



## Anchovy Fish as a Source of Calcium in Blood Pressure Change during Pregnancy (In Vitro Study with Rats)

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### Abstract

**Background:** Hypertension in pregnant women may be caused by lack of calcium. Changes in calcium metabolism have contributed to changes in cardiac output and blood pressure. High calcium was suggested in anchovies (*Stolephorus sp.*).

**The Objective:** The purpose of this study was to know the effect of anchovies in the blood pressure of pregnant women, where this research using in vitro study with pregnant rats (*Rattus norvegicus*).

**Method:** This study was laboratory experimental design with pre- and post-control group that divided into 4 groups items, namely pregnant mice without administration of calcium synthetic, pregnant rats given the drug calcium synthetic with a dose of 15 mg / g, pregnant rats fed extracts calcium anchovies 15 mg / g / body weight and pregnant rats were given fish anchovies 1.5 gram/g body weight

Pregnant rat blood pressure measurements performed at 0 and 21 days of pregnancy. Measurements of blood pressure performed on day 21 before laparotomy.

**Result:** The results showed an increase in systolic blood pressure in the final trimester of pregnancy on the 21<sup>st</sup> day with significant differences. However, there are no changes in blood pressure diastole in early pregnancy and the last quarter of pregnancy. Diastolic blood pressure values in all treatment groups had the same average.

**Conclusion:** It is concluded that there is a significant effect of calcium intake on the systolic blood pressure during pregnancy. However, further study is necessary to reveal the impact to human.

**Keywords:** anchovies, pregnant, blood pressure, calcium.

### Introduction

Hypertension in pregnant women may be caused by nutritional intake of pregnant women are less precise. Physiological changes occur in pregnancy, which increases metabolic needs. Therefore the supply of nutrients and oxygen are used to meet the needs of the mother and fetus.

One change in metabolism is of calcium metabolism contributing to changes in cardiac output, blood pressure and bone metabolism (Rakhsanda et al.,).

Low calcium intake in pregnant women will cause a decrease in intracellular calcium. The reduction of intracellular calcium will impact on the

endothelial function of blood vessels disorders such as vascular, causing preeclampsia and risk for hypertension (Cunningham et al, 2001). To avoid this, the fulfillment of calcium improved with the addition of external calcium intake during pregnancy is recommended.

Calcium intake from outside is given in the form of synthetic calcium tablets. However, artificial calcium can provide mild side effects such as dizziness, constipation, laxatives, nausea, vomiting, abdominal pain and anorexia. Effects of nausea and vomiting from calcium tablets will exacerbate nausea and vomiting that is something reasonable for pregnant women. This will lead to reduced maternal nutritional intake and decrease appetite.

Currently being suggested is to use natural materials as meeting the needs of mineral and medicines, especially for pregnant women to avoid the side effects of synthetic drugs, one of which is the use of maritime resources like anchovies. This is due to all parts of the anchovy can be consumed including bone and head as the calcium content of the anchovy accumulated in the skull and bones (Zapata et al., 2004). However, studies on anchovy still not been explored much, especially the effect of the intake of anchovy as a source of calcium on blood pressure. The purpose of this study was to determine the impact of the consumption of anchovy as a source of calcium naturally in the blood pressure of pregnant women, where this research using in vitro tests with experimental animals pregnant rats (*Rattusnorvegicus*).

## Methods

This research is an experimental research laboratory with the design of pre- and post-control

group. This study used rats (*Rattusnorvegicus*) Wistar strain. Animals must meet the criteria of research objects are female, healthy, 300-400 g. Also, the research requires male rats, while the male mice are proper criteria and weighing more than 500 g. This study using 20 rats were divided into 4 groups, namely pregnant mice without drug administration calcium synthetic, pregnant rats were given the drug calcium synthetic with a dose of 15 mg / g /Body weight, pregnant rats were fed extracts calcium anchovy 15 mg / g/ body weight and pregnant mice were given 1.5 grams anchovy / gram / body weight.

Feeding of anchovy in experimental animals adapted to the consumption of anchovy in humans. Anchovy human consumption is as much as 2 oz per day or 57.12 grams (Mullins, 2011). Drug dose of calcium for pregnant women is 400 mg to 2000 mg. This amount is converted for administration in obtaining prescription for rats = 7.2 to 36 mg / g/ body weight. Measurement of blood pressure in pregnant rats made 0 and 21 days. Blood pressure measurements on day 21 were done before laparotomy. Measurement of blood pressure used a special blood pressure test for animals (Biopac MP150 system). In the measurement of blood pressure, the systolic and diastolic blood pressure is observed.

Paired t-test with the significance of 95% ( $\alpha = 0.05$ ) was performed to see any differences before and after the administration.

## Result

The results of research on the effect of the intake of anchovy as a source of calcium are shown in the following tables.

**Table 1.** Average Blood Pressure (mmHg)

	Systolic pressure		Diastolic pressure	
	Day 0	Day 21	Day 0	Day 21
Without calcium drug synthetic	123	147.5	89.5	89.75
Drugs synthetic calcium 15 mg / g /BW	122.75	132.5	88	88.25
Anchovy extract calcium 15 mg / g /BW	122.75	135.75	88	88.5
Provision of anchovy 1.5 gram/gram /BW	124.5	133.5	87	88

The table shows that there is an increase in systolic blood pressure in the final trimester of pregnancy in day 21. The highest increase in systolic blood pressure is in group therapy pregnancy without calcium. Table 1 shows that there is no change in diastole blood pressure since the beginning of the last trimester of pregnancy.

