



# PROCEEDINGS

## The 4<sup>th</sup> International Conference on Sustainable Innovation (ICoSI) 2020

Cutting Edge Innovations for Sustainable Development Goals

Universitas Muhammadiyah Yogyakarta (Indonesia)

October 13 - 14 2020

<https://icosi.umy.ac.id/>

## Focal Conferences



- ✔ (ICPU) The 2nd International Conference on Pharmaceutical Updates
- ✔ (ICOMS) The 6th International Conference on Management Sciences
- ✔ (ICLAS) The 9th International Conference on Law and Society
- ✔ (ICMHS) The 4th International Conference Medical and Health Sciences
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- ✔ (IConARD) International Conference on Agribusiness and Rural Development
- ✔ (ISHERSS) The 2nd International Symposium on Social Humanities Education and Religious Sciences
- ✔ (ICONPO) The 10th International Conference on Public Organization
- ✔ (DREAM) The 5th Dental Research and Exhibition Meeting
- ✔ (ICHA) The 5th International Conference on Hospital Administration
- ✔ (ICOSA) The 3rd International Conference on Sustainable Agriculture





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## Preface by the Chairperson of the 4<sup>th</sup> ICoSI 2020



**Dr. Yeni Rosilawati, S.IP. S.E., MM.**

Assalamu'alaikum Wr. Wb.

All praise is due to Allah, the Almighty, on whom we depend for sustenance and guidance. Prayers and peace be upon our Prophet, Muhammad SAW, his family and all of his companions.

On behalf of the organizing committee, it is my pleasure and privilege to welcome the honourable guests, distinguished keynote & invited speakers, and all the participants.

With the main theme of “Cutting-Edge Innovations on Sustainable Development Goals (SDGs)”, the 4<sup>th</sup> International Conference on Sustainable Innovation (ICoSI) 2020 serves as a forum to facilitate scholars, policy makers, practitioners, and other interested parties at all levels from Indonesia and abroad to present their novel ideas, promote cutting-edge research, and to expand collaboration network. The conference has about 1373 participants participating from more than 8 countries 4 continents all over the world, making this conference a truly international conference in spirit.

This multidisciplinary conference was first held in 2012 and has undertaken various changes and adopted to the current technological trends of our education system. From having this conference with just 175 participants back in 2012 we have come a long way in making the conference a huge success with more than 1373 participants participating in this two-day conference.

Formerly, this conference consisted of only 9 (nine) focal conferences. This year, there are 14 focal conferences from various disciplines, namely: 1) The 2<sup>nd</sup> International Conference on Pharmaceutical Updates (ICPU), 2) The 6<sup>th</sup> International Conference on Management Sciences

(ICoMS), 3) The 9<sup>th</sup> International Conference on Law and Society (ICLAS), 4) The 4<sup>th</sup> International Conference Medical and Health Sciences (ICMHS), 5) The 6<sup>th</sup> International Conference for Accounting and Finance (ICAF), 6) The 2<sup>nd</sup> International Language and Education Conference (ILEC), 7) The 2<sup>nd</sup> International Conference on Nursing (ICONURS), 8) The International Conference on Information Technology, Advanced Mechanical and Electrical Engineering (ICITAMEE), 9) The 2<sup>nd</sup> International Conference of Agribusiness and Rural Development (IConARD), 10) The 10<sup>th</sup> International Conference on Public Organization (ICONPO), 11) The 2<sup>nd</sup> International Symposium on Social Humanities Education and Religious Sciences (ISHERSS), 12) The 5<sup>th</sup> Dental Research and Exhibition Meeting (DREAM), 13) The International Conference on Hospital Administration (ICHA), and 14) The 3<sup>rd</sup> International Conference on Sustainable Agriculture (ICoSA).

Accordingly, We are proud to announce that this year, the 4<sup>th</sup> ICoSI 2020 breaks the Museum Rekor-Dunia Indonesia (MURI) record as the Virtual Multidisciplinary Conference with the Largest Number of Area of Fields in Indonesia

In addition, this year, this conference holds special value since this is the first conference in the history of our university where the entire conference is taking place remotely on a digital platform through the use of advance technologies due to the Covid-19 Pandemic.

I would take this opportunity to express my highest respect to the Rector of Universitas Muhammadiyah Yogyakarta, Dr. Gunawan Budiyanto who gave approval and ensured the maximal support from all the faculty members of Universitas Muhammadiyah Yogyakarta (UMY) that made this event a big success. In addition, my appreciation goes to all the support teams who have provided their valuable support and advice from planning, designing and executing the program.

Let me conclude my speech by encouraging the delegates to participate with an increasing number in all the activities and discussions through the digital platforms for the next two days. I wish everyone a successful, safe, and fruitful conference.

Thank you!

Wassalamu'alaikum Wr. Wb.

Yogyakarta, Indonesia, 14 October 2020





## Welcoming Remarks by the Rector of Universitas Muhammadiyah Yogyakarta



**Assoc. Prof. Dr. Gunawan Budiyanto**

Innovation is the beginning of the development of technology, and technology is a development machine that is expected to provide benefits to humans and provide the smallest possible impact on environmental quality. In the concept of sustainable development, development must improve the quality of human life without causing ecological damage and maintain the carrying capacity of natural resources.

International Conference on Sustainable Innovation (ICoSI) is an international conference which is an annual conference held by the University of Muhammadiyah Yogyakarta (UMY), Indonesia. In 2020 this raises the issue of "Cutting-Edge Innovations on Sustainable Development Goals." Therefore, on behalf of all UMY academics, I would like to congratulate you on joining the conference, hoping that during the Covid-19 Pandemic, we can still provide suggestions and frameworks for achieving sustainable development goals.

# About The 4<sup>th</sup> International Conference on Sustainable Innovation (ICoSI) 2020

## *Cutting Edge Innovations for Sustainable Development Goals*

The 2030 Agenda for Sustainable Development is enacted by the United Nations as a shared blueprint for peace and prosperity for people and the planet, now and into the future. It consists of strategies to improve health and education, reduce inequality, and spur economic growth while also conserving natures by 2030.

This year, however, at the first one-third of its timeline, the SDG Reports shows that the outbreak of COVID-19 did hinder the achievement, or at least decelerate the progress of achieving the 17 goals. In fact, according to the report, “some number of people suffering from food insecurity was on the rise and dramatic levels of inequality persisted in all regions. Change was still not happening at the speed or scale required”, accordingly.

Therefore, in this event of pandemic, the quantity and quality of research, innovation, and more importantly multi-disciplinary collaboration are indispensable. Furthermore, there needs to be clear ends of those works. That is how those research are applicable and benefits directly to the society. That is how those research is incorporated as the drivers of policy making, and used practically in the society. Hence, the stakeholders especially the triple helix of higher education institution, government, and industry must be re-comprehended and supported to reach the common goal of the SGD.

International Conference on Sustainable Innovation (ICoSI) has been essentially attempting to strengthen this regard since its first establishment. One of the goals of ICoSI is to provide primarily a platform where scholars, practitioners, and government could grasp the development and trends of research. Hopefully, meeting these actors altogether would result in stronger collaboration, sophisticated and advantageous research, and brighter ideas for further research. Based on these reasoning, this year, the 4th ICoSI 2020 UMY is themed ‘Cutting-edge Innovations for Sustainable Development Goals’.

Improving from last year conference which brought nine focal conference, this year ICoSI 2020 UMY brings 14 disciplines, from social sciences, natural sciences, and humanities. ICoSI 2020 received as much as 1005 papers. The paper works submitted in ICoSI 2020 UMY will be published in Atlantis Proceedings, IOP Proceedings, National/International Journals, and ICoSI ISBN-indexed Proceedings.

Nevertheless, ICoSI believes that publication is only the beginning of research dissemination. The publications will enhance the chance of the research known by wider audience, and then used, applied, and incorporated at either system, institutional, or personal level of human lives.



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# TRACK ECONOMICS, LAW, EDUCATION, SOCIAL, AND HUMANITIES



# Risk Factors of Stunting: A Literature Review

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## ABSTRACT

Stunting is a nutritional problem. Nearly 3 in 10 children under 5 years of age are stunted. Stunting can affect a child's mental growth and development. The study aims to analyze the risk factors of stunting among children. The method in this study used literature review method. Sources of data obtained from Science Direct, Proquest and Portal Garuda. The inclusion criteria in this study were nursing mothers, pregnant women, health workers, full text, articles in 2011-2019, international and national journals. Based on 8 studies, it was found that stunting factors were anemia in pregnancy, LBW history, maternal posture (short), socioeconomics, maternal nutritional status, and education. It can be concluded that stunting is caused by various factors.

**Keywords:** children, nutritional status, risk factors, stunting

## 1. INTRODUCTION

*Stunting* is a nutritional problem that is a major concern today. There are nearly 3 of 10 toddlers are stunted and 1 of 10 children experienced wasted in 2018[1]. Indonesia is still facing nutritional problems that have a serious impact on the Quality of Human Resources (HR). The high stunting rate in Indonesia causes WHO placing Indonesia as the third country with the highest stunting prevalence rate in Southeast Asia with an average of 36.4%[2].

The prevalence of stunting in children aged 0-59 months in Indonesia based on the results of the Riskesdas in 2018 reached 30.8%. This figure consists of 11.5% very short and 19.3% short[3]. Although it has decreased by 6.4% from the previous data in 2013, this figure is still high because it still beyond the WHO threshold, which is 20% or one-fifth of the total number of toddlers [4]. So that in this case the government is still considered unable to reduce the stunting rate in Indonesia.

*Stunting* is a condition of length or height for age (height / age) that is less than minus two standard deviations (<-2 SD) of the child's median growth standard according to WHO. *Stunting* included in the 2nd Sustainable Development Goals (SDGs), namely eliminating hunger and all forms of malnutrition by 2030 and achieving food security. The target set by 2025 is to reduce the stunting rate by 40%. To achieve this, the government has set stunting as one of the priority programs [2]. The government also formed the National Movement for the Acceleration of Nutrition Improvement (SUN Movement) through Presidential Regulation No. 42 of 2013[5].

Factors that influence the occurrence of stunting include a history of exclusive breastfeeding, low birth weight, infectious diseases, age, body length at birth, short maternal posture, maternal age at delivery,

maternal nutritional status, socioeconomic, occupation, education, and anemia pregnant women [2,6]. Short-term adverse effects that can be caused by stunting are impaired brain development, intelligence, physical growth disorders, and metabolic disorders in the body. As for the long-term impact that can be caused is decreased cognitive abilities and learning achievement, decreased immunity so that it is easy to get sick, and the risk of experiencing other complications [6].

The results of mapping the social construction of the community related to the phenomenon of stunting are not considered a nutritional problem for toddlers. The community also considers toddlers to be considered healthy if they eat well, ask for snacks, and play activities like other toddlers. However, in the midwife / Health Care assessment, the toddler experienced nutritional problems which were indicated by frequent illness and growth in body weight and height that did not match his age.[7]. So that researchers are interested in conducting a literature review on risk factors for the incidence of stunting.

## 2. RESEARCH METHODS

This type of research is a literature review. The variables in this study were risk factors for stunting, including a history of anemia in pregnancy, maternal height (short), socioeconomic status, maternal nutritional status, and education.

The databases used Science Direct, Proquest and the Garuda portal. The keywords chosen are "stunted", "stunting", "toddlers 24-59", "under five years old", "and maternal factors", "prenatal determinants, anemia in pregnancy", "anemia in pregnancy". The inclusion criteria used are breastfeeding mothers, pregnant women, health workers, articles from 2011-2019, international and national journals that can be accessed in full text in pdf and scholarly formats (peer reviewed journals). Researchers ranked journal findings according



to the most recent issue. Journals that match the theme are then reviewed and analyzed.

### 3. RESULTS AND DISCUSSION

#### 3.1. Result

No	Author/Year	Variables	Methods	Research results	Implications
1	Widyaningrum, & Romadhoni (2018)	Independent variable: Anemia in pregnancy  Dependent variable: Stunting	The research design used is analytic with a case control study approach. The sampling technique used was simple random sampling. Data collection used observation sheets. Data analysis used Chi Square test with $\alpha = 0.05$	The proportion of anemic history of pregnancy in the case group was 18 (66.7%) and 9 (33%) who did not suffer from anemia, while the proportion of anemic history of pregnancy in the control group was 17 (30.9%) and those who did not suffer from anemia were 38 (69.1%). Statistical test analysis used the chi square test ( $p$ value = 0.005 < 0.05) and OR 4.471 which showed a significant correlation between a history of pregnancy anemia and the incidence of stunting in toddlers in Ketandan Dagangan Madiun Village.	Pregnant women who suffer from anemia have four times the risk of having a child with stunting compared to mothers who are not anemic. It is recommended for pregnant women to consume Fe tablets during pregnancy to prevent anemia and stunting in toddlers.
2	Dessie et al (2019)	Independent variable: Maternal characteristics  Dependent variable: nutritional status	Estimation equations are commonly used to measure the relationship between maternal factors and stunting and wasting. Both the odds ratio and the adjusted odds ratio adjusted for the corresponding 95% confidence intervals were reported to show the strength of the association. In multivariable analysis, variables with a $p$ value < 0.05 were considered statistically significant	The likelihood of stunting was higher among children whose mothers had no education (AOR = 1.58; 95% CI: 1.25, 2.0) and basic education (AOR = 1.42; 95% CI: 1, 13, 1.78), underweight nutritional status (AOR = 1.59; 95% CI: 1.27, 2.0), and anemic mother in pregnancy (AOR = 1.16; 95% CI: 1, 04, 1.30). Similarly, a higher chance of losing was observed among children whose mothers had a malnourished status (AOR = 2.34; 95% CI: 1.65, 3.38), giving birth at home (AOR = 1.31; 95% CI: 1.07, 1.60), and the birth interval was less than 24 months (AOR = 1.31; 95% CI: 1.04, 1.64).	Maternal education, nutritional status, and anemia were associated with child stunting. Maternal nutritional status, place of delivery, and previous birth interval were also associated with losing. Therefore, it is necessary to improve the nutritional status of children under five by improving maternal malnutrition, maternal education and maternal anemia status, prolonging the birth interval, and increasing delivery in health facilities.
3	Almasi et al (2019)	Independent variable: economic status of reproductive health, motherhood, newborn and child intervention, life expectancy at birth, mean wind speed, anemia in pregnant women, delivery with health personnel	This type of research is cross sectional with secondary data in the period 2005-2016. After that, the map was extracted using Geographical Information Systems (GIS). Finally, for data analysis, regression, path analysis and cluster analysis techniques were employed in the SPSS Statistical Software (version 23.0).	The highest rates of stunting were in Yemen, Afghanistan, Pakistan, and Sudan, while Djibouti, Yemen, Somalia and Sudan had the highest rates of waste. Thus, children's stunting was affected by their waste (Beta = 0.918), and the economic status of reproductive health, motherhood, newborn and child intervention (Direct Impact = -0.323, R = 0.865, R <sup>2</sup> = 0.748, ADJR <sup>2</sup> = 0.720, P < 0.05). It was also observed that life expectancy at birth (Beta = -0.829, indirect impact = -0.323), mean wind speed (Beta = -0.403, Indirect impact = -0.369), prevalence of anemia in pregnant women (Beta = 0.335, Indirect impact = 0.307), delivery with health personnel (Beta = 0.226, Indirect impact = 0.207), had an	Only five variables affect stunting and wasting (economic status of reproductive health interventions, mothers, newborns and children, life expectancy at birth, average wind speed, prevalence of anemia in pregnant women, and births assisted by skilled health personnel). Stunting and wasting of children in EMR requires more attention from health authorities and policy makers.

