0.001 and 0.005 (P <0.05) mean that 40% strawberry extract Stain Removal Strips are effective in removing extrinsic stains on the tooth surface on day 3 and day 7. Paired data test of extrinsic stain variables on the teeth in the control group on day 3 and day 7 with a P- Value of 0.002 and 0.002 (P <0.05) means that 6% Hydrogen Peroxide Strips effectively remove extrinsic stains on the surface of the teeth on day 3 and day 7. It can be concluded that the administration of the two strips above are equally effective in removing extrinsic stains on the tooth surface because the paired data test for each group shows a significant difference due to (p <0.05).

Table 5. Effectiveness Test of 40% Strawberry Extract Stain Removal Strips and 6% Hydrogen Peroxide Strips against Dental Extrinsic Stains

Group		Mean ± SD	*P-Value*
Intervension	Before	1,104 ± 0,715	0,001**
	Day 3	0,625 ± 0,507	
	Before	1,104 ± 0,715	0,005*
	Day7	0,199 ± 0,268	
Group		**Mean ± SD**	***P-Value***
Control	Before	0,312 ± 0,209	0,002**
	Day 3	0,158 ± 0,138	
	Before	0,312 ± 0,209	0,002**
	Day 7	0,068 ± 0,065	

* Uji Statistik: Wilcoxon
** Uji Statistik: Paired Sample Test

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The results of the unpaired data test to see the difference between the use of 40% strawberry extract Stain Removal Strips and 6% Hydrogen Peroxide Strips on extrinsic dental stains (Table 6). Shows that the use of 40% strawberry extract Stain Removal Strips compared to 6% Hydrogen Peroxide Strips on day 3 and day 7 resulted in a P-Value <0.05. Giving Stain Removal Strips 40% strawberry extract is effective in removing extrinsic dental stains compared to 6% Hydrogen Peroxide Strips on day 3 and day 7, this is in line with research conducted by Farida et al (2023) strawberry extract (Fragaria x annanassea) 25% and 45% effective as an alternative material for cleaning extrinsic stains [14]. Similarly, research conducted by Juanita et al (2019), this study shows after treatment with Strawberry gel (Fragaria X annanassa) 10% on day 3, day 7 to day 12. The observation results that Strawberry gel (Fragaria X annanassa) 10% can brighten the color of the teeth even though it cannot restore the brightness of the color to the baseline [15].

Table 6. Analysis of Differences Between the Intervention Group and the Control Group on Changes in Dental Extrinsic Stains

Observation time	**Intervention**	**Control**	***P- Value***
	Mean(Δ) ± SD	**Mean(Δ) ± SD**	
Before- 3 days (Δ)	0,479 ± 0,306	0,154 ± 0,117	0,009
Before- 7 days (Δ)	0,905 ± 0,497	0,244 ± 0,172	0,002

Strawberries, with their ellagic acid and malic acid content, have the potential to remove extrinsic stains on teeth. The concentration of elagic acid and malic acid in strawberries is believed to play an important role in whitening and cleaning teeth, with the oxidation reaction that occurs in elagic acid damaging the extrinsic staining molecules in teeth. Malic acid also contributes by oxidizing the tooth surface and removing stains. In addition, malic acid and elagic acid in strawberries work to remove staining by destroying double bonds in conjugate bonds, oxidizing other chemical components, and generating H+ radicals, which can change the color of tooth enamel to a lighter shade.

The main ingredients in strawberries that play a role in cleaning extrinsic stains are malic acid and elagic acid. In addition, compounds such as flavonoids, tannins, and catechins also contribute to reducing extrinsic stain formation on teeth by denaturing bacterial cell proteins, inhibiting the attachment of Streptococcus mutans bacteria, and inhibiting dental plaque formation. The pH factor also plays an important role, with strawberry extract having a low pH (pH 3-4) aiding in the erosion of stains on the tooth enamel surface, resulting in whiter looking teeth. Research shows that strawberry extracts, with high acidity and low pH, are effective in removing extrinsic stains on teeth without changing the surface characteristics of the teeth. The factors of material concentration and application time also affect the success in removing extrinsic staining of teeth, with high concentration and regular use can provide better results in a shorter time.

The two main factors that influence the success of removing extrinsic staining of teeth are the concentration of ingredients and the time of application. High concentration of ingredients can produce a higher and faster cleaning effect compared to products with low concentration [16]. It is evident from this study that the average value of the difference in extrinsic stain scores using 40% strawberry extract Stain Removal Strips on day 3 is 0.479 and day 7 is 0.905 while using 6% Hydrogen Peroxide Strips on day 3 is 0.154 and day 7 is 0.244. This means that routinely using 40% strawberry extract Stain Removal Strips can reduce the extrinsic stain score on the tooth surface by 0.479 within 3 days and 0.905 within 7 days.

IV. SUMMARY

Strawberry extract as Stain Removal Strips proved to be effective in removing extrinsic stains on the surface of the teeth as evidenced by Stain Removal Strips 40% strawberry extract (Fragaria X annanassa) proven to remove extrinsic stains on the surface of the teeth for 7 days by going through an oxidation reaction where malic acid and elagic acid will release electrons which will then bind to the extrinsic staining of the teeth to damage the molecules of the extrinsic staining, thus causing the effect of cleaning the extrinsic stain. Stain Removal Strips 40% strawberry extract (Fragaria X annanassa) is feasible to use as an alternative treatment for cleaning extrinsic stains on the tooth surface as evidenced by the results of the organoleptic test showing that strawberry extract Stain Removal Strips are physically stable, namely golden brown in color, with a distinctive aroma of strawberries, and a chewy texture.

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