Results of analysis of variance showed that there were differences in average systolic blood pressure were significantly in the treatment group on blood pressure measurement day 21 ( $p \leq 0.05$ ), while the average diastolic blood pressure was no significant difference ( $p \geq 0.05$ ) as shown in Table 2 and 3.

**Table 2.** ANOVA average on systolic blood pressure at day-21

	Average squares	Sig.
Inter-group	191 896	.010
In Group	31 979	
Total		

**Table 3.** ANOVA average on diastolic blood pressure at day-21

	Average squares	Sig.
Inter-group	4.250	.472
In Group	4.750	
Total		

The results of measurements of systolic blood pressure on day 21 are followed up with Tukey test to determine the average difference between the treatment groups. Tukey test results showed there were differences in average systolic blood

pressure between treatment groups, except among the treatment groups without the administration of calcium with the administration of calcium with anchovies and anchovies calcium administration (Table 4).

**Table 4.** Summary of Test Tukey Average Blood Pressure Day-21

group	A	B	C	D
A		15.00000*	*11.75000	14.00000
B	-15.00000*		-3.25000	1.00000 *
C	-11.75000*	3.25000		2.25000
D	-14.00000	-1.00000 *	-2.25000	

Description:

\*:significant

A: Without the synthetic calcium drug administration

B: drugs synthetic calcium at a dose of 15 mg / g/ BW

C: anchovy extract calcium 15 mg / gram /BW

D: Delivery of anchovy 1.5 g / gram/ BW

Measurement of blood pressure was also performed with paired T-test to determine differences in the average blood pressure on days 0 and 21. Paired T-test results showed that there were significant differences in the average systolic

blood pressure on days 0 and 21 ( $p \leq 0.05$ ) (Table 5). Paired T-test results showed no significant differences in average diastolic blood pressure on days 0 and 21 ( $p \geq 0.05$ ) (Table 6).

**Table 5.** Pair wise T Test average of systolic blood pressure at Day 0 - 21

	Sig. (2-tailed)
Without calcium giving	.014
A synthetic calcium dispensing with a dose of 15 mg / g/ BW	.007
Granting anchovy extract calcium 15 mg / gram/ BW	.005
Anchovy provision 1.5 g / gram/BW	.023

**Table 6.** Pair wise T Test average on diastolic blood pressure on Day 0 - 21

	Sig. (2-tailed)
Without calcium giving	.824
A synthetic calcium dispensing with a dose of 15 mg / g/ BW	.907
Granting anchovy extract calcium 15 mg / gram/ BW	.833
Anchovy provision 1.5 g / gram/BW	.824

## Discussion

The results showed that an increase in systolic blood pressure in the final trimester of pregnancy is day 21. The highest increase in systolic blood pressure is in group therapy pregnancy without calcium, while the diastolic blood pressure does not show any changes. This is likely due to physiological changes in the body due to pregnancy test of animals associated with hormonal and metabolic factors. Also, this difference is due to changes in metabolism due to the fetus, the placenta changes in the anatomy of the uterus, and the increase in the hormones progesterone and estrogen. These metabolic changes cause changes in the cardiovascular system so that the blood volume increased progressively in trimesters in early pregnancy and peaked in the last trimester of pregnancy. This increase in blood volume causes increased heart rate power, so that blood pressure also improved.

In this study, only an increase in systolic blood pressure, but elevated blood pressure is still on the verge of the average value in 115-129 mmHg systolic and diastolic 87-96 mmHg for mice. An abnormal increase in this research was in the group that did not get the calcium therapy or anchovies. This is likely due to less intake of nutrients, especially calcium in pregnancy resulting in an increased blood pressure. Women with low calcium intake have an increased average blood pressure, which predisposes to preeclampsia.

Mineral and nutritional factors play a role as one of the etiology of preeclampsia. Several studies conducted calcium intake in healthy pregnancies with complications. Correlation between calcium intake, plasma levels of calcium, and the incidence of preeclampsia has been investigated. The potential benefits are obtained from calcium

supplements during pregnancy lowers preeclampsia, have been widely explored. Changes in vascular function play an essential role in the control of vascular resistance and blood pressure. Some research suggests the provision of calcium in pregnant women is associated with decreased hypertension in pregnancy (Aamer et al. 2011).

Calcium supplements play an essential role in the prevention of hypertension in pregnancy to maintain levels of calcium ions in the range (range) physiological. Calcium levels should be kept within the concentration is very important in the synthesis of vasoactive substances such as nitric oxide in endothelial prostacyclin and in maintaining healthy endothelial function and reduce blood pressure (Himalaya, 2004).

Villar et'al (2006) has observed 65% reduction in serum parathyroid hormone. Decreased serum parathyroid hormone by the intake of calcium supplementation resulted in a decrease in intracellular calcium ions causing the release of myocyte arteriolar level and lead to a reduction in blood pressure. Increased intracellular calcium causes vasoconstriction, and increased peripheral resistance, eventually an increase in blood pressure. The role of calcium supplements in reducing preeclampsia is a disorder with parathyroid calcium release and lower the concentration of intracellular calcium, eventually, decreases the smooth muscle contraction and increases vasodilation.

## Conclusion

In this in vitro study with rats, both calcium synthetic and anchovy can affect blood pressure in which calcium anchovy able to maintain blood pressure during pregnancy. However, it is urgent to do more research on maternal calcium levels in

pregnant women to explore the function of maternal calcium intake in maintaining blood pressure.

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