		Dependent variable: stunting and wasting		indirect effect on the incidence of wasting in children.	
4	Menon et al (2016)	Variable: Maternal anemia  Independent variable: anemia at different stages of gestation  Dependent variable: Infant outcomes	The type of research used is a prospective cohort, data analysis uses a mixed logistic regression model with a random participant. The data collected included information on sociodemographics and health-related factors, including anemia (i.e., low hemoglobin status), maternal and infant anthropometric data, and infant neurobehavioral data. Mixed logistic regression models were used to examine the impact of anemia during pregnancy on maternal and neonatal outcomes (ie, anthropometric growth parameters and infant neurobehavioral development).	Maternal anemia in the second trimester was positively associated with infant length for age Z-scores and also positively associated with birth weight for age Z-scores and head circumference for age. Infants of pregnant women who were not anemic in the second trimester were 0.26 standard deviation (SD) heavier (P = 0.029), 0.50 SD higher (P = 0.001), and had a 0.26 SD greater head circumference (P = 0.029) compared with infants of anemic pregnant women. Pregnant female infants who were not anemic in the third trimester had a higher orientation score of 3.88 (P = 0.004) than female infants who had anemia.	The results show that maternal anemia in the second trimester of pregnancy affects the growth of the baby after delivery and underscores the need to relieve anemia in young women in the early stages of pregnancy.
5	Ruchayati (2012)	Dependent variable: Hemoglobin levels, upper arm circumference of pregnant women  Independent variable: Length of babies	This research is an explanatory research with a Cohort approach. The data analysis used was univariate and bivariate analysis. Bivariate analysis using Rank Spearman Correlation statistical test.	The results showed 53.3% of the subjects suffered from anemia, and 26.7% had Chronic Energy Deficiency. As many as 70% of pregnant women gave birth to short babies (<48 cm). The results of the Rank Spearman Correlation showed that hemoglobin levels were associated with birth length (r = 0.390; p = 0.033), upper arm circumference was associated with birth length with values (r = 0.597; p = 0.001), weight gain was related to baby length born with a value (r = 0.367; p = 0.046).	The length of a baby born is influenced by hemoglobin levels, upper arm circumference during the third trimester and weight gain during pregnancy. Pregnant women are advised to be more active in asking health workers about the results of hemoglobin checks and measurements of upper arm circumference
6	Ningrum (2017)	Dependent variable: Nutritional status of anemia  Dependent variable: Body weight and length of newborns	The research design used an analytical survey with case control approach. Univariate data analysis in the form of frequency distribution, bivariate analysis in the form of chi square and the strength of the relationship seen from the OR parameter.	The results showed a correlation between anemic pregnant women with newborn body length (p = 0.022) and newborn weight (p = 0.001). Anemic pregnant women have a 4.8 chance of having a short body length compared to mothers who are not anemic. Anemic pregnant women have a 9.3 times chance of experiencing LBW compared to mothers who are not anemic.	anemic pregnant women have a 4.8 chance to have a short body length compared to mothers who are not anemic. Anemic pregnant women have a 9.3 times chance of experiencing LBW compared to mothers without anemia. Health workers treat pregnancies with anemia as early as possible to prevent fetal development
7	Kartini (2018)	Dependent variable: Anemia in pregnancy  Independent variable: Body length	The research design used was case control. The data collection instrument was a filling sheet. Data analysis used chi square test and OR	42 people (11.73%) were infants <48 cm in length. There is a correlation between anemia in pregnancy and the length of the baby at Benyamin Guluh Hospital, Kolaka Regency (X <sup>2</sup> = 12.5; p = 0.00). Mothers who have anemia are at 5.95 times the risk of their babies having a birth length <48 cm	Mothers who have anemia have a risk of 5.95 times their babies having a birth length of <48 cm. Medical personnel can improve the quality of information regarding normal HB levels in pregnancy so that risk factors for LBW and

					stunting due to anemia can be overcome.
8	Pandey et al (2017)	Independent variable: maternal stature, anemia during pregnancy, weight gain in pregnancy, birth weight, mothers age, vitamin A supplementation  Dependence Variable: stunting	This research used a case control study. Data regarding household, motherhood, pregnancy and child care were collected. Adjusted odds ratio (AOR) with confidence interval (CI) was calculated.	Multivariate regression analysis showed that the mother was short (AOR = 1.92 [95% CI = 1.14-3.52]), severe anemia during pregnancy (AOR = 1.98 [95% CI = 1.13-3.82]), weight gain <8 kg during pregnancy (AOR = 6.36 [95% CI = 4.08-10.81]), birth weight <2 kg (AOR = 5.96 [95% CI = 4.22-8.92]), being younger (AOR = 12.62 [95% CI = 8.63 - 18.52]), and not receiving Vitamin A supplementation (AOR = 2.78 [95% CI = 1.87-4.45]) were associated with the likelihood of severe stunting which was higher among 2-year-old children.	Most of factors associated with severe stunting were directly or indirectly related to the mother of child. Therefore, educating and empowering mothers for selfcare before, during, and after pregnancy as well as about parenting practices during the first 2 years of life is essential in the the first 1000 days of life.

Based on the table above, it can be found that there are two studies that emphasize the factors that can influence the incidence of stunting in children, both in terms of child factors, maternal factors, and socioeconomic factors [8-9]. Then narrowed it down again with other studies that have the same problem to be raised as an important point in his research, namely maternal risk factors that can cause stunting in children [10-15]

The eight journals use quantitative research types. A total of seven journals used a case control study design to obtain the odds ratio as a measure of risk, which aimed to determine the size of the association of exposure (risk factors) with the incidence of disease [9-11, 14, 15]. A cohort study design was used to determine the relationship between a particular effect (disease or health condition) and certain risk factors [12-13]. Meanwhile, another study used a cross sectional design with secondary data sourced from the Meteorological Organization (WMO) website [8]. All studies involve two or more variables and use an outline correlative study design with multivariate analysis to measure, explain and predict the level of the relationship between variables. Although the four journals use bivariate analysis, each variable is described in detail and systematically in describing the results and discussions related to the relationship between variables [10, 13-15]

### 3.2. Discussion

The incidence of stunting reflects a process of failure to achieve potential linear growth as a result of health and nutritional status. Stunting is a condition of length or height for age that is less than minus two standard deviations (<-2 SD) of the child's median growth standard. Stunting in toddlers includes chronic nutritional problems caused by many factors such as socioeconomic conditions, maternal nutrition during pregnancy, illness in infants, and lack of nutritional intake in infants. Toddlers with stunting in the future will

have difficulty achieving optimal physical and cognitive development [2].

#### 3.2.1. Risk Factors for Anemia in Pregnancy Against Stunting

Mothers with a history of anemia in their pregnancy have an effect on the growth of their children later [6]. This stunted fetal growth can be started in the womb or postnatally. This is evidenced by the results of Ruchayati's research which explains that the higher the hemoglobin level the longer the size of the baby to be born[13].

Several studies also found that anemia in pregnancy especially during the second trimester was positively associated with infant length for age Z-scores [9-14]. According to Tanner stated that the linear growth rate of the fetus peaks at 16 weeks of gestation. Ultrasound measurements of growth velocity for femur length in the fetus show that peak growth rate occurs during the early second trimester followed by a gradual decline into the third trimester [12].

In contrast, a study in the Eastern Mediterranean Region (EMR) found that the prevalence of anemia in pregnant women has an indirect impact on the incidence of stunting (Beta = 0.335, Indirect = 0.307). Children born to anemic mothers are at risk of losing and if this is allowed, the child will become stunted [8]. So that anemia in pregnancy can have a direct or indirect impact on body height/age children. There are several other factors that are more dominant so that anemia is not a direct factor.

#### 3.2.2. Risk Factors of Low Birth Weight Against Stunting Incidence

Anemic pregnant women have a 9.3 times chance of experiencing LBW compared to mothers who are not anemic[14]. LBW children are more likely to become stunted because LBW children have a higher

susceptibility to infectious diseases. While this infectious disease can worsen the nutritional state. As a result, it can reduce appetite, impair absorption in the digestive tract or increase the need for nutrients due to disease so that nutritional needs are not met and result in suboptimal physical growth [17].

### 3.2.3. Risk Factors for Maternal Height (Short) Against Stunting

Another factor associated with stunting is the height of the mother who has a short stature with AOR = 1.92[9]. Height can be influenced by both internal factors such as genetics and external factors such as disease or nutritional intake. If the height of the parents of a baby born is short due to a disease or inadequate nutritional intake, then the short birth length of the baby can be overcome. If the parents are short because of a gene that carries a short trait in the chromosome, the child will most likely inherit the gene [18].

### 3.2.4. Socio-Economic Risk Factors Against Stunting

Household food insecurity is also associated with lack of economic factors in the family so that it is unable to meet nutritious intake and health services for mothers and children. Previous research also stated that economic factors have a direct impact on stunting with a p value of <0.05 because the economic situation in a family will later affect reproductive health, mothers, newborns and child interventions[8].

Non-stunting status is more common in children with working mothers. This is due to economic factors because working mothers can help with family income. An adequate family income will support the child's growth and development because parents can provide all the basic needs of the child. Even though mothers who do not work have more time to care for their children, if the parenting style is not good, such as diet less attention, it will cause nutritional problems [19].

### 3.2.5. Risk Factors for Maternal Nutritional Status on Stunting

The risk of malnutrition that occurs continuously will cause chronic energy deficiency (CED) in pregnancy which will have an impact on the birth of a stunting baby (<48 cm) [13]. Chronic energy deficiency (CED) is caused by insufficient energy and protein intake [2]. In addition, mothers who gain less weight during pregnancy can also affect the incidence of stunting in children [8,12]. An increase in body weight of less than 8 kg during pregnancy will affect the incidence of stunting in children and a 6.36 greater chance [9].

Increased energy and nutrients during pregnancy it is necessary during pregnancy for the growth and development of the fetus, the increase in the size of the uterine organs, and the growth in the composition and

metabolism of the mother's body, so that a lack of certain nutrients during pregnancy can cause the fetus to grow imperfectly [20].

### 3.2.6. Educational Risk Factors Against Stunting

Mothers who do not have education and basic education are closely related to the incidence of stunting[11]. This finding was in line with a study carried out in Kenya [21]. Mothers with higher education are more likely to make decisions that will improve awareness to control their health, such as antenatal visits, family planning intentions, pregnancy plans and choice of place of care. Mothers who give birth at home or traditional birth attendants are at risk of having a stunted child when compared to giving birth in a health facility. So that many mothers do not get knowledge about optimal breastfeeding and child feeding practices to improve the nutritional status of babies and children. Education is needed by mothers. They will be more responsive to nutritional problems earlier so that stunting can be prevented [21]. Contrary to findings of Makoka et al, they showed that maternal education was not significantly associated with child nutrition [22].

## 4. CONCLUSIONS

Stunting is caused by multi factors which include a history of anemia in pregnancy, a history of low birth weight, maternal posture (short), socioeconomic conditions, maternal nutritional status, and education. So, it is necessary to optimize the MCH (Maternal and Child Health) program both promotive and preventive, especially for young women and women of childbearing age so that their pregnancy programs can be more planned and the incidence of stunting can be handled early.

## BIBLIOGRAPHY

- [1] UNICEF, "Tackling The 'Double Burden' of Malnutrition in Indonesia," [www.unicef.org](http://www.unicef.org). [Online]. Available: [www.unicef.org/indonesia/nutrition](http://www.unicef.org/indonesia/nutrition). [Accessed: 07-Oct-2019].
- [2] Kementerian Kesehatan RI, *Situasi Balita Pendek (Stunting) di Indonesia*. Jakarta, 2018.
- [3] Kementerian Kesehatan RI, *Laporan Hasil Riset Kesehatan Dasar (Riskesdas) Indonesia tahun 2018*. Jakarta: Badan Badan Penelitian dan Pengembangan Kesehatan, 2019.
- [4] Kementerian PMK, *Strategi Nasional Percepatan Pencegahan Anak Kerdil (Stunting)*. Jakarta: Sekretariat Wakil Presiden Republik Indonesia, 2018.
- [5] Bappenas, "Cegah Stunting di 1000 Hari Pertama Kehidupan, Investasi Bersama untuk Masa Depan Anak Bangsa," [www.bappenas.go.id](http://www.bappenas.go.id), 2018. [Online]. Available: [https://www.bappenas.go.id/files/6615/3309/4305/Siara\\_n\\_Pers\\_-\\_Cegah\\_Stunting\\_di\\_1000\\_Hari\\_Pertama\\_Kehidupan\\_](https://www.bappenas.go.id/files/6615/3309/4305/Siara_n_Pers_-_Cegah_Stunting_di_1000_Hari_Pertama_Kehidupan_)

Investasi\_Bersama\_untuk\_Masa\_Depan\_Anak\_Bangsa .pdf. [Accessed: 11-Oct-2019].

[6] Kementerian PDPT, “Buku saku desa dalam penanganan stunting,” Jakarta: Kementerian Desa, Pembangunan Daerah Tertinggal, dan Transmigrasi, 2017.

[7] W. Lestari, L. Kristiana, and A. Paramita, “Stunting: Studi Konstruksi Sosial Masyarakat Pedesaan Dan Perkotaan Terkait Gizi Dan Pola Pengasuhan Balita Di Kabupaten Jember,” *Aspir. J. Masal. Sos.*, vol. 9, no. 1, pp. 17–33, 2018.

[8] A. Almasi et al., “Investigation of some Factors Affecting Stunting and Wasting among the Under-Five Children in Eastern Mediterranean Region,” *Int J Pediatr*, vol. 7, no. 7, pp. 9759–9772, 2019, doi: 10.22038/ijp.2019.40074.3403.

[9] A. Pandey, P., Bajpai, P., Jain, S., & Sharma, “Maternal empowerment holds the key to reducing stunting during first 1000 days of life: Evidence from a case–controlled study,” *Ann. Trop. Med. Public Heal.*, vol. 10, no. 3, pp. 667–677, 2017.

[10] D. A. Widyaningrum and D. A. Romadhoni, “Riwayat Anemia Kehamilan Dengan Kejadian Stunting Pada Balita Di Desa Ketandan Dagangan Madiun,” *Medica Majapahit*, vol. 10, no. 2, pp. 86–99, 2018.

[11] Z. B. Dessie, M. Fentie, Z. Abebe, T. A. Ayele, and K. F. Muchie, “Maternal characteristics and nutritional status among 6–59 months of children in Ethiopia: further analysis of demographic and health survey,” *BMC Pediatr.*, vol. 19, no. 83, pp. 1–10, 2019, doi: 10.1186/s12992-019-0505-7.

[12] K. C. Menon et al., “Effects of anemia at different stages of gestation on infant outcomes,” *Nutrition*, vol. 32, no. 1, pp. 61–65, 2016, doi: 10.1016/j.nut.2015.07.009.

[13] F. Ruchayati, “Hubungan Kadar Hemoglobin Dan Lingkar Lengan Atas Ibu Hamil Trimester Iii Dengan Panjang Abyi Lahir Di Puskesmas Halmahera Kota Semarang,” *J. Kesehat. Masy. Univ. Diponegoro*, vol. 1, no. 2, pp. 578–585, 2012.

[14] E. W. Ningrum, “Korelasi Antara Status Gizi Anemia Dengan Berat Badan Dan Panjang Badan Bayi Baru Lahir,” *Viva Med.*, vol. 10, no. 1, pp. 28–33, 2017.

