Effectiveness of Avocado for Chronic Energy Deficiency in Pregnancy in The District of Aceh Besar, Indonesia: A Pilot Study

Juliastuti Juliastuti, Satrinawati Berkat

Department of Midwifery, Poltekkes Kemenkes Aceh, Aceh Besar, Aceh Province, Indonesia
Corresponding Author: Juliastuti Juliastuti, Email:Juliastuti74@yahoo.com

KEYWORDS
Avocado, chronic energy deficiency, pregnancy.

ABSTRACT
Malnutrition in pregnant women is one of the critical health problems because it impacts the survival of the mother and the fetus. The most common problems in Indonesia are anemia and chronic energy deficiency (CED). The chronic lack of energy intake is indicated by the size of the maternal mid-upper upper arm circumference (MUAC), which is less than 23.5 cm. The prevalence of CED in pregnancy in Indonesia was 36,8%.
This study aimed to assess the benefits of avocado on increasing mid-upper upper arm circumference (MUAC) in pregnant women with chronic energy deficiency (CED). The study design was quasi-experimental with the non-equivalent control group. The study site was four sub-districts in the District of Aceh Besar, Indonesia. The population was all CED in pregnancy in the district of Aceh Besar in 2022. The total sample was 32 pregnant women with CED (16 in the intervention group and 16 in the control group). The pregnant women in the intervention group were given avocado juice every day for 60 days. Meanwhile, in the control group, no treatment was given. The results of the Independent T-test analysis showed that the average increase of MUAC for women in the intervention was 2 cm. Meanwhile, the control group was 1.3 cm. There was a significant difference in increasing the MUAC between the intervention and control groups (P-Value: 0.000). This study indicates that consuming avocado juice every day for two months can increase the MUAC of pregnant women.

1. Introduction

In 2020, approximately 800 women died from preventable causes related to pregnancy and childbirth each day. Maternal death occurred almost every two minutes. (World Health Organization & United Nations Children's Fund, United nation for Fund, 2023). The global maternal mortality ratio (MMR) in 2020 was 223 per 100,000 live births. (UNICEF, 2023). Around 95% of all maternal deaths occurred in low and lower-middle-income countries, and most could have been prevented. Based on region, Sub-Saharan Africa accounted for around 70% of maternal deaths, while Southern Asia around 16% (World Health Organization & United Nations Children's Fund, United nation for Fund, 2023).

Those women die due to complications during and following pregnancy and childbirth. Most of the complications, almost 75% of all maternal deaths, were severe bleeding, infections, high blood pressure during pregnancy (pre-eclampsia and eclampsia), complications from delivery, and unsafe abortion(World Health Organization & United Nations Children's Fund, United nation for Fund, 2023). Some other complications occur before pregnancy but worsen during pregnancy, especially for women who do not receive adequate health care. Complications of pregnancy will harm the mother and harm the fetus. Some complications of pregnancy include anemia, urinary tract infection, hypertension, diabetes mellitus, obesity, infection, hyperemia, and malnutrition problems (Centers for Disease Control and Prevention, 2022).

The problem of malnutrition in pregnant women is one of the critical health problems because it impacts the survival of the mother and the fetus. Problems with malnutrition are anemia and chronic energy deficiency (CED) in pregnant women (Kementerian Kesehatan RI, 2015b). The CED in pregnant women is a chronic lack of energy intake indicated by the size of the maternal mid-upper upper arm circumference (MUAC) less than 23.5 cm (Kementerian Kesehatan RI, 2015a). Pregnant women with CED will be at risk of decreasing muscle strength, which helps the delivery process. It can lead to prolonged labor and postpartum bleeding (Kementerian Kesehatan RI, 2015b), anemia (Helliyana et al., 2019), preeclampsia (Angraini et al., 2020) and even maternal death (Kementerian Kesehatan RI, 2015b). The risk to the baby can result in fetal death (miscarriage), premature birth, birth defects, low birth weight (LBW), and impaired growth and development (Kementerian Kesehatan RI, 2015b) (Restu[a] et al., 2017) (Ekowati et al., 2017)(Kulasekaran, 2012).

