

Original Research

Effect of Tele-Nutrition Counselling and Physical Activity on Nutrition Knowledge, Attitudes and Practices in Obese Adults

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Abstract

Background: Obesity is a condition of excessive body weight. Tele-nutrition counselling is a remote nutrition service as an effort to treat obesity. Physical activity can overcome obesity conditions due to the process of burning calories which causes weight loss.

Objectives: The purpose of this study was to determine the effect of tele-nutrition counselling and physical activity on knowledge, attitudes, nutrition practices (KAP) in obese adults.

Methods: This study used Quasy experimental with pre-post-test control group design. There was 56 obese adult respondents were divided into 2 groups that were given physical activity intervention, moreover the experimental group was given tele-nutrition counselling intervention. KAP scores were taken using a valid and reliable questionnaire. The intervention was conducted online. Data analysis used Wilcoxon and Independent t-test.

Results: There was an effect of the intervention on knowledge ($p=0.009$), attitude ($p=0.021$), nutrition practices ($p=0.000$) of the experimental group. There was no effect on knowledge ($p=0.477$), attitude ($p=0.935$), but there was an effect on nutrition practices ($p=0.003$) in the control group. There was a difference in knowledge ($p=0.023$) but no difference in attitude ($p=0.116$) and nutrition practices ($p=0.213$) between the two groups.

Conclusion: There was an effect of the intervention on nutrition practices in both groups. There was an effect of the intervention on knowledge, nutritional attitudes in the experimental group but not in the control group. There is a difference in the effect of the intervention on knowledge but there is no difference in the effect on attitudes and nutrition practices between the two groups.

Keywords: adults; nutrition knowledge; obese; physical activity; tele-nutrition counselling

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Background

Overweight or obesity are major public health issues that require urgent attention, particularly among adults. Obesity is define as a condition of excessive accumulation of body fat (WHO, 2023), and it significantly increase the risk of various non-communicable diseases including dyslipidemia, type 2 diabetes mellitus, cardiovascular disease, and certain types of cancer (WHO, 2018). A study in Indonesia found that individual with obesity are 1.96 times more likely to develop

ischemic heart disease compared to those with normal weight (Suryati & Suyitno, 2020). Data from Indonesia's 2018 Basic Health Research (Riskesdas) highlights a growing trend, with the prevalence of obesity in adults (aged over 18 years) rising from 14.8% in 2013 to 21.8% in 2018. Furthermore, regional data from Banyumas shows a gender disparity in obesity rates, with 22.49% of men and 46.25% of women classified as overweight or obese (Ministry of Health Republic of Indonesia, 2018). This suggests that adult women are particularly vulnerable, which may be influenced by differences in lifestyle, hormonal factors, and socio-cultural roles.

The primary cause of obesity is an imbalance between energy intake and energy expenditure, leading to excess energy being stored as fat, which then causes weight gain (Kurdanti et al., 2015). Although genetic predisposition may contribute, modifiable lifestyle factors such as poor dietary patterns, low physical activity levels, and limited access to health and nutrition information play a pivotal role (Malik, Willett, & Hu, 2013). Importantly, lack of nutritional knowledge often leads to unhealthy eating behaviors that contribute to fat accumulation in the body (Jayanti & Novananda, 2019). A study conducted by Hutatosit (2020) among women of reproductive age found that 92% of obese respondents exhibited negative nutritional attitudes, highlighting the link between poor nutrition knowledge and obesity risk (Hutasoit, 2020). Given these challenges, nutrition education and counseling are essential interventions to improve knowledge, attitudes, and behaviors related to healthy eating and balanced nutrition (Ranitadewi, Syauqi, & Wijayanti, 2018). In today's era, where most activities can be digitalized, information is easily accessible and shared through social media networks. Tele-nutrition defined as the delivery of nutrition counselling via telecommunications technology, including mobile apps and online platforms offers a practical, flexible, and scalable alternative for disseminating nutrition education (Petalina, Larasati, & Lubis, 2021). This method allows individuals to receive personalized advice remotely, making it an innovative solution for overcoming barriers to access.

In addition to dietary factor and nutritional knowledge, physical activity is a key component in preventing and managing obesity. Studies have consistently shown that higher frequency and intensity of physical activity are associated with lower obesity prevalence (Widiantini & Tafal, 2014). Furthermore, combining physical activity with dietary interventions enhances weight management outcomes, not only by increasing energy expenditure but also by modulating appetite-regulating hormones such as ghrelin, which helps reduce excessive hunger (Malin, Heiston, Gilbertson, & Eichner, 2020).

Physical activity also supports behavioural changes in dietary habits. As Castro et al. (2020) noted, individuals who engage in regular physical activity are more motivated to maintain healthy eating behaviors to achieve a calorie deficit, a state where energy expenditure exceeds intake, leading to weight loss (Castro et al., 2020). The combination of strength training exercises, such as circuit exercise and Tabata exercise, with low-to-moderate aerobic exercises performed consistently, also significantly contributes to weight loss (Kuswari, Rimbawan, Hardinsyah, Dewi, & Gifari, 2021). For individuals with obesity, low-impact aerobic exercises, are particularly suitable because they reduce injury risk while still promoting weight loss (Devi, Winaya, Indrayani, & Adiatmika, 2022).