[15] Kartini, “Hubungan Anemia Dalam Kehamilan Dengan Panjang Badan Bayi Baru Lahir di Rumah Sakit Benyamin Guluh Kabupaten Kolaka Tahun 2018,” *Heal. Inf. J. Penelit.*, vol. 10, no. 1, pp. 33–38, 2018.

[16] H. Woldie, Y. Kebede, and A. Tariku, “Factors Associated with Anemia among Children Aged 6-23 Months Attending Growth Monitoring at Tsitsika Health Center, Wag-Himra Zone, Northeast Ethiopia,” *J. Nutr. Metab.*, vol. 2015, 2015, doi: 10.1155/2015/928632.

[17] M. S. Rahman, T. Howlader, M. S. Masud, and M. L. Rahman, “Association of low-birth weight with malnutrition in children under five years in Bangladesh: Do mother’s education, socio-economic status, and birth interval matter?,” *PLoS One*, vol. 11, no. 6, pp. 1–16, 2016, doi: 10.1371/journal.pone.0157814.

[18] K. T. Warsini, H. Hadi, and D. S. Nurdianti, “Riwayat KEK dan anemia pada ibu hamil tidak berhubungan dengan kejadian stunting pada anak usia 6-23 bulan di Kecamatan Sedayu, Bantul, Yogyakarta,” *J. Gizi dan Diet. Indones. (Indonesian J. Nutr. Diet.)*, vol. 4, no. 1, pp. 29–40, 2016, doi: 10.21927/ijnd.2016.4(1).29-40.

[19] S. Mentari and A. Hermansyah, “Faktor-Faktor Yang Berhubungan Dengan Status Stunting Anak Usia 24-59 Bulan Di Wilayah Kerja Upk Puskesmas Siantan Hulu,” *Pontianak Nutr. J.*, vol. 1, no. 1, pp. 1–5, 2018.

[20] R. . Zaif, M. Wijaya, and D. Hilmanto, “Hubungan Antara Riwayat Status Gizi Ibu Masa Kehamilan dengan Pertumbuhan Anak Balita Di Kecamatan Soreang, Kabupaten Bandung,” *J. Skala Kesehat.*, vol. 3, no. 2, 2017.

[21] B. A. Abuya, J. Ciera, and E. Kimani-murage, “Effect of mother ’ s education on child ’ s nutritional status in the slums of Nairobi,” *BMC Pediatr.* 2012, vol. 12, no. 80, pp. 1–10, 2012, doi: 10.1186/1471-2431-12-80.

[22] D. Makoka and P. K. Masibo, “Is there a threshold level of maternal education sufficient to reduce child undernutrition? Evidence from Malawi , Tanzania and Zimbabwe,” *BMC Pediatr.*, no. 2015, pp. 1–10, doi: 10.1186/s12887-015-0406-8.

# Analysis of Education and Family Income Factors on Caregiver Burden in Elderly Care at Community Health Center of Perak Timur

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## ABSTRACT

Elderly care is an obligation that must be done as a primary form of family support. One of the supports is to make the family a caregiver of the elderly, but the family does not often carry out this task well due to the factors that exist in the caregiver's self, such as lack of knowledge due to the low level of caregiver education and lack of family income. The purpose of this research was to analyse the relationship between educational factors and income towards caregivers burden in elderly care.

The research design used correlational analysis with a cross-sectional approach. Total population was 340 that the samples were 129 samples taken by cluster random sampling. The samples have met the inclusion and exclusion criteria. The ZBI caregiver burden questionnaire (Zarit Burden Interview) was used collect data. Data analysis used SPSS 16 with chi square test with a value  $\alpha < 0.05$ . The results of research conducted on caregivers at Community Health Centre in Perak Timur showed that the care giver burden was mostly medium burden 58.9%, the caregiver was mostly high school education category and most of the income factor was  $\leq 3,000,000,000$ . The results showed an educational factor value  $\alpha > 0.734$  and an income factor value  $\alpha > 0.148$ , which meant there was no relationship between the factors of education and income with the burden of caregiver in elderly care. There are many other factors that can affect the caregiver's burden such as length of stay, age, gender, family and ethnic relationships. Based on the chi square analysis test, the length of time being treated has a significant relationship with a value of  $\alpha < 0,044$ . Since the average length of elderly care in the area at Community Health Centre of Perak Timur region was more than 2 years. There was no relationship between education and income to the burden of caregivers in caring for the elderly. Therefore, it was hoped that in further research, the research can be carried out on other variable factors such as the length of caring for the elderly, gender and family relationships. The health centre in this case government agencies needed to provide support and assistance to families in elderly care.

**Keyword:** Caregiver Burdens, Elderly Care, family income factors, education factor

## 1. INTRODUCTION

Elderly is someone who has reached the age of 60 years and over, at this age will experience the aging process (2). The process of aging is a scientifically continuous process, which starts from birth and is generally experienced by all living things. Aging is a process of slowly disappearing the ability to repair itself or replace oneself and maintain normal structure and function so that they cannot withstand infection and repair the damage suffered, there will be various disease that often occur in the elderly (14).

Families who live with the elderly have an important role in care (10), the decline in ability and the number of disease that occur in the elderly needs support from the family, the role of the family as caregiver informally is as a motivator, educator, and facilitator for the elderly (8). A family must be an encouragement for the elderly to live the rest of their life well. The family must be able to provide health information, so that the elderly can know which

things to do or not, the family must also be able to guide, help and fulfill all their needs. The family as a caregiver has a big influence on the elderly, but often this role cannot be carried out properly due to various factors that exist outside and within the caregiver. The large burden of family caregivers in elderly care and the increasing number of elderly people in the community are reasons for the need to know the factors that affect the caregiver's burden in elderly care.

Population ageing is a global phenomenon. Virtually every country in the world is experiencing growth in both the size and the proportion of older persons in the population. In 2019, there were 703 million persons aged 65 years or over in the global population. This number is projected to double to 1.5 billion in 2050. Globally, the share of the population aged 65 years or over increased from 6 per cent in 1990 to 9 per cent in 2019. That proportion is projected to rise further to 16 per cent in 2050, when it is expected that one in six people worldwide will be aged 65 years or over. Globally, the number of persons aged 80 years or older nearly tripled between 1990 and 2019,

growing from 54 million to 143 million; it is projected to triple again between 2019 and 2050 to reach 426 million. Between 1990 and 2019, the number of persons aged 80 or over doubled in all regions except Europe and Northern America and tripled in four of eight regions. Between 2019 and 2050, the number of persons aged 80 years or over is projected to show the largest percentage increases in Eastern and South-Eastern Asia and in Northern Africa and Western Asia (13). In almost five decades, the percentage of Indonesian elderly has doubled (1971-2017), namely to 8.97 percent (23.4 million), where female elderly is about one percent more than male elderly (9.47). percent versus 8.48 percent). In addition, the Indonesian elderly is dominated by the 60-69 year old group (young elderly) whose percentage reaches 5.65 percent of the Indonesian population, the rest is filled by the 70-79 year old age group (middle elderly) and 80+ (old elderly). In 2019 the number of elderly people in East Java reached 13.06% and Surabaya 8.84% (1).

The increasing population of the elderly creates more problems in Indonesia. This is related to the changes that occur due to the aging process where the elderly has decreased various functions of the body's organs. It can cause them to not function optimally that has an impact on the quality of life of the elderly. This condition requires support from various parties, especially families as caregivers who are able to care for the elderly and meet their needs, both physically and psychosocial.

A preliminary study conducted at Community Health Centre in Perak Timur of Surabaya in November 2019 that obtained data in July. The total number of elderly people in posyandu (Integrated service post) was 1465 out of 21 posyandu, while elderly diseases that often occurred / complained by elderly people in the last 3 months at Community Health Centre in Perak Timur were, Rheumatism, OA, Arthritis, ARI and Myalgia. Based on the results of interviews with 10 caregivers who care for the elderly at Community Health Centre in Perak Timur of Surabaya, 2 of them do not experience the burden when caring for the elderly then 1 of the caregiver experiences a light burden, then 4 other caregivers experience a moderate burden and 3 caregivers say a heavy burden when caring for the elderly at home.

As a caregiver a lot of pressure and burdens, both caused by the elderly and the conditions experienced by the caregiver itself. Difficulties and inability of the caregiver to overcome and resolve problems that arise in carrying out their duties as a caregiver can become a burden and pressure. Emotional conditions that are usually marked by extreme sadness, feelings of meaninglessness and guilt, withdrawal from others, sleeplessness, changes in appetite, sexual desire and interest in activities that are usually carried out (12). The occurrence of disturbances in this emotional condition certainly has a negative effect on the daily functioning of the caregiver.

The amount of caregiver burden in providing care for the elderly is influenced by several factors. According to Morimoto, Schreiner, and Asano (2003), the factors that influence caregiver burden are age, gender, relationship with clients, and education; client's chronic disease; the

level of functional dependence of the client, namely Activity Daily Living (ADL) and Instrumental Activity Daily Living (IADL), the length of time the caregiver takes care of the client; and caregiver chronic disease (6). Michon, et al. (2005) also suggested that the burden is determined by the strength of the relationship between client and caregiver. Client variables are the need to manage psychosocial behavior and symptoms, while the caregiver variables are satisfaction in caring, demographic characteristics, and social roles. Caring expenses, among others, are related to; physical problems, including fatigue, sleep disturbances, chronic conditions (hypertension, arthritis); psychological problems include feelings of anxiety, worry, pessimism, shame, guilt, impaired self-esteem, and depression; social problems include limitations in relationships with other people, limitations in social activities and free time; financial problems include limited costs and financial resources (3). Sansoni, Vellone and Piras (2004) in their research stated that the level of caregiver education affects the level of depression they experience when caring for elderly people with Alzheimer's disease, where caregivers with a high level of education will have a lower incidence of depression (9).

The effects of the impact experienced by the caregiver as a result of caring for the elderly needs to be prepared early in the face of changing situations they experience. However, to be able to determine what needs the caregiver needs, it is important to know the challenges and obstacles that the caregiver experiences in caring for the elderly in the community. The caregiver's needs can be met and the forms of support or care needed for the elderly can be developed caregiver.

Based on the background description above, the researcher is interested in conducting research on the relationship between education and income factors on the caregiver's burden in elderly care. With this research, it is hoped that the needs and forms of support that can be provided to the caregiver can be identified.

## 2. RESEARCH METHOD

The research design used a correlational analysis with a cross-sectional approach, by linking the variables of education and income factors to the burden of caregivers in caring for the elderly. The total population was 340 elderly who were treated by caregivers with a total sample of 129 which were taken by cluster random sampling and had met the inclusion and exclusion criteria. The independent variables were education and income factors while the dependent variable was caregiver burden. The ZBI caregiver burden questionnaire was used collect data (Zarit Caregiver Burden Interview from Hebert, Bravo and Preville, 2000) by Yossie (15). The process of collecting data with Data analysis used SPSS 16 with chi square test with a value  $\alpha < 0.05$ . The process of collecting data, the researched conducted a license to conduct research at Puskesmas Perak Timur Surabaya. Before the research, the researcher asked for a permit letter from the Muhammadiyah University of Surabaya, then submitted a permit to the head of the Surabaya Bankesbangpol and a

recommendation letter from the Surabaya Health Office for data collection. Further data collection by visiting the respondents one by one to their house. The researcher provided an explanation of the aims and objectives of the study and submitted a request for permission (informed consent) to the respondent, then conducted an interview using the instrument that had been prepared.

### 3. RESULT AND DISCUSSION

Table 1. Characteristics of Caregiver Respondents

Characteristics	Total	Percentage
<b>EMPLOYMENT</b>		
Government Employees	8	6.2
Self-employed	45	34.9
Pension	11	8.5
Private employees	21	16.3
Housewives	35	27.1
Not working	9	7
<b>AGE CAREGIVER</b>		
12-25 years	4	3.1
26-45 years	54	41.9
46-60 years	71	55
<b>SEX</b>		
Female	83	64.3
Male	46	35.7
<b>LONG OF CARING</b>		
< 2 years	11	8.5
≥ 2 years	118	91.5
<b>FAMILY INCOME</b>		
<3,000,000	80	62
≥3,000,000	49	38
<b>EDUCATION</b>		
Junior High School	33	25.6
Senior High School	81	62.8
Higher Education	15	11.6

Based on table 1.above showed the characteristics of caregiver respondents based on work, most are self-employed 34.9% (45 people), and a small proportion of civil servants 6.2% (8 people). Characteristics of respondents based on age were mostly 46-60 years old, 55% (71 people) and a small proportion of 12-25 years 3.1% (4 people). Characteristics of respondents based on gender showed that most of the sex was female 64.3% (83 people) and a small proportion of men 35.7% (46 people). Characteristics of respondents based on length of care mostly ≥ 2 years 91.5% (118 people) and a small proportion <2 years 8.5% (11 people). Characteristics of respondents based on income were mostly <3,000,000 62% (80 people) and a small proportion ≥ 3,000,000 38% (49 people). Characteristics of respondents based on education most of senior high school 62.8% (81 people) and a small

proportion of universities 11.6% (15 people).

Table 2.Characteristics of Elderly

Characteristics	Total	Percentage
<b>ELDERLY AGE</b>		
61-64	9	7
65-68	29	22,5
69-72	21	16,35
73-76	18	14
77-80	33	25
81-84	15	11.6
85-88	4	3.1

Based on table 2 The characteristics of the elderly showed that most of them are 77-80 years old, 25.6% (33 people) and a small proportion of them aged 85-88 years 3.1% (4 people).

Table 3. Caregiver Burden

Criteria	Total	Percentage
No burden	6	4.7
Light burden	32	24.8
Medium burden	76	58.9
Heavy burden	15	11.56
	129	

Based on table 3.above showed that the burden of caregivers mostly had medium burden criteria of 58.9% (76 people) and a small proportion had criteria no burden 4.7% (6 people).

Table 4. Relationship between factors of caregiver

Income	Caregiver Burden			
	No Burden	Light Burden	Medium Burden	Heavy Burden
< 3.000.000	5 (3,8%)	19 (14,7%)	47 (36,4%)	9 (6,9%)
≥ 3.000.000	1 (0,7%) <sup>2</sup>	13 (10%)	29 (22,4%)	6 (4,6%)
	6	32	76	15

$P = 0,734 > \alpha = 0,05$

Based on table 4. above showed the above relationship Income and caregiver expense factors were found mostly with income categories <3,000,000 with moderate caregiver expenses as much as 36.4% (47 people) and a small portion of income ≥ 3,000,000 with caregiver expenses in the no-burden category as much as 0.7% (1 person). Based on the chi square analysis test showed the value  $P = 0.734 > \alpha = 0.05$ , which meant that there was no relationship between income and caregiver expenses.



Table 5. Relationship between Educational Factors and Caregiver

Education	Caregiver Burden			
	No Burden	Light Burden	Medium Burden	Heavy Burden
Junior High school	2 (1,5%)	12 (9,3%)	14(10,8%)	5 (3,8%)
Senior High School	4 (3,1%)	14(10,8%)	55(42,6%)	8 (6,2%)
Higher Education	0 (0%)	6 (4,6%)	7 (5,4%)	2 (1,5%)
	6	32	76	15

P = 0,148 > α = 0,05

Based on table 5. above showed the relationship of the factors of education and caregiver burden were found in the high school education category and the caregiver burden was moderate as much as 42.6% (55 people) and a small proportion with tertiary education and no caregiver burden as much as 0% (0 people). Based on the chi square analysis test, it showed the value of  $P = 0.148 > \alpha = 0.05$ , which meant there was no relationship between educational factors and caregiver burden.