Based on Indonesian Basic Health Research 2018 conducted by the Indonesia Ministry of Health (MOH)

throughout Indonesia, the prevalence of CED in pregnancy in Indonesia was 36.8% (Balitbangkes, 2018), an increase from 24.2% in 2013(Departemen Kesehatan Republik Indonesia, 2013). The authors did not find data on CED's prevalence worldwide for comparison. Many factors cause the CED in pregnancy, including occupation, food intake, education level, knowledge, family income, age, parity, utilization of ANC services, and culture (Departemen Kesehatan Republik Indonesia, 2013)(Purwanto et al., 2020)(Rachmawati et al., 2019)(Stallaza Alifka et al., 2020)(Novelia et al., 2021). In addition, there are indirect factors that trigger CED in pregnancy, including political crisis, economic crisis, war, insufficient food supply, lack of hygiene and sanitation, and inadequate health services (Centers for Disease Control and Prevention, 2022).

Management of CED in pregnancy is different in each country. In Indonesia, with a high number of CED patients, the intervention carried out by health workers based on standard operating procedures (SOP) for CED in pregnancy provides nutritional counseling and distribution of supplementary feeding. According to the SOP, every CED during pregnancy receives supplementary feeding of 500-800 kcal of energy per day. The form of supplementary feeding is biscuits, milk, and nutritious drinks. The supplemental feeding was distributed by the Indonesia Ministry of Health (Jakarta), and the pregnant women accepted the packet for consumption for 3-4 months (depending on the stock). Due to the supply of goods being carried out from Jakarta (the capital city of Indonesia) and distributed throughout Indonesia (Indonesia is the largest archipelagic country in the world and is very wide), the distribution of these supplementary foods is often late. Many CED women don't get it, or get it only for a month. All of those supplement foods are packaged food, not fresh food. The reason it is durable is that it can be consumed for months.

Interventions by local government to CED in pregnancy are very limited, depending on the availability of funds. Usually, the health workers will distribute sugar and green beans to the mother in limited quantities. Meanwhile, fresh and local food has not become a priority for the CED management program for pregnant women in Indonesia. Although this local food is more accessible, the nutritional value is higher. According to local potential and wisdom, local food is consumed by local people (Sekretariat Negara, 2012). Local food can be in the form of vegetables, fish, fruits, etc. One local fruit that contains high nutritional value is avocado (Avocado). Avocado contains nutrients needed by the body, including energy, carbohydrates, fats, various vitamins, and minerals (United States Department of Agriculture Research (USDA), 2012). Several previous studies concluded that avocado is one of the recommended fruits for consumption by pregnant women every day because of its high nutrition and other substances needed by pregnant women (Comerford et al., 2016b).

According to Indonesia Basic Health Research 2018, the prevalence of CED in pregnancy in Aceh Province was 11.27%, and in the district of Aceh Besar, the location of this research was 14.56% (Badan Penelitian dan Pengembangan Kesehatan, 2019). The number of pregnant women in the district of Aceh Besar in 2020 was 11,428 (Dinas Kesehatan Kabupaten Aceh Besar, 2020b), and in 2021, there were 10,526 (Dinas Kesehatan kabupaten Aceh Besar, 2021)(Dinas Kesehatan Kabupaten Aceh Besar, 2020a). Assuming the prevalence of CED in pregnancy was 14.56%, the number of pregnant women with CED in the district of Aceh Besar in 2020 was 1,631, and in 2021 was 1,533.

Given the high incidence, prompt and appropriate intervention is needed to treat CED in pregnancy. Changes must be made; interventions not only depend on additional food imported from Jakarta or waiting for budget availability, but community empowerment to overcome their problems must be done by using available local foods, including avocado, which is cheap and very nutritious. Although this fruit is easy to find and affordable (USD 1- 1.5/kg), it is not widely consumed by pregnant women. It is necessary to study the benefits of avocado for CED in pregnancy.

This study aimed to assess the benefits of avocado on increasing mid-upper upper arm circumference (MUAC) in pregnant women with CED. The hypothesis in this study is that there was a difference in the increase in MUAC of pregnant women with CED between those who consume avocados every day and those who do not consume avocados every day. This research was a pilot study because it was only conducted with a small sample size and limited references from the previous study. The results of this study will determine for further research.

2. Materials and Methods

2.1 Study design

The study design was quasi-experimental with a non-equivalent control group. The output that was observed was the changes in MUAC of pregnant women within two months between those who consumed avocado every

day and those who did not. The study was conducted from May to October 2022.

2.2. Study sites

The study site was in the district of Aceh Besar (one of 23 districts in Aceh Province, Indonesia). Four subdistricts were the study sites: Baitussalam, Darussalam, Kutabaro, and Darul Kamal.