Despite the evidence supporting both nutrition education and physical activity as interventions to tackle obesity, few studies have explored the combined effects of tele-nutrition counseling and structured physical activity programs on improving knowledge, attitudes, and practices (KAP) among obese adults. Therefore, this study aims to investigate the impact of tele-nutrition counseling combined with physical activity interventions on the nutritional knowledge, attitudes, and dietary practices of obese adults. By integrating these two approaches, this research seeks to offer a comprehensive model for obesity management that is accessible, practical, and aligned with modern technological advancements.

Methods

Study design and settings

The research design used was a quasi-experimental with pretest-posttest control group design involving two research groups: a control group and an intervention group. A quasi-experimental design was chosen over a true experimental design because it was not possible to fully control participants' daily dietary intake, which could potentially influence the outcomes. However, both groups were monitored under similar conditions to maintain comparability. The pretest-posttest design was used to assess changes in participants' knowledge, attitudes, and practices (KAP) related to nutrition and obesity management before and after the intervention period. Data collection was conducted using structured questionnaires administered at baseline (pretest) and after the intervention (posttest).

Setting

Both the control and intervention groups participated in light to moderate physical activity, aligned with the World Health Organization (WHO) recommendations for adults. The physical activity sessions were conducted three times per week, with each session lasting 30 to 60 minutes, and were designed to be feasible for individuals with obesity. The physical activity program focusing on low to medium impact exercises that minimize the risk of injury while supporting weight management efforts. Participants performed these activities individually with remote guidance, following a standardized

activity module and program developed by the research team, ensuring consistency in the type and intensity of exercises performed by participants. To monitor adherence, participants were provided with a weekly checklist book to record their completed activities. In addition, the research team reminded participants weekly via WhatsApp (WA) to encourage compliance and address any challenges faced during the activities. Participants were also asked to report back weekly regarding their progress and any difficulties encountered, ensuring ongoing support and engagement throughout the intervention period.

In addition to physical activity, the intervention group received tele-nutrition counseling aimed at improving their knowledge, attitudes, and nutritional practices. Tele-nutrition counseling refers to nutrition education and counseling delivered through digital communication platforms. The counseling sessions were conducted once a week for eight weeks, with each session lasting 45 to 60 minutes, delivered online via Zoom. The content of the counseling included topics such as balanced nutrition principles, healthy eating patterns, portion control, and strategies to support weight management.

The counseling sessions in this study were conducted by fourth-year Nutrition Department students who had undergone relevant training. To ensure the quality and consistency of the intervention, all counselors were supervised by licensed nutritionists and dietitians throughout the program. The study was conducted over an eight-week period, from May to June 2024, in Banyumas District, Central Java, Indonesia. Physical activities were performed individually by participants at their respective locations, guided remotely, while tele-nutrition counseling sessions were conducted virtually to enhance accessibility and flexibility for participants.

Sample

The research sample or respondents were selected using purposive sampling based on inclusion and exclusion criteria. The sample size was determined using the sample size estimation formula to test the hypothesis of the difference in the means of two groups, ensuring adequate statistical power for detecting meaningful differences. The inclusion criteria for this study were adults aged 19-29 years with a BMI $>25 \text{ kg/m}^2$ and owning an electronic device to access WhatsApp and Zoom applications. Meanwhile, the exclusion criteria for this study were students majoring in Nutrition Science, adults who were following a diet program and consuming dietary supplements, having a history or being diagnosed with certain diseases, and not participating in the research program series by failing to perform at least 75 minutes of physical activity per week or failing to meet 75% attendance.

Sample recruitment was conducted through an online form distributed to potential respondents who met the eligibility criteria. After collecting responses, eligible participants were randomized into the control and intervention groups to ensure group equivalence and reduce potential biases. Initially, 68 respondents were recruited and equally divided into two groups; however, only 56 participants completed the program until the end. Details on participant flow, including dropout rates and reasons for attrition, are presented in the study's flow diagram of treatment in the control and intervention groups (Fig 1).

Instrument

The instrument used in this study was the Nutrition Knowledge, Attitude, and Practice (KAP) Questionnaire, which was selected to assess changes in key behavioural determinants related to obesity management. The use of the KAP model aligns with the study's objective of determining the effect of tele-nutrition counselling and physical activity on knowledge, attitudes, and nutrition practices in obese adults. The questionnaire was designed to measure participants' understanding of nutrition concepts, their attitudes toward healthy eating and physical activity, and their dietary and lifestyle behaviours.

