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Original Research

Differences in Dietary Density Between Physical Activity Group and Tele-nutrition Counseling with Physical Activity Group

Perbedaan Dietary Density Kelompok Aktivitas Fisik dan Telekonseling Gizi Dengan Kelompok Aktivitas Fisik

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Abstract: *Obesity is one of the risk factors for non-communicable diseases. Lifestyle changes such as physical activity and improved diet through tele-nutrition counseling are effective ways to overcome obesity. The study aims to determine the difference in dietary density in the group given physical activity and tele-nutrition counseling with the group physical activity in obese adults. Quasy-experimental research design with the untreated control group design with dependent pretest and posttest samples. A total of 55 respondents aged 19-25 years were taken using purposive sampling. Respondents were divided into two groups: intervention I (physical activity and tele-nutrition counseling) and intervention II (physical activity). Food consumption data was taken by 2x24H recall interview. Data analysis used Paired Sample Test, Independent Sample Test, Wilcoxon, And Mann Whitney. Respondents with obesity I nutritional status were 49.05% and obesity II were 50.95%. There is a difference in dietary energy density in intervention I (p = 0.047). There is no difference in food nutrient density in intervention I (p = 0.480). There was no difference in dietary energy density (p = 0.548) and food nutrient density (p = 0.307) in intervention II. There was no difference in dietary energy density (p = 0.589) and food nutrient density (p = 0.134) between intervention I and intervention II after treatment. There was a difference in dietary energy density before and after treatment in intervention I. There was no difference in muscle mass and dietary density between intervention I and intervention II after treatment.*

Key word: adults, dietary density, obese, physical activity, tele- nutrition counseling

1. INTRODUCTION

Obesity represents a significant public health challenge due to its high prevalence and its role as a risk factor for various diseases, including cancer, coronary heart disease, metabolic disorders, gastrointestinal disturbances, and neurological disorders (Oroh et al., 2021). In 2018, the prevalence of obesity in Banyumas Regency was 12.47% among men and 29.78% among women (Kementrian Kesehatan RI, 2018). Fat accumulation in the body and low physical activity levels are key factors contributing to obesity (Septiyanti & Seniwati, 2020). Low physical activity can disrupt the balance between energy intake and expenditure, leading to obesity (Nisrina et al., 2023). The proportion

of individuals aged >10 years with insufficient physical activity in Indonesia was 33.5%, according to the 2018 Basic Health Research data (Kementerian Kesehatan RI, 2018). Energy expenditure can be increased through physical activity (Woon et al., 2020). In the other hand, previous study showed that nutrient density of Indonesian adult still below the recommendation and need to be improved (Prasetyo et al., 2021; Prasetyo & Khoiriani, 2020).

Mismatch between dietary patterns and the recommendations of the Balanced Nutrition Guidelines can impact nutritional status. One method to assess diet quality is through Dietary Density, using the Nutrient Rich Food Index 9.3 (NRF 9.3). Energy density refers to the total energy intake (kcal) relative to the total food weight (grams) and is calculated using the dietary energy density (DED) method (Ekaningrum et al., 2017). The NRF 9.3 optimizes nine nutrients—protein, fiber, vitamin A, vitamin C, vitamin E, calcium (Ca), iron (Fe), magnesium (Mg), and potassium (K)—while limiting three components: added sugars, saturated fats, and sodium (Drewnowski, 2010).

Obesity management can be more effectively achieved through lifestyle modifications, including balancing dietary intake and physical activity (Wadden et al., 2020). One approach to fostering healthier lifestyles is through education or counseling. Nutrition education or counseling can improve knowledge, raise awareness, and promote behavior changes to achieve optimal nutritional status and health (Nurmasyita et al., 2016). Tele-nutrition education can improve fat percentage, cholesterol levels and increase physical activity in obese subjects (Prasetyo et al., 2024). This study examines the effects of physical activity and nutrition tele-counseling on dietary density by comparing an intervention group receiving both physical activity and tele-counseling (Intervention Group I) with a group receiving physical activity alone (Intervention Group II)..

2. METHODS

The research design was a quasi-experimental study with an untreated control group design and dependent pretest and posttest samples, involving two groups: Intervention Group I (physical activity and tele-nutrition counseling) and Intervention Group II (physical activity only). The study was conducted from April to July 2024 in Banyumas Regency. The physical activity and tele-nutrition counseling interventions were implemented over eight weeks. A purposive sampling technique was employed, involving a total of 55 obese respondents aged 19–25 years from Banyumas Regency. The participants were divided into two groups: Intervention Group I (n = 28) and Intervention Group II (n = 27).