Caregiver burden was a negative assessment and feelings of stress resulting from caring for someone who was sick physically, emotionally, socially, and financially. This burden can be experienced by family caregivers as caregivers (7). The results showed that the sick elderly needed more help and care. When doing family caregiver care that you can experience high stress. In accordance with research (4) which stated that the older someone who had physical limitations can add to the challenges for the caregiver and of course can increase the risk of burdening the caregiver. Increasing age can cause psychological decline, thereby increasing the need for nurture. The results of this research indicated the increasing age of the elderly that the more they needed full care from a caregiver in meeting the needs of the elderly. This can cause a moderate to heavy burden on the caregiver due to physical changes that were occurred in the elderly. They got the needs that must be given and also the treatment that must be done.

Based on the results of research conducted on caregivers at Community Health Centre in Perak Timur. It showed that caregiver burden had no relationship between education level and income. A High level of education will increase knowledge and raise one's awareness in meeting health needs. High income or income is also expected to make it easier to fulfill health service facilities for the elderly. The results of the research on caregiver burden in elderly care show that caregivers have a high level of education and sufficient income, but the burden of caring for the elderly will create a situation that makes the caregiver stressful and research shows that the care carried out on the elderly is mostly carried out over a long period of time more than 2 years and most of them have a high level of load, and the results of the chi-square test on the factor of length of care and caregiver burden showed a significant relationship ( $p = 0.044 < \alpha = 0.05$ ). In line with Siti Maryam's (2012) research, it shows that there is no significant relationship between family characteristics,

namely age, gender, marital status, education, occupation, income, and family relationships with family burdens who care for the elderly but health status, ability to care for, and satisfaction in caring was significantly related to the burden of family caring for the elderly ( $p = 0,009; p = 0,041; p = 0,021; \alpha = 0,05$ ) (11).

Moreover, it can be understood that the educational status of a person can affect knowledge and information. The difference in the results of this research with previous studies that were because the length of treatment performed on the elderly exceeds 2 years and the elderly who were treated are elderly people. Therefore, the length of treatment became a heavy burden for the caregiver. According to research Henrikson, 2013 (5) stated that the length of a person's illness can be worsen the condition and experienced additional symptoms, loss of physical function, and required more treatment. As the disease develops, the caregiver's burden can be higher. The results showed that the sick elderly needed more help and care. When doing family caregiver care, you can experience high stress.

#### 4. CONCLUSION

The results of research conducted on caregivers at Community Health Centre in Perak Timur showed that the care giver burden was in the category of no burden 4.7%, 24.8% light burden, 58.9% medium burden, 11.65% heavy burden. Based on the results of research conducted at Community Health Center in Perak Timur, it can be concluded that the caregiver was mostly high school education category and most of the outreach was  $\leq 3,000,000,000$ . There was no relationship between education and income to the burden of caregivers in caring for the elderly. Therefore, it was hoped that in further research, the research can be carried out on other variable factors such as the length of caring for the elderly, gender and family relationships.

#### REFERENCES

1. Badan Pusat Statistik (BPS). (2019). *Statistik Penduduk Lanjut Usia*. Jakarta. <https://www.bps.go.id/>, diakses pada 15 Oktober 2020
2. Depkes RI, (2013). *Gambaran Kesehatan Lanjut Usia di Indonesia*. Jakarta: Kemenkes RI. [www.depkes.go.id/folder/view/01/structure-promosikesehatan-pedoman-dan-buku.html](http://www.depkes.go.id/folder/view/01/structure-promosikesehatan-pedoman-dan-buku.html), 9 April 2016
3. Harris, G.J. (2008). *Caregiver Well-being: Factor influencing positive outcomes in the informal caregiving process* (Disertation, Doctor of Philosophy). Department of Family and Child Science, Florida State University.
4. Hsu, T., Loscalzo, M., Ramani, R., Forman, S., Popplewell, L., Clark, K., Matthews, K. (2015) *Factors Associated with High Burden in Caregivers*, 120(18), 2927-2935. <https://doi.org/10.1002/28765.Faktors>
5. Henrikson, A. & Arestedt, K. (2013) Exploring

- Factors and Caregiver Outcomes Associated with Feelings of Preparedness for Caregiving in Family in Family Caregivers. *Paliative Medicine*, 27(7), 639-46. <https://doi.org/10.1177/0269216313486954>
6. Morimoto, T., Schreiner, A.S., & Asano, H. (2003). Caregiver burden and health related quality of life among Japanese stroke caregiver. *Age and Aging*, 32 (2), 218–223.
  7. Myron, F. W. & Anne. M. L. (2009). *The American Psychiatric Publishing Textbook of Alzheimer Disease and Other Dementias*. London: American Psychiatric Nursing.
  8. Putra, H dan Aisyah. (2010). Hubungan Peran Keluarga Dalam Perawatan Kesehatan Terhadap Status Kesehatan Lansia Di Wilayah Kerja Community Health Center Mojo Kecamatan Gubeng Surabaya. Skripsi. Fakultas Ilmu Kesehatan UMS Surabaya
  9. Sansoni, J., Vellone, E. dan Piras, G., 2004. Anxiety and depression in community-dwelling, Italian Alzheimer's disease carers. *International Journal of Nursing Practice*, Vol. 10, pp. 93–100.
  10. Saddock (2010). *Buku ajar Psikiatri Klinis*. Edisi 2. Jakarta : EGC
  11. Siti Maryam<sup>1\*</sup>, Rosidawati<sup>1</sup> , Ni Made Riasmini<sup>1</sup> , Eros Siti Suryati<sup>1</sup>, (2012). *Beban Keluarga Merawat Lansia Dapat Memicu Tindakan Kekerasan Dan Penelantaran Terhadap Lansia* Jurnal Keperawatan Indonesia, Volume 15, No.3, November 2012; hal 143-150
  12. Tanton, S. (2006). *Beban Caregiver Lanjut Usia di Beberapa Tempat Sekitar Kota Bandung*. *Majalah Psikiatri XL*, 4, 32-33.
  13. United Nations, (2019). *World Population Ageing 2019*. Diakses 15 Oktober 2020. <https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Report.pdf>
  14. WHO. *Dementia: Public Health Priority*. 2012; Available from: [http://who.int/mental\\_health/publications/dementia\\_report\\_2012/2n/](http://who.int/mental_health/publications/dementia_report_2012/2n/)
  15. Yossie Susanti Eka Putri, 2013. *Prediktor Beban Merawat Dan Tingkat Depresi Caregiver Dalam Merawat Lanjut Usia Dengan Demensia Di Masyarakat*. *Jurnal Ners* Vol. 8 No. 1 April 2013: 88–97

# Analysis of Diet Compliance in Patients with Diabetes Mellitus on the occurrence of complications in the Polyclinic in Nganjuk Regional Hospital

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## ABSTRACT

Compliance in implementing a healthy diet and lifestyle is the main key in controlling blood sugar levels in people with diabetes mellitus. If it is not controlled, it will cause various diseases that will be caused by impaired eyesight, cataracts, heart problems, impaired kidney function, sexual impotence, difficult to heal a wound, or even rot/gangrene, occurrence of lung infections, disorders of blood vessels and strokes. The purpose of this study is to determine what factors influence diet adherence in people with diabetes mellitus for the occurrence of complications. This research uses mixed methods. This research uses accidental sampling and obtained quantitative data of 77 respondents to see the relationship between diet adherence with the occurrence of complications, and after that qualitative data, of 10 respondents were conducted by interview knowing what factors influence diet adherence. Quantitative statistical test results  $p\text{-value} = 0.002 < \alpha = 0.05$ , which means there is a relationship between diet adherence with the occurrence of complications. While the results of qualitative data obtained three themes, namely lack of dietary knowledge, no family support, and difficulty in complying. Adherence to the diet in people with diabetes mellitus is very important to prevent complications; therefore the health team needs to always provide knowledge on how to diet properly, and families are expected always to support the diet so that motivation arises to carry out the diet in order to avoid complications seriously.

*Keywords: Diabetes Mellitus, Diet Compliance, and Complications*

## 1. INTRODUCTION

Diabetes mellitus is a chronic disease characterized by increased blood sugar levels due to hormonal disorders that can cause complications. Complications in DM are usually heart disease, kidney failure, hypertension, glaucoma, impotence, cataracts, and gangrene. Complications arise due to non-adherence to diet<sup>1</sup>. Compliance can be interpreted to the extent of adherence to the advice of health workers. Some can influence compliance, which including internal factors including knowledge, family support, and social support. DM diet adherence greatly affects blood sugar levels and routine adherence can help in controlling the diet of DM patients<sup>2</sup>. Diet is the basis of DM management, which aims to provide all essential food elements, achieve and maintain body weight, meet energy needs, and prevent fluctuations in blood glucose levels. Glycemic control of patients is strongly influenced by patient's adherence to dietary recommendations, including the type, amount, and schedule of food consumed, and non-

compliance is one of the obstacles to achieving treatment goals. Long-term adherence to diet is one of the most challenging aspects of the management of DM<sup>4</sup>.

Complications of DM consist of acute complications, changes in glucose levels and chronic complications, namely changes in the cardiovascular system, changes in the peripheral nervous system, mood changes, and increased susceptibility to infections. In addition, vascular changes in the lower extremities in people with DM can lead to arteriosclerosis, resulting in complications involving the legs that cause a high incidence of amputation in DM patients<sup>5</sup>. Patients with diabetes mellitus mostly do not understand the discipline of diet so that it will lead to complications that will aggravate the patient's condition.

## 2. METHOD

The method that will be used in this research is mixed methods. Research using quantitative research approaches with qualitative research used in one study to obtain more comprehensive, valid, reliable, and objective data<sup>17</sup>. Quantitative data uses correlation design, which examines

relationships, estimates, and tests existing theories. The approach used is cross-sectional, which is a type of research that emphasizes the time of measuring/observing independent and dependent variable data only once at a time (Nursalam, 2016). Data collection of diet adherence and occurrence of complications in people with diabetes mellitus was conducted using questionnaire on 77 respondents in three weeks.

While qualitative data with a phenomenological approach, which means research that focuses on the discovery of facts in accordance with experience. Qualitative research is methods to explore and understand the meaning of a number of individuals or groups of people considered from social or humanitarian problems<sup>17</sup>. Phenomenology is a research method that understands the uniqueness of the world of individual life phenomena, the unique and specific responses experienced by each individual, including interactions with others<sup>16</sup>.

Researchers randomly took respondents and conducted in-depth interviews to explore what factors influence diet compliance with the occurrence of complications in people with diabetes mellitus.

### 3. RESULTS

After data collection, tabulation, and analysis using SPSS, there is a correlation between diet adherence in people with diabetes mellitus and complications. Based on the table above, the results obtained  $p\text{-value} = 0.002 < \alpha = 0.05$  so that it can be concluded that there is a relationship of diet adherence in people with diabetes mellitus with complications.

Table 1 Nonparametric Test Results

Correlations				
			obedience	The occurrence of complications
Spearman's rho		Correlation Coefficient	1,000	,351**
	obedience	Sig. (2-tailed)	.	,002
		N	77	77
	The occurrence of complications	Correlation Coefficient	,351**	1,000
		Sig. (2-tailed)	,002	.
		N	77	77

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Based on the results of in-depth interviews and thematic analysis on ten respondents, the results of qualitative data shows that so that a theme can be drawn namely, 1). Lack of knowledge about diet, 2). Lack of family support and 3). Difficulty in following a diet.

Table 2 Themes Lack of knowledge about diet

Them	Lack of knowledge about diet			
es				
Category	Do not understand	Do not understand	Do not understand	Do not understand
Sub-categories	What foods can be eaten	Don't understand and what to do	Don't eat	No sugar consumption
Code	Do not understand	Eat 3 smpai 4 times a day	Fear of eating	Fear of eating rice

Respondent 3: "Sometimes I don't eat, afraid of eating rice, fried food let alone eat sugar."

Table 3 Themes Lack of family support

Themes	Lack of family support			
Category	Family doesn't care	Families less supportive of diet		
Sub-categories	Not paying attention to the food of family members suffering from DM	Don't understand what to do	Cooking food using sugar	Always provide rice
Code	Regular cooking	Does not control Do not regulate the feeding hours of DM sufferers	Regular cooking does not reduce sugar	Providing rice

Respondent 8: "My family cooks as usual, I also consume rice."

Respondent 5: "Sometimes I eat 3 to 4 times a day even though the portions are small."

Table 4 Themes Difficulty in complying with diet

Them es	Difficulty in complying with diet			
Category	Always feeling hungry	Fear of eating		
Sub-categories	Want to eat	Can't control appetite	Do not know the number of portions of food	Do not know the meal time
Code	Always hungry	Eat anytime	Eat whatever's there	Eat when you're hungry

Respondent 1: "I eat when I feel hungry."

Respondent 7: "I find it difficult to have to set the hours and portions."

## 4. DISCUSSION

### 4.1. Diet Compliance for Diabetes Mellitus Patients

Based on the results obtained from 77 almost all respondents were not compliant in carrying out the diet. Among the respondents aged 56-60 years, there are 14 respondents who were not compliant in carrying out the diet. Based on the sex category, there are 31 male respondents and 33 female respondents who do not adhere to the male diet. Diet adherence in diabetics is greatly influenced by knowledge of diet and family support so that blood sugar levels will be controlled and complications will not occur<sup>18</sup>. Diet adherence is still very low in respondents at the age of 56-60 years which likely influenced by lack of support from families who prepare food without regard to diet in people with diabetes mellitus.

### 4.2. Complications in Diabetes Mellitus Patients

Based on the results obtained from 77 respondents, almost 83.1% had complications. The biggest complication suffered was heart disease, 23.4%. This study is in line with previous study conducted by Saputri (2020) on systemic complications in patients with type 2 diabetes mellitus

conducted in 72 patients found that 11.1% had complications of heart disease, neuropathy jam, diabetic acidosis, nephropathy, hypoglycemia, cerebrovascular, and ulcer.

Diabetes mellitus is susceptible to complications because the blood of patients with concentrations becomes thick so that it will inhibit blood flow, especially in capillaries. Complications will usually arise in patients who are more than one year suffering from diabetes mellitus.

### 4.3. Dietary Compliance and the Occurrence of Complications in Patients with Diabetes Mellitus

Based on the results of the statistical test, the results obtained p-value = 0.002 < α = 0.05 which means that there is a relationship between diet adherence with the occurrence of complications in people with diabetes mellitus and the value of R = 0.351 which means that the lower the adherence, the greater the complications occur. Based on the results of in-depth interviews to find out what factors influence diet compliance, there are three obtained, 1). Lack of knowledge about diet, 2). Lack of family support, and 3). Difficulty in following a diet.

This research is in line with research conducted by Widyarni (2020) with 40 respondents who mostly did not adhere to the diet. (Fullstop) – start new sentence. This is influenced by the level of education, level of knowledge and employment. These factors affect diet adherence in patients with diabetes mellitus in the inpatient hospital Dr. R. Soeharsono Banjarmasin.

While research conducted by Delima (2020) on 67 respondents found that there is a relationship between knowledge and family support in carrying out diabetes diet adherence in patients with diabetes mellitus at the Kendari City Hospital.

Diet adherence in people with diabetes mellitus is very heavy if it is not understood by sufferers and is supported by the family to help prepare the diabetic diet in daily life. People with diabetes also have difficulty in adhering to the diabetic diet in daily life. This is influenced by the age of most sufferers which is more than 50 years in which memory and ability which has been decreased.

