# The Effect of Semangit Tempeh Cookies on MUAC, Hb, and Serum Ferritin in Pregnant Women with CED

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## ABSTRACT

This study aimed to analyze the effect of semangit tempeh cookies on Mid-Upper Arm Circumference (MUAC), Hemoglobin (Hb), and Serum Ferritin (SF) of pregnant women with Chronic Energy Deficiency (CED) in Lebak, Banten. The study included 47 pregnant women with MUAC<23.5 cm who were divided into Control Group (CG) (n=22) and Intervention Group (TSG) (n=25). The mean increase in MUAC in the intervention group was 0.72±0.97 cm, while that in the control group was 0.75±1.23 cm (p>0.05), and there was an increase in hemoglobin levels of 0.84 mg/dL in the control group and 0.18 mg in the intervention group. The level of adherence to consumption of semangit tempeh cookies in the intervention group was lower than in the control group (p>0.05). The supplemental feeding of semangit tempeh cookies to pregnant women in intervention group did not have a significant effect on MUAC, Hb and serum ferritin compared to control group.

**Keywords**: MUAC, cookies, serum ferritin, hemoglobin, semangit tempeh

## INTRODUCTION

Chronic Energy Deficiency (CED) in pregnant women is a chronic nutritional problem characterized by a Mid-Upper Arm Circumference (MUAC) less than 23.5 cm. Data from the Ministry of Health of Republic of Indonesia (MoH RI 2018) shows the high prevalence of CED in women of childbearing age (15–49 years), which is 20.78%, and in pregnant women (15–49 years), which is 24.2%. Providing additional food to mothers during pregnancy helps improve nutritional status (Dewey 2016). The supplementary food provided for the community should ideally be as locally-sourced as possible and one of the potential food products is semangit tempeh. The characteristics of semangit tempeh are light brown in color, slightly soft in texture, and slightly odoriferous (Gunawan-Puteri *et al.* 2015). The purpose of this study was to analyze the effect of providing semangit tempeh cookies to pregnant women at risk of CED in Lebak, Banten on their MUAC, body weight, Hemoglobin (Hb), and Serum Ferritin (SF) levels.

## METHODS

The study was conducted in seven comunnity health centers in Lebak, Banten: Warung Gunung Community Health Center, Mandala Community Health Center, Cibadak Community Health Center, Kolelet Community Health Center, Mekarsari Community Health Center, Kalanganyar Community Health Center, and Baros Community Health Center. The subjects were pregnant women with CED who met the inclusion criteria. Pregnant women in the late second trimester who were willing to participate in the study and sign an informed consent were screened. The protocol of this study was approved by the Institute for Research and Community Service, IPB University, with reference number 500/IT3.KEPMSM-IPB/SK/2021.

The subjects of this study were divided into two groups, the control group and the intervention group who received tempe semangit cookies. Hemoglobin (Hb) was measured by Hemacue 201+ and serum ferritin level was measured by colorimeter assay. Data are presented as mean

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values±Standard Deviation (SD). Differences in variable between the control and intervention groups were determined by independent t-test and Mann-Whitney U test.

## RESULTS AND DISCUSSION

According to World Health Organization (WHO) (2001), pregnant women are described as anemic if they have Hb levels <11 mg/dL. Changes in hemoglobin levels, Serum Ferritin (SF) levels, and MUAC in the control and intervention groups during the 12-week intervention are shown in Table 1. The MUAC of the subjects before and after the intervention was significantly different ($p < 0.05$).

Decreased serum ferritin levels may reflect decreased of iron stores due to an associated nutritional deficiency. Nutrients that are thought to contribute to changes in SF of pregnant women include protein, iron, and vitamin C.

The results of this study showed that intervention group had a more significant reduction reduction of SF concertration with 27.65±62.45 mg/dL in SF concentration before and after the intervention ($p < 0.05$). Meanwhile, there was no significant change in the control group ($p > 0.05$).

The mean weight of the subjects in the treatment group was lower than that of the control group. Weight gain in pregnant women is influenced by several factors, including pre-pregnancy nutritional status, height, nutrient intake, physical activity, hemoglobin level, and gestational age (Institute of Medicine/National Research Council (IOM/NRC) 2009). Like body weight, changes in MUAC during pregnancy are also influenced by similar factors (Ghosh *et al.* 2019).