The independent variables in this study were physical activity and nutrition tele-counseling, while the dependent variable was dietary density. The instruments used included a respondent characteristics questionnaire and a 2x24-hour food recall form. Data analysis was performed using the Kolmogorov-Smirnov test, Paired Sample Test, Wilcoxon test, Independent Sample Test, and Mann-Whitney test.

3. RESULTS

Table 1 presents the characteristics of the study participants divided into two groups: Intervention Group I (physical activity and nutrition tele-counseling) and Intervention

Group II (physical activity only). The majority of participants in both groups were female, accounting for 85.7% in Intervention Group I and 77.8% in Intervention Group II. Most participants were aged 20–22 years, comprising 64.3% in Group I and 77.7% in Group II. Regarding education, the majority had completed senior high school, with 82.1% in Group I and 92.6% in Group II. The primary occupation of participants was students, making up 92.9% in Group I and 92.6% in Group II. In terms of nutritional status, participants were evenly distributed between Obesity Class I and Class II across both groups, with nearly equal proportions in each classification.

Table 1. Subjects Characteristic

Variable	Intervention Group I		Intervention Group II	
	n	%	n	%
Aged (Year)				
19	3	10.7	3	11.1
20	10	35.7	6	22.2
21	3	10.7	8	29.6
22	5	17.9	7	25.9
23	3	10.7	1	3.7
24	2	7.1	1	3.7
25	2	7.1	1	3.7
Gender				
Male	4	14.3	6	22.2
Female	24	85.7	21	77.8
Education				
Senior High School	23	82.1	25	92.6
Higher Education	5	17.9	2	7.4
Occupation				
Stundent	26	92.9	25	92.6
Entrepreneur	1	3.6	1	3.7
Other	1	3.6	1	3.7
Income				
<Rp1.500.000	15	53.5	11	40.7
≥Rp1.500.000	13	46.4	16	59.2
Nutritional Status				
Obese I	14	50	13	48.1
Obese II	14	50	14	51.9
Total Subjects	28	100	27	100

The table 2 showed the changes in nutrient density and dietary energy density between the pre-test and post-test phases. The median nutrient density increased from -0.53 to 0.29 with a score change of 0.25, but the difference was not statistically significant (P = 0.4801). The mean dietary energy density decreased from 2.11 ± 0.33 to 1.90 ± 0.43, showing a reduction of -0.21 ± 0.53, which was statistically significant (P = 0.0472). These results suggest that the intervention had a meaningful impact on reducing dietary energy density but not on improving nutrient density.

Table 2. Differences in Dietary Density Before and After Treatment in Intervention Group I

Variable	Median			
	Pre Test	*Post Test*	*Δ Skor*	*P Value*
Nutrient Density	-0.53	0.29	0.25	0.480[1]
Variable	**Mean ± SD**			
	Pre Test	*Post Test*	*Δ Skor*	*P Value*
Dietary Energy Density	2.11±0.33	1.90±0.43	-0.21±0.53	0.047[2]

[1]Wilcoxon test; [2]Paired Sample Test

Table 3 illustrates changes in food nutrient density and dietary energy density (DED) between the pre-test and post-test phases. The median food nutrient density decreased from 0.36 to -1.66, with a score change of -1.95, but the difference was not statistically significant (P = 0.3071). Similarly, the mean DED increased slightly from 2.09 ± 0.51 to 2.16 ± 0.47, with a score change of 0.07 ± 0.60, which was also not statistically significant (P = 0.5482). These findings indicate that the intervention did not significantly affect food nutrient density or dietary energy density in this group.