## 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1. Conclusion

Adherence to the diet in people with diabetes mellitus is very important to maintain blood sugar levels so that it is always in normal level. If this is not taken seriously, it will lead to various complications. Diet adherence in patients with diabetes mellitus includes lack of knowledge about the diet, lack of family support, and difficulties in adhering to the diet.

### 5.2. Suggestions

Family support is very important in maintaining diet adherence in People with diabetes mellitus, therefore the

family is a caregiver for sufferers who should always be active in maintaining a diet of People with diabetes mellitus sufferers. Providing health education specifically about diets for diabetics is always done to increase knowledge and motivate them to always be obedient in implementing a diabetes diet.

## REFERENCE

- Fauzia, Y., Sari, E., & Artini, B. (2018). Gambaran faktor-faktor yang mempengaruhi kepatuhan diet penderita diabetes mellitus di wilayah puskesmas pakis Surabaya. *Keperawatan*, 4(2).
- Kartini, T. D., Amir, A., & Sabir, M. (2018). Kepatuhan Diet Pasien DM Berdasarkan Tingkat Pengetahuan Dan Dukungan Keluarga di Wilayah Puskesmas Sudiang Raya. *Media Gizi Pangan*, 25(1), 55-63.
- Risnasari, N. (2014). Hubungan Tingkat Kepatuhan Diet Pasien Diabetes Mellitus dengan Munculnya Komplikasi di Puskesmas Pesantren IIKota Kediri. *Efektor*, 01(25), 15–19.
- Lestari, D. D., Winahyu, K. M., & Anwar, S. (2018). Kepatuhan Diet pada Klien Diabetes Melitus Tipe 2 Ditinjau dari Dukungan Keluarga di Puskesmas Cipondoh Tangerang. *Jurnal Ilmiah Keperawatan Indonesia (JIKI)*, 2(1), 83-94.
- Adnyani, I. A. P. S., Widyantari, D. M., & Saputra, K. (2015). Hubungan health locus of control dengan kepatuhan penatalaksanaan diet DM tipe 2 di paguyuban DM puskesmas III Denpasar Utara. *COPING (Community of Publishing in Nursing)*, 3(3).
- Al-zoubi, I. A. (2018). Awareness of Patients with Diabetes Mellitus About Oral and Systemic Complications of Diabetes Mellitus and Their Oral Health Practices in a Saudi Arabian Population. 9(1), 7–10.
- Alkayyali, S., & Lyssenko, V. (2014). Genetics of diabetes complications. *Mammalian Genome*, 25(9–10), 384–400. <https://doi.org/10.1007/s00335-014-9543-x>
- Booth, G. L., & Zinman, B. (2014). Diabetes: Progress in reducing vascular complications of diabetes. *Nature Reviews Endocrinology*, 10(8), 451–453. <https://doi.org/10.1038/nrendo.2014.90>
- Burta, F. S. (2018). Hubungan Pengetahuan Dengan Kepatuhan Diet Pada Pasien Diabetes Mellitus Tipe Ii Di Poliklinik Penyakit Dalam Rsud Dr. Achmad Mochtar Kota Bukittinggi. 15(1), 430–439.
- Dewi, T., & Amir, A. (2018). Kepatuhan Diet Pasien Dm Berdasarkan Tingkat. *Media Gizi Pangan*, 25(1), 55–63.
- Ema Purwanti, L., & Nurhayati, T. (2018). Analisis Faktor Dominan Yang Mempengaruhi Kepatuhan Pasien Dm Tipe 2 Dalam Melakukan Perawatan Kaki. *Journal of Health Sciences*, 10(1), 44–52. <https://doi.org/10.33086/jhs.v10i1.141>
- Rosyada, A., & Trihandini, I. (2013). Determinan of Diabetes Mellitus Chronic Complications on Elderly. *Jurnal Kesehatan Masyarakat Nasional*, 7(9), 395–402. <https://doi.org/10.21109/kesmas.v7i9.11>
- Sugandi, A., N, Y. H., & Bayhakki. (2013). Faktor-faktor yang Mempengaruhi Kepatuhan Diet Diabetes pada Pasien Diabetes Mellitus Tipe 2. *Jurnal Keperawatan Universitas Riau*, 143–152.
- T., S., B., P., P., D., & P.V.M., L. (2019). Levels of compliance of self-care practices of diabetes mellitus type 2 patients: a study from a tertiary care hospital of North India. *International Journal of Diabetes in Developing Countries*, 39(1), 193–200. <https://doi.org/10.1007/s13410-018-0623-4>
- Terapi, O. (2018). Pengaruh Kepatuhan Terhadap Outcome Terapi Pasien Diabetes Mellitus Tipe 2 Dengan Hipertensi *The Effect of Adherence to The Therapeutic Outcome of Patients with Type 2 Diabetes Mellitus with Hypertension Members of Prolanis*. 7(1), 33–38.
- Afiyanti, Yati dan Imami Nur Rachmawati. (2014). *Metodologi Penelitian Kualitatif dalam Riset Keperawatan* Ed. 1. Cet. 2. Rajawali Pers. Jakarta
- Creswell, John W. (2016). *Research Design Pendekatan Metode Kualitatif, Kuantitatif dan Campuran*. Ed.4. Pustaka Pelajar, Yogyakarta
- Manurung, T., Manalu, R. M., & Manurung, Y. (2020). Hubungan Motivasi Dengan Kepatuhan Pelaksanaan Diet Pada Penderita Diabetes Melitus. *Jurnal Keperawatan Priority*, 3(2), 53-61.
- Saputri, R. D. (2020). Komplikasi Sistemik Pada Pasien Diabetes Melitus Tipe 2. *Jurnal Ilmiah Kesehatan Sandi Husada*, 11(1), 230-236.
- Delima, N., Lisnawaty, L., & Fithria, F. (2020). Faktor Yang Berhubungan Dengan Kepatuhan Diet Diabetes Mellitus Pada Pasien Diabetes Mellitus Di Rsud Kota Kendari Tahun 2018. *Jurnal Gizi Dan Kesehatan Indonesia*, 1(1).
- Widyarni, A. (2020). Analisis Faktor Yang Berpengaruh Terhadap Kepatuhan Diet Pada Pasien Diabetes Mellitus Di Ruang Rawat Inap Rumah Sakit Dr. R Soeharsono Banjarmasin. *MPPKI (Media Publikasi Promosi Kesehatan Indonesia): The Indonesian Journal of Health Promotion*, 3(2), 105-112.

# Anti-Cancer Activity of Ants Nest Plant (*Myrmecodia Pendans* Merr. & Perry) on Protein Transduction Signal Resistance Complex CDK-2-Cyclin-E and NF-Kb: Silico Molecular Docking Study

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## ABSTRACT

**Background:** Efforts to inhibit cancer cells' growth in the oral cavity require effective strategies and potential. One of them uses the ant nest plant (*Myrmecodia pendans* Merr & Perry), a natural medicinal plant. It has been empirically and scientifically tested in its potential for antitumor. Herbal cancer treatment has advantages, i.e., minimal side effects than conventional therapies. *Myrmecodia pendans* Merr & Perry is a plant with the content of terpenoid, *procyanidin* B1, *rosmarinic acid*, alkaloid, flavonoid, and tocopherol compounds as anticancer compounds. **Objective:** To examine the anticancer activity of ant nest plants (*Myrmecodia pendans* Merr. & Perry) on the inhibition of signal transduction of the CDK-2-cyclin-E protein complex NF-kB in silico molecular docking'. **Method:** Using the main Auto DockVina application, in the silico molecular docking test. DS Visualizer was used to making and visualizing target proteins and test ligands. The molecular docking results measured root mean square atom position deviation (RMSD) values < 2.00Å. **Results:** The molecular docking test showed that in the ethyl acetate fraction compounds, terpenoid, procyanidin B1, rosmarinic acid, alkaloids, flavonoids, and tocopherols had docking scores with RMSD values < 2.00Å. **Conclusion:** Terpenoids, Procyanidin B1, rosmarinic acid, alkaloids, flavonoids, and tocopherols were active compounds in the M. Pendans fraction of ethyl acetate showing activity against its cancer. Ants Nest (*Myrmecodia pendans* Merr. & Perry) had anticancer activity in the protein complex CDD-2-cyclin-E and signal transduction barrier NF-kB: by the molecular docking test In Silico

**Keywords :** anticancer, in silico, molecular docking, *Myrmecodia Pendans*

## 1. INTRODUCTION

According to the National Center for Health Statistics in 2017, the data on mortality collected were 1.7 million new cancer cases and 600,920 mortalities due to cancer, projected to occur in the United States [1]. The number of new cancer cases globally reaches nearly 12.7 million and is expected to increase to 21.4 million by 2030 [2]. Cancer is a significant public health problem worldwide and is the second leading cause of death in the United States [1]. According to the 2013 Basic Health Research (Risksedas) data, the prevalence of cancer in Indonesia was relatively high, namely 1.4 per 100 population or around 347,000 people [3].

The World Health Organization reports that cancer in the human body is a disease characterized by uncontrolled cell growth, and its development can spread to other organs, which can cause mortality [4]. Invasion, metastasis and therapeutic resistance are important phenomenon in the malignancy and progression of cancer cells. The abnormality of cell cycle regulation and the imbalance between dead cells

and living cells is one of the triggers for the occurrence of malignancy and aggressiveness of cancer cells [5].

Cancer treatment's success is still low, and treatments such as chemotherapy are expensive, so it is necessary to find new anticancer agents by exploring natural medicinal plants. One of them is using ant nest plants (*Myrmecodia Pendans* Merr & Perry), which have antitumor potential tested empirically and scientifically. Ant nest plant or *Myrmecodia Pendans* Merr. & Perry is an epiphytic plant from Papua from hydnohytinae (Rubiaceae), which can be in symbiosis with ants and is said to be epiphytic as it attaches to other plants, but does not live parasitically against its host [6].

*Myrmecophytes* (*Myrmecodia pendans*, literally "ant-plant") originates from the Papua Islands, located in Indonesia's eastern part. This plant can also be found in the Malay Peninsula, the Philippines, Cambodia, Sumatera, Java, Cape York, and the Solomon Islands. *M. pendans* belongs to the Rubiaceae family, which contains five genera, and only two of these genera are associated with ants, *Myrmecodia* (45 species) and *Hydnophytum* (26 species). Out of all these species, only *H. formicarium*, *M. pendans*, and *M. bulbosa* are



frequently used as natural remedies. *M. pendans*, known by the Papuans as a medicinal plant, can be used to treat various diseases, such as cancer, tumors, gout, diarrhea, and fever [7]. Therefore, many studies have been conducted on the use of natural compounds for the prevention of disease.

Ant nest plants contain active compounds of flavonoids, polyphenols, and tannins, which function as antioxidants that can prevent the growth of various types of human cancer cells and effectively suppress carcinogens. Ant nests also contain tocopherol and alpha-tocopherol, substances with high activity that can inhibit free radicals [7]. The content of the metabolite compound *Myrmecodia Pendens* is believed to increase human immunity and can treat various infectious and degenerative diseases [8]. Cytotoxic test results showed that *Myrmecodia* extract was toxic to several cancer cells in humans, including uterine cancer cells (HeLa) and breast cancer cells or MCM-B2 [7], as well as oral carcinoma cells (KB) [9].

*NF-κB* is a transcription factor that controls the expression of genes involved in immune response, apoptosis, and the cell cycle. The high regulation of the *NF-κB* protein can cause inflammation and autoimmunity, viral infections, and cancer [10]. It underlies the *in silico* test using molecular docking to prove the active compounds in the ethyl acetate fraction of *Myrmecodia Pendens* having anti-cancer activity so that further research can be carried out related to the inhibition activity of the protein complex CDK-2-cyclin-E and *NF-κB*.

## 2. METHODS

The optimization structure of the active compound ethyl acetate fraction was as independent variables and the protein structure of the CDK2-Cyclin E and *NF-κB* complex as control variables, while the dependent variable was the docking score.

This study used a computer to download the Autodock Vina application and other supporting applications such as DS Visualizer, AutoDock Tools, Python, YASARA, and Open Babel. Each application had a function in the molecular docking process. The main application used was Autodock Vina. DS Visualizer was used for the preparation and visualization of target proteins and test ligands. Meanwhile, AutodockTools was used to process target proteins and test ligands. AutodockTools could be run by first activating the Python application. The results of the molecular docking were measured by the RMSD value using YASARA. Meanwhile, the application was used to convert the docking results into PDB extensions so that Open Babel could be visualized.

The structure of the VEGF, HER-2, and COX-2 target proteins was downloaded via the Protein Data Bank (PDB) according to PDB ID. The changed structures were structures, ligands, sequences, and active sites. The test ligand structure could be made by describing the nobiletin compound's 2D structure using Marvin Sketch 6.0.0 software. To save the ligand structure in 3D, a .cml to .pdb conversion was performed.

The target protein molecule was opened in the AutoDock Vina application and added with polar hydrogen using the Edit> Hydrogens> Add> Polar Only tool. Then the

structure was converted to a .pdbqt extension. These changes could be done with the Grid tool. The grid size used for the docking process was determined. After the target protein was ready, only ligand files (without protein) were prepared. A selection was then made for the bonds that could be rotated by clicking the Ligan tools> Torsion Tree> Choose Torsion. Just like the target protein, the ligands were stored in .pdbqt extension.

Docking was carried out by opening a command prompt and typing the command `cd Nama_Dir \ Nama_Sub_Dir`. Thus, after a while, the results of the running of the docking appeared in the form of affinity and RMSD values. The results of the docking were observed for the bond interaction with the DS Visualizer application. Files that could be viewed through this application must be in the .pdb extension. They must be converted from .pdbqt to .pdb using Indonesia's Babel application. Furthermore, DS Visualizer could identify ligands and proteins' position and a 3-dimensional (3D) picture of their interactions.

## 3. RESULT AND DISCUSSION

The *in silico* molecular docking test used a cyclin-dependent kinase-2 (CDK-2) complex. The results of docking ligands from the CDK-2 receptor can be seen in Table 1.

Original ligand docking score of the CDK-2 receptor

Compound	Intervention	Protein	RMSD (<2.00 Å)	Docking Score
Native Ligand			0.458	-9.1
Terpenoid			1.190	-7.5
Procyanidin B1	Auto-dock	CDK-2 (Code)	1.556	-7.6
Rosmarinic acid	Vina	Protein: 1PYE)	1.680	-7.6
Alkaloid			1.531	-7.0
Flavonoid			1.108	-7.8
Tocopherol			1.846	-6.3

Based on Table 1, the results of the three ligand tests with CDK-2 protein showed terpenoids (docking score: -7.5), procyanidin B1 (docking score: -7.6), and rosmarinic acid (docking score: -7.6) at the 2nd conformation. The best compound detected was flavonoids as it had a docking score of -7.8 and was the closest to the original ligand docking score (-9.1).

Furthermore, the results of visualization using the DS Visualizer application showed that the ligand docking score of the cyclin-dependent kinase 2 (CDK-2) receptor was -9.1, with a root mean square deviation of atomic position (RMSD) value of 0.458 (<2.00Å) located at the 2nd amino acid conformation. The visualization results showed that the ligands bind to several residues of the target protein, as shown in Figure 1 below.