The Analysis of Covariance (ANCOVA) were used to determine the effect of supplemental feeding on indicators of nutritional status, including Mid-Upper Arm Circumference (MUAC) and body weight, by correcting for the covariate variables thought to affect the results. The provision of supplemetary food in the form of semangit tempeh cookies did not significantly affect maternal weight and and MUAC. The results of ANCOVA of hemoglobin and serum ferritin indicators are shown in Table 2.

Table 1. Changes in serum ferritin (µg/dL), Hemoglobin (mg/dL), and MUAC of pregnant women as affected by provision of semangit tempeh cookie

| Parameter | | Control group (n=22) | Intervention group (n=25) | $p^2$ |
|---|---|---|---|---|
| Serum ferritin (µg/dL) | Before | 81.14±47.7 | 82.46±58.8 | |
| | After | 69.52±46.6 | 54.81±23.1 | 0.733 |
| | Δ | -11.61±61.2 | -27.65±62.45 | |
| | $p^1$ | 0.390 | 0.030* | |
| Hb (mg/dL) | Before | 11.61±1.34 | 11.45±1.66 | |
| | After | 12.45±1.51 | 12.04±2.22 | 0.689 |
| | Δ | 0.84±1.49 | 0.18±1.28 | |
| | $p^1$ | 0.015* | 0.211 | |
| MUAC (cm) | Before | 21.61±1.15 | 22.14±0.94 | |
| | After | 22.37±1.36 | 22.86±1.03 | 0.174 |
| | Δ | 0.75±1.23 | 0.72±0.97 | |
| | $p^1$ | 0.011* | 0.001* | |

*Significant at $p < 0.05$; 1: Paired t-test; 2: Independent t-test analysis; Mann-Whitney U test

Table 2. ANCOVA of hemoglobin and serum ferritin indicators is pregnant women as affected by provision of semangit tempeh cookies

| Parameter | | Control group (n=22) | Intervention group (n=25) | $p^2$ |
|---|---|---|---|---|
| Hb | Before | 11.61±1.34 | 11.45±1.66 | |
| | After | 12.45±1.51 | 12.04±2.22 | |
| | $p^1$ | 0.015 | 0.211 | |
| | Δ | 0.84091±1.49 | 0.59200±2.65 | 0.689 |
| | Adjusted ANCOVA[3] | | | 0.769 |
| Serum feritin | Before | 81.14±47.7 | 82.46±58.8 | |
| | After | 69.52±46.6 | 54.81±23/1 | |
| | $p^1$ | 0.390 | 0.030 | |
| | Δ | -11.6177±61.2 | -27.6536±62.45 | 0.733 |
| | Adjusted ANCOVA | | | |

Significant at p<0.05; 1: Paired t-test; 2: Independent t-test; 3:ANCOVA

*Wilcoxon signed-rank test; **Mann-Whitney U test

Significant at p<0.05; Covariates: Pre-intervention Hb, pre-treatment BMI, parity, subject's age, gestational interval, energy intake, protein, Fe, Vitamin C, folic acid, B12

## CONCLUSION

Supplementation of semangit tempeh cookies to pregnant women in the intervention group did not have a significant effect on MUAC, Hb and serum ferritin compare to the control group.

## DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflicts of interest to declare.

## REFERENCES

Dewey KG. 2016. Reducing stunting by improving maternal, infant, and young child nutrition in regions such as South Asia: Evidence, challenges and opprtunities. Matern Child Nutr 12:27–38. https://doi.org/10.1111/mcn.12282

Ghosh S, Suri D, Vuvor F, Armah S, Uauy R, Scrimshaw N. 2010. Dietary Protein Quality is Associated with Risk of being Stunted in Peri-Urban Children of Greater Accra. In Proceedings of the Poster Abstract Presented at 2nd World Public Health Congress on Nutrition, October 2010. Portugal (PT).

Gunawan-Puteri MDPT, Hassanein TR, Prabawati EK, Wijaya CH, Mutukumira AN. 2015. Sensory characteristics of seasoning powders from overripe tempeh, a solid state fermented soybean. Procedia Chem 14:263–269. https://doi.org/10.1016/j.proche.2015.03.037

[IOM/NRC] Institute of Medicine/National Research Council. 2009. Weight Gain During Pregnancy. Washington DC (US): National Academic Press.

[MoH RI] Ministry of Health Republic of Indonesia. 2019. Laporan Nasional Riskesdas 2018. Jakarta (ID): Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan.

[WHO] World Health Organization. 2001. Iron Deficiency Anemia Assessment Prevention and Dontrol: A Guide for Program Managers. Geneva (SZ): WHO.