Table 3. Differences in Dietary Density Before and After Treatment in Intervention Group II

Variabel	**Median**			
	Pre Test	*Post Test*	*Δ Skor*	*P Value*
Densitas Zat Gizi Pangan	0.36	-1.66	-1.95	0.307[1]
Variabel	**Mean ± SD**			
	Pre Test	*Post Test*	*Δ Skor*	*P Value*
Dietary Energy Density (DED)	2.09±0.51	2.16±0.47	0.07±0.60	0.548[2]

[1]Wilcoxon test; [2]Paired Sample T-Test

Table 4 presents the dietary energy density (DED) and Nutrient Rich Food Index (NRF 9.3) scores based on food groups in both Intervention Group I (physical activity and nutrition tele-counseling) and Intervention Group II (physical activity only). In both groups, fruits and vegetables had the lowest DED values but varied in NRF 9.3 scores, with a notable decline in NRF 9.3 scores for fruits in both groups after the intervention. Packaged snacks and biscuits had consistently high DED values and low or negative NRF 9.3 scores, showing minimal improvement post-intervention. For sources of carbohydrates, DED slightly decreased in both groups, but NRF 9.3 scores showed mixed changes, with a decrease in Group II post-intervention. Animal-source foods demonstrated a minor increase in DED and varied NRF 9.3 scores, with Group I showing improved nutrient density compared to Group II. Lastly, legumes showed an increase in NRF 9.3 scores in both groups, indicating an improvement in nutrient quality for this food group, while fats/oils and instant noodles continued to exhibit high DED values with negligible changes in nutrient density. These results suggest that while some food groups improved in nutrient density, others remained largely unchanged, highlighting the complexity of dietary behavior modifications.

Table 4. DED and NRF 9.3 Scores Based on Food Groups

Kelompok Bahan Pangan	**Intervention Group I**				**Intervention Group II**			
	Pre		**Post**		**Pre**		**Post**	
	DED (kkal/g)	**NRF 9.3**	**DED (kkal/g)**	**NRF 9.3**	**DED (kkal/g)**	**NRF 9.3**	**DED (kkal/g)**	**NRF 9.3**
Fruits	0.51	0.09	0.59	-0.46	0.56	-0.07	0.55	-0.44
Biscuit/*cookies*	4.78	0.00	4.86	0.00	5.04	-0.01	4.95	-0.02
Snack/ packaged food	3.96	-0.13	4.06	-0.15	5.18	-0.18	3.62	-0.04
Source of carbohydrates	2.04	-2.10	1.89	-1.71	1.92	-0.96	1.92	-2.42
Dairy produck	3.36	0.00	2.50	0.00	3.26	0.00	3.08	0.01
crackers	3.65	-0.01	3.92	-0.01	3.17	-0.02	3.78	-0.01
Fat/Oil	7.66	-0.36	6.60	-0.12	8.64	-0.25	7.95	0.11
Instant Noodle	4.14	-0.04	3.14	0.00	4.48	0.00	3.61	-0.04
Animal source food	2.04	-0.55	2.16	0.42	1.84	0.21	2.15	-0.11
leegumes and their derivatives	1.70	0.31	1.89	0.43	2.27	0.53	1.87	0.57
Bread	2.78	0.00	3.34	-0.03	4.35	0.18	2.79	-0.01
Vegetable	0.36	0.22	0.33	0.42	0.54	-0.02	0.33	0.15
Egg	1.55	0.54	1.54	0.27	1.54	0.46	1.60	0.45
Sweetened condensed milk	3.44	0.00	3.00	0.00	3.43	0.00	4.40	0.00
Other	2.52	-0.69	2.14	-0.09	3.27	-1.32	2.77	0.04

Table 5 summarizes the differences in nutrient density of food between Intervention Groups I and II after the treatment. The median change in nutrient density was higher in Intervention Group I (0.25) compared to Group II (-1.95), although the variability in both groups was substantial, as shown by the wide range of minimum and maximum values. Despite these differences, the statistical analysis revealed no significant difference between the two groups (P = 0.1341). These findings suggest that while Group I showed a slight improvement in nutrient density, the changes were not statistically significant when compared to Group II.

Table 5. Differences in Nutrient Density of Food in Intervention Groups I and II After Treatment

Variable	Intervention Group I			Intervention Group II			*P*
	Median	Min	Max	Median	Min	Max	*value*
Δ Nutrient Density	0.25	-7.9	14.35	-1.95	-12.87	29.05	0.134[1]

[1]Mann Whitney

Table 6 highlights the differences in dietary energy density (DED) between Intervention Groups I and II after treatment. The mean change in DED was -0.21 ± 0.53 in Intervention Group I, indicating a reduction, while Intervention Group II showed a slight increase with a mean change of 0.07 ± 0.60. However, the statistical analysis revealed no significant difference in the changes between the two groups (P = 0.5892). These results suggest that the intervention in Group I may have contributed to a reduction in DED, but the differences were not statistically meaningful when compared to Group II.