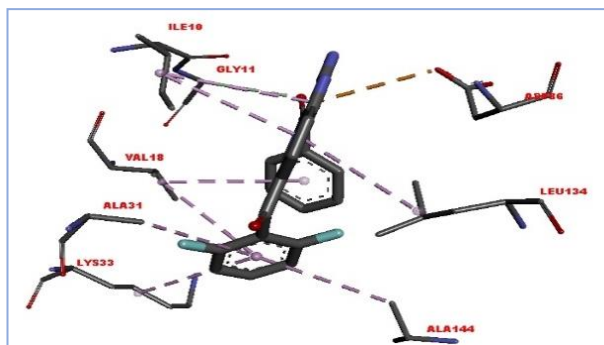


Figure 5. Visualization of the original ligand with the CDK-2 protein

The result of ligand docking from the cyclin-E receptor showed that all active M. Pendens compounds had a docking score with an RMSD value of <2.00Å. The compound that was best detected to have the strongest bond was flavonoids with the smallest docking score of -7.8. Based on these results, it was confirmed that the compounds in the active fraction of M. Pendens had a cell cycle of inhibition effect through the reduction of cyclin-E regulation that can be seen in Table 2 below.

TABLE I. THE ORIGINAL LIGAND DOCKING SCORE OF THE CYCLIN-E RECEPTOR

Compound	Intervention	Protein	RMSD (<2.00 Å)	Docking Score	Conformation of amino acid Amino
Terpenoid			1.088	-7.4	3
Procyanidin B1			1.433	-7.1	3
Rosmarinic acid	Auto-dock Vina	Cyclin E	1.935	-7.4	2
Alkaloid		(Code Protein: 1W98)	1.983	-6.3	6
Flavonoid			1.280	-7.8	3
Tocopherol			1.365	-7.5	6
Terpenoid			1.088	-7.4	3

The original ligand docking results of the NF-κB receptor showed the ligand docking score of the NF-κB receptor was -4.2 with an RMSD value of 1.688 or <2.00Å, located at the 5th conformation. The compounds were best detected in alkaloids and tocopherols as they were closest to the original ligand docking score (-4.2). Based on these results, it was confirmed that the compounds in the active fraction of M. Pendens had a cell cycle of inhibition effect through the reduction of NF-κB regulation, which can be seen in Table 3 below.

The original ligand docking score of the NF-κB receptor

Compound	Intervention	Protein	RMS D (<2.00 Å)	Docking Score
Native Ligand			1.688	-4.2
Terpenoid			1.635	-5.4
Procyanidin B1			1.421	-5.4
Rosmarinic acid	Auto-dock Vina	NF-κB (Code Protein: 1LB5)	1.967	-5.8
Alkaloid			1.537	-5.2
Flavonoid			1.573	-2.9
Native Ligand			1.688	-4.2

Based on the inhibition test study for the complex protein CDK-2-cyclin-E and NF-κB against Burkitt's

lymphoma oral cells treated with the ethyl acetate fraction Myrmecodia Pendens, it showed a decrease in the activity of complex proteins CDK-2-cyclin-E and NF-κB according to increasing concentrations. It suggested that the ethyl acetate fraction of Myrmecodia Pendens was shown to inhibit Burkitt's lymphoma oral cells' growth through the mechanism of signal transduction inhibition of the protein complexes CDK-2-cyclin-E and NF-κB. It is known that the CDK-2 protein inhibition test results in Burkitt's lymphoma oral cells treated with ethyl acetate Myrmecodia Pendens fraction at a concentration of 300 µg / mL showed CDK-2 inhibition of 49%. Meanwhile, the cyclin-E protein inhibition test results in Burkitt's lymphoma oral cells treated with ethyl acetate Myrmecodia Pendens fraction at a concentration of 300 µg / mL showed a cyclin-E inhibition of 54% [11].

The active compound in the ethyl acetate fraction of M. Pendens showed anticancer activity through molecular docking tests. Ethyl acetate fraction from the plant Myrmecodia Pendens was shown to inhibit Burkitt's lymphoma oral cells' growth through the mechanism of signal transduction inhibition of NF-κB and the protein complex CDK-2-cyclin-E. It was reported that NF-κB activation would inhibit apoptosis [12].

When it was activated, NF-κB would suppress apoptosis and disruption of proliferation (Putra, 2011). It is evidenced by the research results on the inhibition of protein NF-κB on Burkitt's lymphoma oral cells treated with ethyl acetate fraction at a concentration of 300 µg / ml showing a protein barrier of 28% [11].

Based on the results of the docking test, it can be seen that all active compounds, including terpenoids, procyanidin B1, rosmarinic acid, alkaloids, flavonoids, and tocopherols in ant nest plants (Myrmecodia Pendens) showed anti-cancer activity. It was proven in the validation process using the AutoDock Vina application that all test compounds had an RMSD value <2.00 Å so that the Molecular Docking process could be carried out.

#### 4. CONCLUSION

Terpenoids, Procyanidin B1, rosmarinic acid, alkaloids, flavonoids, and tocopherols were active compounds in the M. Pendens fraction of ethyl acetate showing activity against its cancer. Ants Nest (Myrmecodia pendans Merr. & Perry) had anticancer activity in the protein complex CDD-2-cyclin-E and signal transduction barrier NF-κB: by the molecular docking test In Silico

#### DECLARATION OF INTEREST

The authors report no conflict of interest

#### REFERENCES

- [1] R.L. Siegel, K.D. Miller, and A. Jemal, "Cancer Statistics", A Cancer J for Clinicians, vol. 67, pp. 7–30, 2017.
- [2] World Health Organization, "Cancer : Fact Sheet", WHO, 2017.
- [3] Riset Kesehatan Dasar (Riskesdas), "Badan Penelitian dan Pengembangan Kesehatan Kementerian RI tahun 2013," 2013.
- [4] World Health Organization (WHO), "The GLOBOCAN Project," *Cancer Fact Sheets*, 2015.



- [5] Supriatno, Harada K, Yoshida H, Sato M. Basic investigation on the development of molecular targeting therapy against cyclin- dependent kinase inhibitor p27Kip1 in head and neck cancer cells. *Int J Oncol* 2005; 27:627-35.
- [6] F. Crisnaningtyas and A.T. Rachmadi, “Pemanfaatan Sarang Semut *Myrmecodia pendens* asal Kalimantan Selatan sebagai Antibakteri, *JRIHH*, vol. 2, 2010.
- [7] A. Soeksmanto, M.A. Soebroto, H. Wijaya, and P. Simanjuntak, “Anticancer activity for extracts of Sarang Semut plant (*Myrmecodia pendens*) to HeLa and MCM-B2 cells,” *Pakistan J Biol Sci*, vol. 13, pp.148-51, 2010.
- [8] Supriatno, “Antitumor Activity of Papua’s *Myrmecodia pendens* in Human OralTongueSquamous Cell Carcinoma Cell Line Through Induction of CyclinDependent Kinase Inhibitor p27Kip1 and Suppression of CyclinE,” *J of Cancer Research and Therapy*, vol. 2, pp. 48-53, 2018.
- [9] S.E. Yuletnawati and Supriatno, “Antitumor Activity Of Chronic Heart Failure Drug Quinolinone Derivate-Vesnarinone On An Oral Malignant Burkitt’s Lymphoma Cell (Study on proliferation, chemotactic migration and cell apoptosis),” *J Int Dent Med Res*, vol. 11, pp. 834-839, 2018.
- [10] Z. Bibi, J. Achmad, A. Ali, A. Siddiqa, S. Shahzad, S. HK. Tareen, H.A. Janjua, and S. Khusro, “On the modeling and analysis of the biological regulatory network of NF- $\kappa$ B activation in HIV-1 infection,” vol. 4, pp. 1-18, 2016.
- [11] A. Medawati, Supriatno, S. Mubarika, and S. Widyarini, “Ethyl Acetate Fraction of Papua Ant Nest Plant (*Myrmecodia pendens* Merr & Perry) Induce Cell Cycle Arrest and Apoptosis of an Oral Malignant Burkitt lymphoma Cell through down Regulationof cyclin-E-CDK-2 Complex Mechanism,” *Indian J of Public Health Research Development*, vol. 11, pp. 884-889, 2020.
- [12] D. Hanahan and R.A. Weinberg, “Hallmarks of cancer: the next generation,” *Cell*, vol.144, pp. 646-74, 2011.

# Black Triangle Treatment with Non Surgeryaesthetic Restoration (Case Report)

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## ABSTRACT

**Introduction:** Black Triangle is a periodontal problem which is very disturbing to esthetics because it disturbs the patient's appearance. In the case of black triangle, the patient's teeth will appear elongated with a large embrassure and often feel sore. The usual treatment is surgery, but often the end result is unsatisfactory because from the aesthetic point of view it is not corrected and the post-surgical healing process is long, and the lack of success in surgical treatment makes the teeth appear elongated with visible embrassure gaps still present. **Purpose:** This case report informs us that the black triangle case was successfully treated by non-surgical aesthetic restoration. **Procedure:** A 22-year-old female patient with complaints of impaired appearance because teeth 43, 42, 41, 31, 32, and 33 have black triangles and often have pain in these areas. Patients object to surgery because they are afraid and do not want repeated visits. The case analysis was carried out, then, the preparation was in the embrassure area. First, color matching with a shade guide, applying PTFE, then applying bonding and drying it moist, then shining with LEDs for 20 seconds. Application of color A2 pacable composite resin and forms all exposed parts of the embrassure. Then do the finishing and polish. **Result:** the open embrassure area is corrected. The patient feels very satisfied. **Conclusion:** black triangle cases can be corrected by non-surgical aesthetic restoration treatment.

**Keywords:** black triangle, non surgery, aesthetic restoration

## 1. INTRODUCTION

Black Triangle is a periodontal problem which disturbs the aesthetics so much that it disturbs the patient's appearance. In the case of black triangle, the patient's teeth will appear elongated with a large embrassure and often feel sore. Loss of the papillae can cause deformities that interfere with esthetics because the teeth appear to appear elongated and phonetic problems because there is a feeling of space allowing air or saliva to interfere with the patient's pronunciation. Often the loss of the papillae is a consequence of periodontal disease due to gingival inflammation, loss of adhesions and high resorption of interproximal bone<sup>1</sup>. Missing papillae can also occur as a result of periodontal surgical therapy, because the soft tissue usually contracts during the healing period<sup>2</sup>. A clinical study shows that the cut interdental papillae do not regenerate fully to their original height and line<sup>3</sup>. Aesthetically, the presence of a gap in the embrasure can affect the patient's smile. In one study<sup>4</sup>, orthodontists rated a 2 mm gap in the gingiva of the embrassure area to be less attractive than a smile with normal gingiva without gaps in the embrassure area. An open embrasure gap greater than 3 mm is considered less attractive by dentists and the general public. Gaps in the embrassure area are visible and don't go unnoticed when people smile. Corrective action must be taken to minimize and correct the condition. Restorative, periodontal, and orthodontic

treatment planning can play an important role in closing the gingival opening<sup>5</sup>. The usual treatment is surgery, but often the end result is unsatisfactory because from the aesthetic point of view it is not corrected and the post-surgical healing process is long, and the lack of success in surgical treatment makes the teeth appear elongated with visible embrassure gaps still present. This case report informs that the black triangle case was successfully treated with one visite non-surgical aesthetic restoration

## 2. CASE REPORT

A 22-year-old female patient who complained of impaired appearance because teeth 43, 42, 41, 31, 32, and 33 had black triangles and often felt pain in these areas (Figure 1). Patients object to surgery because they are afraid and do not want repeated visits. Case analysis is performed and treatment is carried out by performing restoration to correct the black triangle that occurs. Initially, measurements of the vertical direction of the contact point with the sliding calipers were taken. There is a vertical distance under the contact point, namely 3 mm in the mesial embrassure area of teeth 31 and 41, 2 mm in the distal area 31 and mesial 32, and 1.5 mm in the distal area 41 and mesial 42. Next, preparations are carried out with a round bur to roughen it. embrassure area (Figure 2). At first, the color was matched with a shade guide and the color matched, A2 according to the color of the natural teeth. After the preparation is complete, PTFE is used

as a matrix and helps form the embrassure area (Figure 3), then applies the 7th generation bonding and is moisturized, then illuminated with an LED for 20 seconds. Application of a pacable composite resin and forming all exposed parts of the embrassure (Figure 4). After that, finishing (Figures 5 and 6) and polishing (Figure 7) were carried out after PTFE was removed from the tooth surface. The final result shows the open embrassure area corrected (Figure 8). The patient feels very satisfied. Control results 1 week later there were no complaints, gingiva looked normal and the patient was very satisfied.



Fig 1. Black triangle Anterior Mandibular



Fig 2. Preparation



Fig 3. PTFE and bonding



Fig 4. Composite Application



Fig 5. Finishing



Fig 6. Labial finishing



Fig 7. Polishing



Fig 8. Black triangle was corrected

### 3. DISCUSSION

In this case it is included in class 3 with details of size, namely there is a vertical distance below the point of contact is 3 mm in the mesial area of teeth 31 and 41, a vertical distance of 2 mm in the distal area 31 and mesial 32, a vertical distance of 1.5 mm in the distal area 41 and mesial 42. After treatment, it can be seen that the distance is corrected. Classification according to Nordland and Tarnow<sup>6</sup>, which is based on 3 anatomical signs, namely the interdental contact point, the most coronal point of the cemento-enamel junction (CEJ) on the interproximal surface, and the most apical point of the CEJ on the labial surface. There are 4 classes in this classification, namely:

a. Normal, that is, the interdental papillae fill the entire interdental space to the apical part of the interdental contact point

b. Class 1, ie the tip of the interdental papillae lies between the interdental contact point and the most coronal part of the CEJ on the surface. Interproximal.

c. Class 2, ie the tip of the interdental papillae lies between the most coronal part of the CEJ on the interproximal surface and the most apical part of the CEJ on the labial surface.

d. Class 3, ie the tip of the interdental papillae is at the CEJ or more apical than the most apical part of the CEJ on the labial surface. In addition, if there is a black triangle case with a vertical distance of 2 mm below the point of contact, it is classified as class 1-2.

There are several considerations in planning restorative treatment for papillae that are wide open. Mesiocervical and distocervical restorations will improve appearance by changing the shape of the crown. Composite resin can be inserted into the gingival sulcus to guide tooth formation in the embrassure area. Restoration should not affect the interdental tissue as this will irritate the gingiva and create retention for plaque. Restorative treatment alone is used to reduce the space in the large embrassure area. A combination of orthodontic and restorative treatment may be required. Restorative treatment requires maintaining a proper crown height ratio between the connector and the central incisors. The connector is where the teeth appear for contact, the point of contact is where the teeth actually connect. The maxillary anterior connector has a proportional relationship with the height of the central incisors. The ratio (Figure 9) of joints to the tooth height for central, lateral, and canine were 50, 40, and 30%, respectively<sup>7</sup>. To hide severe tissue damage, it is recommended to use pink porcelain or a removable prosthetic device<sup>8</sup>. A comprehensive understanding of anterior aesthetics is essential in determining the appropriate treatment<sup>9</sup>.

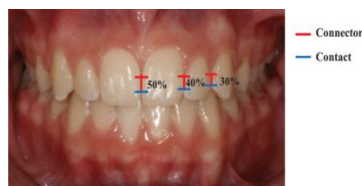


Fig 9: Ratio of connector height to gear height

The choice of restoration material can be combined with a pink resin restoration material to improve aesthetics. Use of pink resin also to form the appearance of the interdental papilla. This condition is more common, especially in adult patients than in young patients<sup>10</sup>. In this case, the addition of pink color was not carried out for the composite resin because by restoring the formation of embrasure areas 32 and 41, 41 and 42 and 31 and 32 it was possible to correct the black triangle area that occurred. The use of direct composite resin has the advantage of being cost effective when compared to veneer. Long-term satisfaction (5 years) with composite restoration has been reported<sup>6</sup>. In addition, both pink and white composite materials have been shown to have the same bond strength<sup>11</sup>. The use of composite resin is more aesthetic and can be used to correct the anatomical shape and color of the teeth so that they resemble natural teeth. In direct restoration treatment with composite resin, the treatment procedure should be discussed with the patient and careful when working out, as this is very important for the long-term success of the restoration<sup>12</sup>.