2.3 Population and Sample

The population in this study was all CED in pregnancy in the district of Aceh Besar in 2022. Non-probability sampling with quota sampling was used for technical sampling. The total sample was 32 pregnant women with CED, with the following details: 16 pregnant women who received the intervention and 16 pregnant women who did not receive the intervention or as controls.

2.4. Inclusion and exclusion criteria

Inclusion criteria for the sample were: gestational age > 8 weeks, single pregnant, and no history of tuberculosis, malaria, hepatitis, and other infectious diseases. Exclusion criteria: CED pregnant women with hyperemesis and allergic to avocado.

2.5. Procedure of data collection

After determining the sample, 16 people in the intervention group and 16 people in the control group (without any intervention) were divided into two groups. Furthermore, pregnant women in the intervention group were given daily avocado juice for 60 days. Avocado juice made by the research team was then delivered to the subject's house every morning to be drunk by the mother. The first measurement of MUAC was carried out before the start of the intervention, and the second measurement after the intervention (60 days later). In the control group, the first measurement of MUAC was carried out on the day when the interview and the mother agreed to participate in the study, and the second measurement was 60 days later.

The composition of each serving of avocado juice was 200 grams of avocado (320 calories), added two teaspoons of white sugar (32 calories), mineral water, and blended, then put in a bottle. The bottle containing the juice was delivered to the subject's house every morning to be drunk by CED's mother for 60 days

2.6. Statistical Analysis

To answer the research hypotheses, univariate and bivariate analyses were carried out. The independent T-test was used in bivariate analysis.

3. Result and Discussion

3.1. Results

Univariate Analysis

The univariate analysis is divided into two parts: the subject's characteristics and the husband's characteristics. In the characteristic of the subject, most of them lived in subdistrict Baitussalam; 9 people or 28.2%. Most subjects were between 20-35 years old (29 people or 90.6%). Most subjects were high school graduates (11 people or 34.3%). Most subjects are housewives, namely 19 subjects or 59.4%.

In the obstetric history, most subjects were pregnant in the second trimester; 17 people or 53.1%. Most subjects were first pregnant, 17 people or 53.1%. In the history of childbirth, most of the subjects were never given birth (18 people or 56.3%). Table 1 shows the characteristics of the subject.

Tab.1. Characteristic of subject

Characteristic of subject	Intervention group (16)		Control Group (16)		Total (32)	
	n	%	n	%	n	%
Subdistrict						
- Baitussalam	9	56.0	0	0.0	9	28.2
- Darussalam	7	44.0	0	0.0	7	21.8
- Kutabaro	0	0.0	8	50.0	8	25.0
- Darul Kamal	0	0.0	8	50.0	8	25.0
Total	16	100.0	16	100.0	32	100.0

Age							
-	< 20 years old	1	6.3	0	0.0	1	3.1
-	20-35 years old	13	81.2	16	100.0	29	90.6
-	>35 years old	2	12.5	0	0.0	2	6.3
Total		16	100.0	16	100.0	32	100.0
Level of education							
-	Degree	2	12.5	1	6.3	3	9.4
-	Diploma	2	12.5	2	12.5	4	12.5
-	High School	3	18.7	8	50.0	11	34.3
-	Junior High School	5	31.3	5	31.2	10	31.3
-	Elementary School	4	25.0	0	0.0	4	12.5
Total		16	100.0	16	100.0	32	100.0
Occupation							
-	Government/private company	2	12.5	1	6.3	3	9.4
-	Freelance/Trader	2	12.5	1	6.3	3	9.4
-	Farmer	1	6.3	3	18.7	4	12.5
-	Labor	3	18.8	0	0.0	3	9.4
-	Housewife	8	50.0	11	68.8	19	59.4
Total		16	100.0	16	100.0	32	100.0
Gestational age							
-	First Trimester	7	43.8	4	25.0	11	34.4
-	Second Trimester	7	43.8	10	62.6	17	53.1
-	Third Trimester	2	12.4	2	12.4	4	12.5
Total		16	100.0	16	100.0	32	100.0
Gravida							
-	I	7	43.8	10	62.5	17	53.1
-	II-IV	6	37.5	4	25.0	10	31.3
-	≥ V	3	18.8	2	12.5	5	15.6
Total		16	100.0	16	100.0	32	100.0
Parity							
-	0	7	43.8	11	68.7	18	56.3
-	1-3	8	50.0	4	25.0	12	37.5
-	≥ 4	1	6.3	1	6.3	2	6.2
Total		16	100.0	16	100.0	32	100.0

Source: Authors

In terms of husband characteristics, most husbands were between 26 and 50 years old (25 people or 78.1%). Generally, they were high school graduates (13 people or 40.6%). Most of the husbands of the research subjects work as farmers/fishers or laborers (13 people or 40.6%). The median family income per month is USD 140, and the general family income is above the median (24 families or 75%).