Table 6. Differences in Dietary Energy Density of Intervention Groups I and II After Treatment

Variable	Intervention Group I		Intervention Group II		*P*
	Mean	Std. Deviasi	Mean	Std. Deviasi	*value*
Δ *Dietary Energi Density*	-0.21	0.53	0.07	0.60	0.589[2]

[2]Independent sample test

Table 7 illustrates changes in food nutrient intake in Intervention Group I before and after the intervention. Protein intake decreased significantly, with a mean reduction of -17.28 ± 39.94 g, while fiber intake showed a mean increase of 5.58 ± 17.91 g. Vitamin C intake increased substantially by 32.30 ± 78.05 mg, and potassium intake also rose slightly by 3.44 ± 13.31 mg. Conversely, calcium and vitamin E intake both decreased, with reductions of -7.61 ± 15.69 mg and -1.25 ± 10.7 mg, respectively. Sodium intake dropped notably by -20.18 ± 27.72 g, suggesting a positive dietary adjustment.

Median values revealed an increase in vitamin A intake (23.23 IU) and saturated fat intake (78.53 g), while magnesium decreased slightly by -3.08 mg. Added sugar intake declined substantially, with a median reduction of -8.09 mg. These results suggest that the intervention had mixed effects on nutrient intake, with improvements in some nutrients like fiber and vitamin C but reductions in others, such as protein and calcium.

Tabel 7. Differences in Food Nutrients in Intervention Group I

Nutrient	Mean±SD		
	Pre	***Post***	**Δ *Skor***
Protein (g)	97.91±28.06	80.63±35.82	-17.28±39.94
Fiber (g)	21.15±12.65	26.73±12.69	5.58±17.91
Vitamin C (mg)	50.04±62.25	82.35±73.18	32.30±78.05
Vitamin E (mg)	16.71±7.21	15.46±8.08	-1.25±10.7
Calcium (mg)	29.77±11.899	22.16±11.46	-7.61±15.69
Fe (mg)	70.73±50.35	84.39±56.69	13.66±83.3

Potassium (mg)	22.4±9.11	25.85±12.2	3.44±13.31
Sodium (g)	49.81±25.12	29.62±22.68	-20.18±27.72
Nutrient	**Median**		
	Pre	***Post***	**Δ *Skor***
Vitamin A (IU)	44.73	58.67	23.23
Magnesium (mg)	24.65	22.66	-3.08
Saturated Fat (g)	362.64	404.21	78.53
Added Sugar (mg)	19.88	7.76	-8.09

Table 8 highlights the changes in nutrient intake for Intervention Group II before and after the intervention. Protein intake showed a slight increase, with a mean change of 0.78 ± 45.60 g, while fiber intake improved significantly by 11.37 ± 20.39 g. Vitamin A intake increased modestly by 9.06 ± 73.30 IU, whereas calcium intake decreased slightly by -3.17 ± 20.70 mg. Added sugar and sodium intakes both decreased, with reductions of -8.99 ± 27.79 g and -5.33 ± 28.86 mg, respectively, indicating some positive dietary changes.

Median nutrient changes showed a decrease in vitamin C intake (-5.94 mg), while vitamin E intake increased slightly (0.81 mg). Iron, potassium, and magnesium intakes all declined slightly, with median reductions of -7.78 mg, -2.98 mg, and -2.98 mg, respectively. Notably, saturated fat intake increased substantially, with a median rise of 212.82 g. These results suggest a mixed effect of the intervention on nutrient intake, with notable improvements in fiber intake and reductions in added sugar, but increases in saturated fat and minor decreases in other micronutrients.

Table 8. Differences in Food Nutrients in Intervention Group II

Zat Gizi	**Mean±SD**		
	Pre	*Post*	**Δ** *Skor*
Protein (g)	94.27±35.82	95.05±39.48	0.78±45.60
Fiber (g)	16.55±9.85	27.93±19.04	11.37±20.39
Vitamin A (IU)	62.37±52.76	71.43±52.77	9.06±73.30
Calcium (mg)	34.89±20.04	31.72±17.9	-3.17±20.70
Added Sugar (g)	26.22±25.32	17.22±17.34	-8.99±27.79
Sodium (mg)	39.09±23.2	33.76±22.44	-5.33±28.86
Zat Gizi	Median		
	Pre	*Post*	**Δ** *Skor*
Vitamin C (mg)	48.63	39.91	-5.94
Vitamin E (mg)	15.63	16.21	0.81
Fe (mg)	74.74	69.12	-7.78
Potassium (mg)	20.01	19.91	-2.98
Magnesium (mg)	19.47	18.02	-2.98
Saturated Fat (g)	396.52	547.08	212.82