#### 4. CONCLUSION

Black triangle cases can be corrected with one-visit restorative measures so that the esthetic problems complained by patients can be corrected and the patient is very satisfied with the results of the treatment. There needs to be a case analysis beforehand so that it can support the success of treatment.

#### REFERENCE

1. Montevocchi M, Checchi V, Laura Piana L, Checchi L. Variables Affecting the Gingival Embrasure

Space in Aesthetically Important Regions: Differences between Central and Lateral Papillae. *The Open Dentistry Journal*, 2011, 5, 126-135.

2. Wu YJ, Tu YK, Huang SM, Chan CP. The influence of the distance from the contact point to the crest of bone on the presence of the interproximal dental papilla. *Chang Gung Med J*. 2003;26(11):822-828.
3. Holmes CH. Morphology of the interdental papillae. *J Periodontol*. 1965;36(6):455-460.
4. Kokich V, Kiyak A, Shapiro P. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 2005;1:311-24.
5. Sharma A A, park J H. Esthetic Considerations in Interdental Papilla: Remediation and Regeneration. *Jerd. Journal Compilation* © 2010, Wiley Periodicals, Inc. Volume 22, Number 1, 2010
6. Zorba Y.O., Bayindir Y.Z., Barutcugil C. Cagatay barutcugil. Direct laminate veneers with resin composites: two case reports with five-year follow-ups. *J. Contemp. Dent. Pract.* 2010;11(4):1-7.
7. Raj V, Heymann H. The apparent contact dimension and covariates among orthodontically treated and nontreated subjects. *J Esthet Restor Dent* 2009; 21:96-112.
8. Tarnow D, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. *J Periodontol* 1992;63:995-6.
9. Kokich V. Esthetics and anterior tooth position: an orthodontic perspective part III: mediolateral relationships. *J Esthet Dent* 1995;5:200-7.
10. Paryag AA, Rafeek RN, Mankee MS, Lowe J. *Clinical, Cosmetic and Investigational Dentistry*. 2016 Apr 18; 8: 63-69
11. An H.S., Park J.M., EJ P. Evaluation of shear bond strengths of gingiva-colored composite resin to porcelain\* metal and zirconia substrates. *J. Adv. Prosthodont*. 2011;3(3):166-171.
12. Coachman C., Calamita M. The reconstruction of pink and white esthetics. *Inter. Dent. SA*. 2010;12(3):88-93

# The Effect of Rosella Flower Tea Solution Onto Discoloration of Plate Heat Cured Acrylic Resin Base

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## ABSTRACT

**Background:** The loss of teeth from one's mouth will increase the need for dentures. The denture base used was heat-cured acrylic resin, in Indonesia. Many natural products are offered to the community where these products have many benefits for the body, one of which is rosella flower tea. Rosella flower tea contains natural dyes, anthocyanins, if consumed regularly it can cause discoloration on the acrylic resin plate. **Aim:** This study was to determine the effect of immersing heat-cured acrylic resin in a solution of rosella flower tea (*Hibiscus sabdariffa L.*) on discoloration. **Material and method:** Experimental study with control group pre-test and post-test design. The samples were heat cured acrylic resin plate with N number was 32 and divided into 2 groups, the control groups and the treatment groups. The control group (16 samples) was immersed in distilled water and the treatment groups (16 samples) was immersed in rosella flower tea solution. First, all of the samples 32 samples were immersed for 7 days, dried and performed color changed measurement, then immersed again for additional 7 days, dried and performed color changed measurement. Color changes were measured using the VITA Easyshade device both before and after 7 and after additional 7 days of immersion. **Results:** The result of the Friedman test showed significant color changes in acrylic resin plates in treatment group, especially on the value of chrome. The result of the Mann Whitney test showed that they were significant differences in the heat acrylic resin plate after immersions in distilled water solution and rosella flower tea for 7 days, and after additional 7 days especially in the chrome. **Conclusions:** Immersing heat cured acrylic plates in rosella flower tea has color changes effect, the longer the immersion time, the greater the potential the color changes

**Keywords:** Heat cured acrylic resin plates, Rosella flower tea, Color changes

## 1. INTRODUCTION

The base material for dentures consists of various materials, but the material commonly used in Indonesia is acrylic resin. The type of acrylic resin that is often used is hot polymerization acrylic resin because it has the advantage of being harmonious with the surrounding tissue so that it meets the aesthetic factor, it can be coated and re-affixed easily, is relatively lighter, the manufacturing and polishing technique is easy, and the price is relatively cheap. While the drawbacks of acrylic resin are that they break easily when they fall on a hard surface or due to material fatigue due to long use and experience a change in color because they can absorb water or liquid, food scraps or chemicals considering that this type of resin also has porosity properties[1][2]

Porosity in acrylic resin results in the absorption of water or liquids (drinks) and foodstuffs and chemicals slowly for a certain period of time, this can affect the color change in acrylic resin due to the entry of food or beverage liquids that have been consumed. This color change in acrylic resin can occur due to the habit of consuming solutions containing dyes. The absorption of the dye into the acrylic resin can affect the color of the denture base. One of the beverage ingredients that can affect color change is tea. [2].

Rosella flower (*Hibiscus sabdariffa L.*) has been used by the global community as a herbal medicine, such as in Sudan and South Africa, Indonesia itself which is a country producing roselle flowers also utilizes the properties of these flowers, where the roselle petals are brewed and consumed as tea. also known as red tea. [3] According to Augustine, anthocyanin-rich rosella extract is an effective antioxidant. Studies have also stated that poly-phenolic acids, flavonoids and anthocyanins found in roselle flowers are powerful antioxidants [4]. According to research by Diansari (2015) states that soaking hot polymerized acrylic resin in roselle flower tea for 1, 3, 5, and 7 days can causes dimensional changes. The duration of soaking is determined by an average person drinking roselle flower tea for 5 minutes three times a day, so the total time to consume rosella flower tea is 15 minutes per day. [5] So that 7 days of immersion is equivalent to 22 months of consumption, and +7 days is equivalent to 44 month of consumption. Because of the differences in the results of previous studies, it is the reason for the researchers to further investigate the effect of immersion of hot polymerized acrylic resin into rosella flower tea solution (*Hibiscus sabdariffa L.*) on color changes.

## 2. MATERIALS

### 2.1. Heat-Cured Acrylic Resin

Acrylic resin is a material that is still used in the field of Dentistry. More than 95% of the denture plates are made of acrylic resin material. [6] Acrylic resin is the result of polymerization of acrylate or methacrylic acid or its derivatives, used for the manufacture of medical prostheses as well as restorations and dental equipment. Polymethyl methacrylate is the basic material for acrylic resin in dentistry which is used as a material for making removable denture bases. Acrylic resin is an ethylene derivative which contains a vinyl group in its structural formula. Based on the reaction setting, acrylic resin is divided into chemically polymerized (self-cured) acrylic resin and heat-cured (heat-cured) acrylic resin. Hot polymerization acrylic resin is one of the denture materials which polymerization process by applying heat. [7]. Today most denture bases are made of heat-cured acrylic resin based on polymethyl methacrylate. This material is packaged in a powder and liquid system. The liquid contains non-polymerized methyl methacrylate and the powder contains the pre-polymerized polymethyl methacrylate resin in the form of small grains. Hot polymerized acrylic resin qualifies as an ideal denture base material, because hot polymerized acrylic resin is non-toxic, does not irritate tissue, has good physical and aesthetic properties, is relatively inexpensive, can be repaired, is easy to manipulate and manufacture. However, the disadvantages are that it breaks easily when it falls on a hard surface or is due to material fatigue due to long use and changes in color after some time being used in the mouth and is also easy to porous and easily absorbs fluids, both water and chemicals [8].

One of the physical properties is porosity caused by the evaporation of unreacted monomers and low primary molecular weight, when the resin temperature reaches or exceeds the boiling point of the acrylic resin material, this results in bubbles that can appear on the surface and / or under the surface of the denture base. Porosity can also come from the incomplete stirring of the powder and liquid components. If the mixing process is not perfect, then during the polymerization process some resin masses will contain more monomers than others, and some parts of the resin mass will contain less monomer. These two things cause the formation of porus. [9] [2]

Acrylic resin material has the property of absorbing water slowly over a period of time. One of the shortcomings of acrylic resin is the diffusion process of liquid into acrylic resin because it not only affects the color stability of acrylic, but also the dynamic and polymeric properties caused by the slow absorption process of liquid over a long period of time. Acrylic resin absorbs relatively little water when placed in an alkaline environment, and vice versa when placed in an acidic environment, acrylic resin absorbs relatively much water. This water absorption ability will usually increase the weight of acrylic by 1.0-2.0% [9] [2]. .

Heat-cured acrylic resin exhibits good color stability. The discoloration of the acrylic plate can be caused by the ability to absorb liquid in the material and the environment

around the denture, so that the absorbed substance can react with the elements in the acrylic resin. Color stability and surface roughness are closely related. This is because surface roughness will affect plaque retention and accumulation of stains in the restoration material. The rougher the surface, the easier it is to accumulate stain and cause discoloration of the restoration material [2]. The discoloration of the acrylic plates is not only caused by immersion in a disinfectant solution, but also by food and beverage consumption factors such as tea, coffee, drinks containing dyes, and fruit juices. [2]. This is due to the accumulation of color pigments on the surface and absorption of the adhesions of the particles. The discoloration of the denture base can be caused by intrinsic factors and extrinsic factors. The intrinsic factor is the chemical change in the material itself, namely the polymerization process that is not perfect, while the extrinsic factor is in the form of an external factor, namely the color change. Extrinsic factors include the habit of consuming beverages such as tea, coffee, wine or other beverages that contain coloring agents. This is due to the accumulation of color pigments on the surface and absorption of the adhesions of the particles[10].

### 2.2. Rosella Flower Tea

Rosella flowers as shown in Figure 1 have both pistils and pollen so they do not need other flowers to reproduce. Rosella (*Hibiscus sabdariffa L.*) can live in areas that have a humid and warm climate in tropical and sub-tropical regions. Rosella has advantages compared to other tropical and subtropical plants, namely that it can withstand very cold weather and can live in rooms that have little lighting but the best growth is obtained in open spaces with sunlight. The most nutritious part of the plant is on the petals. Where is the way to consume it by drinking steeping rosella flowers. [11].



Figure1. Rosella flower

Rosella petals contain several chemical compounds needed by the body, namely carotene, riboflavin, anthocyanins, ascorbic acid, niacin, calcium, iron and vitamin C. The human body needs 22 amino acids. Of these 22, 18 of them are fulfilled from rosella flowers. Rosella flowers are widely used to reduce appetite, respiratory problems caused by flu, and discomfort in the stomach. Rosella is used to treat ulcers and inflammation of the skin, burns, canker sores, and herpes zoster infection. [11] The most dominant secondary metabolic compound in red rosella is the presence of anthocyanins that form flavonoids

that act as antioxidants. Rosella flavonoids consist of flavonos and anthocyanin pigments. Anthocyanin compounds contain delphinidin-3-siloglucoside, delphinidin-3-glucoside, cyanidin-3-siloglucoside, which are a source of natural dyes found in roselle flower petals and in almost all plants that provide strong colored pigments. While the flavonoids contain gosipetin and mucilage (rhamnogalakuronan, arabinogalactants, arabinan). [9] [11].

Anthocyanin compounds are a source of natural dyes found in roselle flower petals and in almost all plants which provide strong colored pigments and when applied in water will cause red, orange, purple, and blue colors. [9] In addition to producing strong color pigments, anthocyanin compounds are also functions as an antioxidant which is believed to cure degenerative diseases. Antioxidants, known as scavengers, are molecules that can react with free radicals and function to neutralize free radicals [12].

**2.3. Discoloration Measurement Tool**

Measurement of color change on heat-cured acrylic resin plates in this study using the VITA Easyshade tool, as can be seen in Figure 2. The VITA Easyshade is the newest spectrophotometer used in clinical use. The spectrophotometer is a digital color measuring instrument. This tool is often used for laboratory and research purposes. Over time, the spectrophotometer was made more compact and lightweight so that it could be used for everyday clinical purposes. The spectrophotometer is a tool that consists of 3 principle elements, namely as a light source, a tool for directing light to objects. A spectrophotometer is a tool that measures light in certain waves. Traditionally, spectrophotometers use a diffraction grating and a Charge Couple Device (CCD) line detector. [13]. The software of this instrument is programmed to provide absolute hue, value, chroma / chrome measurement results according to the Munsell color system. [14]



Figure 2. Vita Easy Shade

**3. METHODS**

The design used was experimental laboratory research. The study was conducted at laboratory room Faculty of Dentistry Prof. Dr. Moestopo (Beragama) in October 2018. 32 samples of heat-cured acrylic resin plates with sample length of 20 mm, width 10 mm, and sample thickness 1 mm. Sampling by simple random sampling.

The work procedure of the research was carried out as follows : (1) Preparing the tools and materials to be used in the study ( 2) Each sample was cleaned with water and dried with a dry tissue (3) Perform measurement with the Vita Easyshade test on each sample (pre-test) (4) The process of making rosella flower tea solution began by provided 7 petals (± 5 grams) of dried flower petals. The roselle petals were infused with 250 ml of boiling water (90°C) for 5 minutes, then the petals were removed and the solution was waited until it reaches room temperature (5) Then it was poured into the 6 ml plastic container that had been provided (6) Prepare distilled water in a measuring cup as much as 6 ml, then put in a plastic container (7) The samples were divided into 2 groups, which were control and treatment group with 16 samples in each group. Control group was immersed in a plastic container filled with aquadest, while treatment group was immersed in a plastic container that contained rosella flower tea which was already in a 6 ml dose (8) Both control and treatment group samples were measured using digital spectrophotometer (VITA Easyshade) (9) Both samples in control and treatment groups were then immersed within 24 hours for 7 days (assumed for 2 year consumption) and then the samples were rinsed with water, dried with tissue paper and the color changes were recorded using a digital spectrophotometer and named as “after 7 days immersion” (10) The second immersion was then performed for additional 7 days (assumed for 4 year consumption) and then the samples were rinsed with water, dried with tissue paper and the color changes were recorded using a digital spectrophotometer and named as “after additional 7 days immersion” (11) Compare color changes in control group and treatment group and performed data processing presentation and analysis.

**4. RESULTS**

The aim of this research is to study and explain the effect of immersion time of rosella flower tea on the changes of color plates of heat cured acrylic resin for 7 days and additional 7 days immersion. This research was carried out in an experimental laboratory using 32 samples of cured acrylic resin plate. First group was immersed distilled water as a control group, while the second group was immersed in rosella flower tea as a treatment group. Each groups contains 16 samples. All of the samples were immersed in distilled water and rosella flower tea for 7 days and additional 7 days immersion time. The results of the study can be seen from the following table.

Table 1. Mean Rank of Value Rosella Flower tea

	Mean rank
Value (L) Rosella tea before immersion	2.44
Value (L) Rosella Tea 7 days after immersion	2.16
Value (L) Rosella Tea after add 7 days immersion	1.41

Table 2. Friedman test

N	16
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Chi-Square	9.700
Df	2
Asymp.Sig.	.0008

Table 1 showed a difference on the value of value before the study, after 7 days of immersion, and after addition 7 days of immersion. This was supported by the results of the Friedman test (table.2) which showed  $p = 0.008$  ( $p < 0.05$ ), which means that there was a statistically significant difference on the value in the acrylic resin plate before the immersion, after 7 days of immersion, and after addition 7 days of immersion rosella flower tea.