Tab. 2. Characteristic of the husband of the subject

Characteristic of husband		Intervention Group (16)		Control Group (16)		Total (32)	
		n	%	n	%	n	%
Age							
-	≤ 25 years old	4	25.0	3	18.8	7	21.9
-	26- 50 years old	12	75.0	13	81.2	25	78.1
-	> 50 years old	0	0.0	0	0.0	0	0.0
Total		16	100.0	16	100.0	32	100.0
Level of education							
-	Master	1	6.3	0	0.0	1	3.1
-	Degree	1	6.3	2	12.5	3	9.4
-	Diploma	3	18.8	2	12.5	5	15.6
-	High School	6	37.5	7	43.8	13	40.6
-	Junior High School	3	18.8	2	12.5	5	15.6
-	Elementary School	2	12.5	3	18.8	5	15.6
Total		16	100.0	16	100.0	32	100.0
Occupation							
-Government/Private employed		2	12.5	0	0.0	2	6.3
-	Private company employed	0	0.0	3	18.8	3	9.4
-	Farmer/Labor/Fisherman	9	56.3	4	25.0	13	40.6
-	Trader/Independent work	2	12.5	0	0.0	2	6.3
-	Freelance	3	18.8	9	56.3	12	37.5
Total		16	100.0	16	100.0	32	100.0
Family Income (Median: USD 140/per month)							
-	Above Median	11	68.8	13	81.3	24	75.0
-	Under Median	5	31.2	3	18.7	8	25.0
Total		16	100.0	16	100.	32	100.0

Source: Authors

Bivariate Analysis

The results of the Independent T-test analysis showed that the average increase of MUAC for women in the intervention group who consumed avocado regularly for 60 days was 2 cm with a standard deviation of 0.3 cm. Meanwhile, the average increase of MUAC in the control group who did not consume avocado was 1.3 cm for 60 days, with a standard deviation of 0.6 cm. The results of the Levine test to analyze the homogeneity of variance of the two groups showed a value of 0.045 (P:<0.05), and the equal variance not assumed value was 0.000. The conclusion was that at 5% alpha, there was a difference in variance in the two groups. There was a significant difference in increasing the MUAC between the intervention and control groups (P-Value: 0.000).

Tab. 3. The Result of T-Test: The Average Increasing MUAC For Two Months

Group	Mean	SD	SE	P-value	n
Intervention	2.088	0,27	0,07	0.00*	16
Control	1,356	0,63	0,16		16

Significant variable: $p < 0.05$* (source: Authors)

3.2. Discussion

This study indicates that consuming avocado juice every day for two months can increase the MUAC of pregnant women. The authors did not find any previous research related to avocados and CED in pregnancy, but several studies examine the benefits of consuming avocados during pregnancy, including a study conducted in Bekasi in 2022 that concluded that routinely consuming avocados can increase the weight of pregnant women (Nursila & Maryati Sutarno, 2023).The other study concluded that consuming avocado and honey increased the hemoglobin level in the third trimester of pregnancy (Bunga Tiara Carolin, 2023).

The authors also found many articles about the benefits of avocados for pregnancy.(Comerford et al., 2016b) (The American College of Obstetrician and Gynocologist, 2022) (Christian et al., 2015)(U.S Department of Health and Human Services, 2015)(Comerford et al., 2016a), but there are no articles that specifically discuss the benefits of avocado for pregnant women with CED. This study can be essential for further research for a larger sample and broader location.

4. Conclusions

This study showed a strong association between the consumption of avocado juice daily and an increase in MUAC (P value: 0.00). Thus, it indicates that avocado juice can increase the MUAC of pregnant women. If this research is developed further and the results are utilized by the Indonesian government for health policies, it will have implications for improving maternal and child health, as well as reducing maternal and child mortality rates in the future.

CONFLICT OF INTEREST

The authors state no conflict of interest.

AUTHORS CONTRIBUTION

Study design, collecting data, analyzing data, preparing for manuscript: SB. Administrative of study & collecting data: FF

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INFORMED CONSENT

Informed consent has been obtained from all individuals included in this study—ethical approval for this study from the Health Research Ethics Committee of Health Polytechnic of Aceh.

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