4. DISCUSSION

Respondent Characteristics

The characteristics of the respondents in this study included age, gender, education level, occupation, pocket money or income, and nutritional status. The respondents were aged between 19 and 25 years. According to the 2023 Indonesian Health Survey, the prevalence of obesity increased in higher age groups: 8.5% at age 19, 13.4% at ages 20-24, and 20.8% at ages 25-29 (Kementerian Kesehatan RI, 2023). Factors such as food intake, lifestyle, daily activities, and psychological conditions contribute to the onset of obesity in older age groups (Masrul, 2018). In terms of gender, the majority of respondents were female (81.75%) compared to male respondents (18.25%).

Regarding education, most respondents were high school graduates (87.35%), while a smaller percentage had higher education (12.65%). A higher level of education facilitates access to and the application of health and nutrition information (Sutrisno & Tamim, 2023). The respondents were primarily students (92.75%), and the median pocket money or income was Rp1,500,000. Higher income typically leads to greater expenditure on food (Rizki, 2022).

Differences in Dietary Density Before and After Treatment in Intervention Group I

There was a significant difference in dietary energy density before and after treatment in Intervention Group I. The average dietary energy density score decreased, indicating improved dietary habits among the respondents. However, no significant difference was found in food nutrient density before and after treatment, although the food nutrient density score showed improvement, reflecting a positive dietary change. After treatment, the scores for nutrients to be optimized according to the NRF 9.3 were higher, and the scores for nutrients to be limited were lower. The improved dietary habits were likely due to the tele-nutrition counseling provided during the intervention. Throughout the tele-nutrition counseling process, respondents discussed topics such as meal timing, foods to reduce, recommended foods, and healthy snack options. Additionally, they received information about balanced nutrition guidelines, the "plate" principle, and the nutritional content of foods, which made them more selective in their food choices. This information aimed to promote changes in eating behavior. Previous research has shown that tele-nutrition-based nutrition education can improve consumption patterns in adolescents by significantly increasing fruit consumption and reducing sugar and fat consumption (Prasetyo et al., 2023).

Differences in Dietary Density Before and After Treatment in Intervention Group II

No significant differences in dietary energy density or food nutrient density were observed before and after treatment in Intervention Group II. There was an increase in dietary energy density and a decrease in food nutrient density, indicating a shift toward poorer eating behaviors. The decrease in dietary energy density suggested that respondents were consuming foods with higher energy density. Examples of foods with high dietary energy density included instant noodles, biscuits, cookies, crackers, bread, fried foods, fats, and oils (Table 4). The lack of change in dietary density in Intervention Group II was due to a decrease in the intake of nutrients to be optimized according to NRF 9.3, such as vitamin C, calcium, iron, and magnesium (Table 8).

Differences in Dietary Density Between Intervention Groups I and II After Treatment

No significant differences in dietary density were observed between Intervention Groups I and II after the 8-week treatment. Intervention Group I experienced a decrease in dietary energy density and an increase in food nutrient density. In contrast, Intervention Group II showed an increase in dietary energy density and a decrease in food nutrient density. Based on Table 7, the nutrients that increased after treatment in Intervention Group I included fiber, vitamin C, vitamin A, iron, and potassium, while the nutrients that decreased were added sugars and sodium. In Intervention Group II, the nutrients that increased were protein, fiber, and vitamin A, while added sugars and sodium decreased (Table 8). The quality of food consumption can be assessed through energy density and food nutrient density scores. Higher food nutrient density and lower energy density scores reflect better food quality (Drewnowski, 2010). Another study showed that the higher the dietary energy density value and the lower the

nutrient density value of food, the poorer the quality of food consumption (Lestari et al., 2020). Based on these findings, it can be concluded that the quality of food consumption in intervention group I is better than in intervention group II.

5. CONCLUSION

There was a significant difference in dietary energy density in Intervention Group I. No significant difference in food nutrient density was observed in Intervention Group I. In Intervention Group II, no significant differences were found in dietary energy density or food nutrient density. Additionally, there were no significant differences in dietary energy density or food nutrient density between Intervention Group I and Intervention Group II after the treatment.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in this study.

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