Table 3. Mean Rank of Chrome Rosella Flower tea

Mean Rank	
Chrome (C) Rosella tea before immersion	2.88
Chrome (C) Rosella Tea 7 days after immersion	1.97
Chrome (C) Rosella Tea after add 7 days immersion	1.16

Table 4. Friedman test

N	16
Chi-Square	16.484
Df	2
Asymp.Sig.	.0000

Table 3 showed the results of measurements of Chrome that there was a difference in the Chrome values before the study, after 7 days of immersion, and after additional 7 days of immersion. Table 4 also showed the results of the Friedman test which showed the results of  $p = 0.000$  ( $p < 0.05$ ), which means that there was a statistically significant difference in the Chrome value in the acrylic resin plate before the immersion, after 7 days of immersion, and after additional 7 days of immersion rosella flower tea.

Table 5. Mean Rank of Value Aquadest

Mean Rank	
Value (L) Aquadest before immersion	2.25
Value (L) Aquadest 7 days after immersion	2.31
Value (L) Aquadest add 7 days after immersion	1.44

Table 6. Friedman test

N	16
Chi-Square	7.871
Df	2
Asymp.Sig.	.0200

Table 5 showed a difference on the value of value before the immersion, after 7 days of immersion, and after additional 7 days of immersion. In table 6, the Friedman test results showed the results of  $p = 0.020$  ( $p < 0.05$ ), which means that there was a statistically significant difference on the value in the acrylic resin plate before the immersion, after 7 days of immersion, and additional 7 days of immersion with distilled water.

Table 7. Mean Rank of Chrome Aquadest

Mean Rank	
Chrome (C) Aquadest before immersion	2.78
Chrome (C) Aquadest 7 days after immersion	1.41
Chrome (C) Aquadest after add 7 days immersion	1.81

Table 8. Friedman test

N	16
Chi-Square	16.484
Df	2
Asymp.Sig.	.0000

Table 7 showed a difference in the Chrome values before the immersion, after 7 days of immersion, and after additional 7 days of immersion. Table 8 showed the results of the Friedman test  $p = 0.000$  ( $p < 0.05$ ) which means that there is a statistically significant difference in the Chrome value in the acrylic resin plate before the study, after 7 days of immersion, and after additional 7 days of immersion with distilled water.

Table 9. Mann-Whitney result between Aquadest and Rosella Flower tea before immersion

Value (L)		Chrome (C)	
Mann-Whitney U	90.500	Mann-Whitney U	123.500
Wilcoxon W	226.500	Wilcoxon W	259.500
Z	-1.416		
Asymp. Sig. (2-tailed)	.157	Asymp. Sig. (2-tailed)	.865
Exact Sig. [2*(1-tailed Sig.)]	.160	Exact Sig. [2*(1-tailed Sig.)]	.867

Table 9 showed the results of the Mann-Whitney test on the Value (L) and Chrome (C) values on the acrylic resin plate in the control group with distilled water and the treatment group with rosella flower tea before the immersion. The Mann-Whitney test results for the value (L) showed  $p = 0.157$  ( $p > 0.05$ ) and the Mann-Whitney test results for the value (C) showed  $p = 0.865$  ( $p > 0.05$ ). Both of these indicated that there was no statistically significant difference in L and C values between the acrylic resin plate in the aquadest group and the resin plate in the rosella flower tea group before the immersion.

Table 10. Mann-Whitney result between Aquadest and Rosella Flower tea after 7 days of immersion

Value (L)		Chrome (C)	
Mann-Whitney U	122.500	Mann-Whitney U	30.500
Wilcoxon W	258.500	Wilcoxon W	166.500
Z	-207	Z	-3.682
Asymp. Sig. (2-tailed)	.836	Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.838	Exact Sig. [2*(1-tailed Sig.)]	.000

Table 10 showed the results of the Mann-Whitney test on the Value (L) and Chrome (C) values on acrylic resin

plates in the control group with distilled water and the treatment group with rosella flower tea after 7 days of the immersion. The Mann-Whitney test results for the value (L) showed  $p = 0.836$  ( $p > 0.05$ ) and the Mann-Whitney test results for the value (C) showed  $p = 0.00$  ( $p < 0.05$ ). This indicated that there was no statistically significant difference in L value but at C value there was a statistically significant difference between the acrylic resin plate in the aquades group and the resin plate in the rosella flower tea group after additional 7 days of immersion.

Table 11. Mann-Whitney result between Aquadest and Rosella Flower tea after additional 7 days of the immersion

Value (L)		Chrome (C)	
Mann-Whitney U	118.000	Mann-WhitneyU	29.500
Wilcoxon W	254.000	Wilcoxon W	166.500
Z	-377	Z	-3.721
Asymp. Sig. (2-tailed)	.706	Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.724	Exact Sig. [2*(1-tailed Sig.)]	.000

Table 11 showed the results of the Mann-Whitney test on Value (L) and Chrome (C) on acrylic resin plates in the control group with distilled water and the treatment group with rosella flower tea after additional 7 days of the immersion. In the Mann-Whitney test results for the L value showed  $p = 0.706$  ( $p > 0.05$ ) where there was no statistically significant difference in the L value and the Mann-Whitney test results for the Chrome value showed  $p = 0.00$  ( $p < 0.05$ ) this is showed that at the Chrome value there was a statistically significant difference between the acrylic resin plate in the aquades group and the resin plate in the rosella flower tea group after additional 7 days of the immersion

## 5. DISCUSSION

This research was conducted to determine the effect of immersion rosella flower tea on the change in color of the heat cured acrylic resin plates for 7 days and additional 7 day immersion. The study was conducted on 32 samples divided into 2 groups: the control group and the treatment group. The results of this study obtained that average value of value control group was no difference but after soaking were significant differences. The average value of chrome control group was no difference but after soaking were significant differences. Friedman test results showed that rosella flower tea for additional 7 days had more effect on the discoloration of the heat cured acrylic resin plate than immersion for 7 days. This means that the greater the change in the color of the acrylic resin heat cured polymerization heat, the greater the color change of the acrylic resin.

The discoloration of the acrylic resin plate can be caused by two factors, intrinsic and extrinsic. Extrinsicly, these changes can be caused by anthocyanin compounds, found in roselle petals, which contain delphinidin-3-siloglucoside, delphinidin-3-glucoside, and cyanidin-3-siloglucoside, which produce strong pigments, such as red, orange, purple, and blue, when dissolved in water. [9] [11].

Intrinsically, one of the properties of acrylic resins is to absorb water slowly over a certain period of time, with the diffusion absorption mechanism of water molecules according to the diffusion law. The absorption of liquid dyes in acrylic resin is one of the factors causing the discoloration of acrylic resin. [15] Rosella flower tea solution contains several acidic chemical compounds, namely a mixture of citric acid and malic acid, anthocyanin hydroxyflavone and hibiscin, vitamin C and amino acids. [2] According to Anusavice, acrylic resin absorbs relatively more water when placed in an acidic environment.7 this allows the accumulation of more anthocyanin dye absorption into the acrylic resin plate. The physical properties of hot polymerized acrylic resin are porosity. Porosity determines the sticking of the porous color particles. The more porosity, the more accumulation of dyes absorbed through the diffusion process will also increase. The length of contact between the resin material and the colored substance as contained in the roselle flower tea solution can affect the color change, this is because the longer the resin material is soaked, the more major color change that occurs. In addition, color stability and surface roughness are closely related to each other. The rougher the surface, the easier it is to accumulate stain, causing discoloration of the restoration material.[2]

The same result was also obtained by Zulkarnain et al. (2017) which uses 40% rosella flower extract as a natural disinfectant. This study proved that there was a significant color difference in the immersion of hot polymerized acrylic resin in rosella flower extract solution within 61 hours (1 year of use), 122 hours (2 years of use), and 183 hours (3 years of use) with  $p = 0.025$ . ( $p < 0.05$ ) .13 However, the difference from this study was the shape and size of the acrylic resin used, the plate size used by Zulkarnain was cylindrical with a diameter of  $50 \pm 0.1$  mm and a thickness of  $0.5 \pm 0.1$  mm. Whereas in this study an acrylic resin plate was used with a size of 20 x 10 mm and a thickness of 1 mm. According to Anusavice, the color changes that occur in resins can vary, this is due to several factors, including sample size, sample microporosity and duration of contact between materials. The wider the sample size, the greater the physical changes in the material can occur. [2] This study is also in line with the results of the study of Tunggal et al. (2015) who used a roselle denture cleaning paste (2.5%) which was used by 5 denture wearers every day and the changes were calculated every 3rd, 6th, and 9th months. The results showed a change in the color of the acrylic base. statistically significant after using the paste for 6 and 9 months. [18] However, the difference from this study was that this study was conducted in vitro, whereas Tunggal et al. conducted an in vivo study where subjects used acrylic-based dentures and used rosella cleaning paste daily for 9 months. Exposure to roselle dye, anthocyanin, continuously for a long period of time allows this dye to enter the pores created by the micro-porosity nature of acrylic, causing the acrylic plates to turn redder after using the paste every day for 9 months. [18]

Different research results obtained by Thalib et al. (2013) who immersed hot polymerized acrylic resin in roselle petals extract with a concentration of 40% with 6 test



groups, namely: immersion group 5 minutes, 10 minutes, and 15 minutes once a week, and 5 minutes, 10 minutes, and 15 minutes twice a week. Soaking is carried out for 4 weeks. It can be said that the longest immersion time is 15 minutes twice a week for 4 weeks, which is 120 minutes or equal to 2 hours of immersion (15 minutes x 2 x 4), while the immersion in this study was carried out for 24 hours in 7 days and after additional 7 days.

The absence of this significant color change could be due to the not too long contact time so that the natural dyes in the roselle petal extract, namely anthocyanins, have not diffused into acrylic and cause significant color changes in acrylic resin. [19] Diffusion of liquid into acrylic resin is also one of the disadvantages of acrylic resin because the process of slow absorption of liquid over a long period of time not only affects the color stability of the acrylic, but also the mechanical properties and dimensions of the polymer. Rough or porous surfaces can also affect the color stability of the acrylic as this can lead to greater absorption of water and food coloring. Porosity can occur as a result of the evaporation of unreacted monomers and low molecular weight polymers, when the resin temperature reaches or exceeds the boiling point of the material, but this type of porosity does not occur uniformly along the affected resin segments. [2]

## 6. CONCLUSION

Based on the results of research that has been done, it was concluded that there were changes in the color of the heat cured acrylic resin plates after immersing in rosella flower tea solution for 7 days and additional 7 days. The color change after additional 7 day immersion was more significant than 7 day immersion. The longer the immersing time, the greater the potential for color change. Things that can be done to progress this research going forward are conducting research with a larger amount of samples and do a longer immersion time trial in order to get a more accurate final result.

## REFERENCES

- [1] Billmeyer. FW, Textbook of Polimer Science, 3rd Ed. New York: Internasional John Wiley and Sons, 1984, pp. 409–11.
- [2] Anusavice. KJ, Phillips: Science of Dental Materials, 11th Ed, Louis: Elsevier Science, 2003, pp 723, 739-46, 724-30.
- [3] Singh. P, Khan. M, Hailemariam. H, “Nutritional and Health Importance of Hibiscus Sabdariffa: A Review and Indication for Research Needs”, J.Nutr Health Food Eng, 2017, 6(5): pp 125-128 .
- [4] Olusola AO,” Evaluation of the Antioxidant Effects of Hibiscus Sabdariffa Calyx Extracts on 2, 4-Dinitrophenylhydrazine-Induced Oxidative Damage in Rabbits”, Webmed Central Biochemistry,,2011; 2(10):WMC002283 .
- [5] Diansari. V, Fitriyani. S, Gustya AD, “Pengaruh Durasi Perendaman Resin Akrilik Heat-cured Dalam Minuman Teh Rosella (Hibiscus sabdariffa) Terhadap Perubahan Dimensi “, Cakradonya Dent J, 2015, 7(2): pp 807-868 .
- [6] Phillips. RW, Skinner’s Science of Dental Materials, 9th ed. Philadelphia, WB Saunder Co, 1991, pp 199-204.
- [7] Kumar. VM, Bhagath. S, Jei B, ”Historical Interest of Denture Base Material”, SRM University Journal of Dental Sciences, 2010, 1(1): pp 103-5
- [8] Sari. Sawtell. RM, Downes. S, Patel. MP, Clarke. RL, Braden. M. “Heterocyclic Methacrylates for Clinical Applications-Further Studies of Water Sorption”, J Mater Sci Mater Med, 1997, 8(1) pp 667–74.
- [9] Hayati. EK, Budi. US, Hermawan. R, ”Konsentrasi Total Senyawa Antosianin Ekstrak Kelopak Bunga Rosella (Hibiscus sabdariffa L.): Pengaruh Temperatur dan pH”, Jurnal Kimia, 2012, 6(2) pp 138-147.
- [10] Padiyar. N, Kaurani. P, ”Colour Stability: an Important Physical Property of Esthetic Restorative Materials, IJCDS, 2010; 1(1) pp 81-4.
- [11] Direktorat OAI BPOM RI, Serial Data Ilmiah Terkini Tumbuhan Obat: Rosela (Hibiscus sabdariffa L.), Jakarta, Badan POM RI. 2010, pp 1-4, 10
- [12] Marx. J.L, “Oxygen Free Radicals Linked to Many Disease”, Science, 1985, 235 pp 529-531
- [13] Corciolani. G, “A Study of dental Color Matching, Color Selection and Color Reproduction” [Thesis], Siena, 2009 pp 8-13.
- [14] Anonimus, *Defining Color Systems for Precise Color Validation*. Munsell Color. Michigan: X-Rite World Headquarters, 2007. [https://www.pantone.com/downloads/articles/pdfs/L10\\_315\\_Defining\\_Color\\_Munsell\\_en.pdf](https://www.pantone.com/downloads/articles/pdfs/L10_315_Defining_Color_Munsell_en.pdf), diakses tanggal 27 September 2018
- [15] Maryani. H, Kristiana. L, Khasiat dan Manfaat Rosella, Jakarta, PT Agromedia Pustaka, 2008, pp 1–9, 23–34.
- [16] Lestari. WA, Pengaruh Lama Perendaman Plat Gigitiruan Akrilik dalam Ekstrak Bunga Rosella Terhadap Kekuatan Transversal Plat Gigitiruan [Skripsi], Makassar, PPDGS Prostdonsia FKG Unhas, 2013 pp 47
- [17] Zulkarnain. M, Angelyna. P, ”The Effect of Immersed Heat Cured Acrylic Resin Denture Base in Chlorhexidin and Extract of Roselle Flower towards Color Stability”, Advances in Health Science Research, 2018, 8 pp 177-179
- [18] Tunggal. EG, Dharmautama. M, Jubhari. EH, “Perubahan Warna Basis Akrilik setelah Penggunaan Pasta Pembersih Gigi Tiruan Rosella (The Changes of Acrylic Base Color after Using Roselle Pasta Denture Cleanser)”, Dentofasial, 2015, 14(1), pp 25-28.
- [19] Thalib. B, “Warna Plat Resin Akrilik Setelah Direndam Dengan Ekstrak Bunga Rosella (Hibiscus Sabdariffa Linn) Sebagai Pembersih Gigi Tiruan”, Prosiding: Bridging Sciences in Stomatognathic System, Surabaya, FKG Universitas Airlangga, 2013 pp 77-84 .