To ensure the validity and reliability of the instrument, the KAP questionnaire was tested on 33 subjects prior to implementation. The Nutrition Knowledge Questionnaire consist of 10 valid questions with a Cronbach's Alpha value of 0.669, assessing participants' comprehension of dietary principles relevant to weight management. The Nutrition Attitude Questionnaire comprises 11 valid questions with a Cronbach's Alpha value of 0.745, evaluating participants' perspectives and motivation toward adopting healthier behaviours. Lastly, the Nutrition Practice Questionnaire consist of 15 valid questions with a Cronbach's Alpha value of 0.779, capturing self-reported adherence to recommended dietary and physical activity guidelines. By utilizing the KAP questionnaire, this study aims to quantify the impact of the intervention on participants' knowledge, attitudes, and practices, providing insight into the effectiveness of tele-nutrition counseling combined with physical activity in promoting positive behavioral changes among obese adults.

Data analysis

Statistical analysis was conducted to assess the effect of the intervention on nutrition knowledge, attitude, and practice. The Kolmogorov-Smirnov test was used to assess the normality of the data distribution, as it is suitable for moderate sample sizes and allows for the evaluation of deviations from normality. The normality test results indicated that the KAP data in both groups were not normally distributed, leading to the use of the non-parametric Wilcoxon signed-rank test. However, the delta scores (the difference between pre- and post-intervention values) were found to be normally distributed. Therefore, an independent t-test was used to compare delta scores between the intervention and control groups. A significance level of $p < 0.05$ was set for statistical tests to determine whether the observed differences were statistically significant.

Ethical consideration

This study has been approved by the Ethics Committee of the Faculty of Health Sciences, Universitas Jenderal Soedirman, with letter number 1415/EC/KEPK/IV/2024.

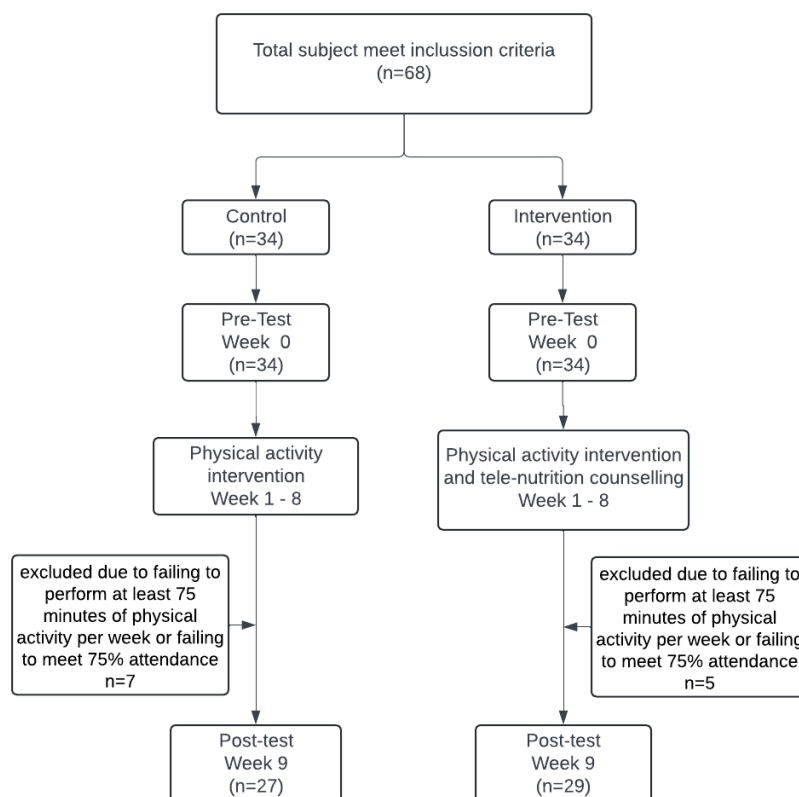


Figure 1. Flow diagram of treatment in control and intervention group

Results

This study involved adult respondents aged 19-29 years in the Banyumas Regency area with an obesity nutritional status ($\text{BMI} \geq 25 \text{ kg/m}^2$) using a quasi-experimental study design. A total of 68 respondents were recruited and divided randomly into two groups, but only 56 were able to complete the program until the end, consisting of 27 subjects in the control group and 29 subjects in the intervention group. The physical activity intervention was conducted three sessions per week, with each session lasting 30-45 minutes for both groups. Tele-nutrition counselling was provided to the intervention group once a week, with each session lasting 45-60 minutes per respondent via Zoom meetings.

Table 1. Subject's Characteristic

Variable	Kelompok Intervensi		Kelompok Kontrol	
	n	%	n	%
Age (years)				
19 - 21	17	58.6	17	63.0
22 - 25	12	41.4	10	37.0
Gender				
Male	4	13.8	6	22.2
Female	25	86.2	21	77.8
Occupation				
Student	27	93.1	25	92.6
Entrepreneur	2	6.8	2	7.4
Income				
<Rp1.500.000	16	55.1	11	40.7
≥Rp1.500.000	13	44.8	16	59.2

Table 1 shows the characteristics of the study subjects. Most of the subjects in both the intervention and control groups were aged between 19–21 years and were female. The majority of respondents in the intervention group had an income of less than Rp1,500,000 per month (55.1%), while in the control group, most respondents had an income of Rp1,500,000 or more per month (59.2%). In both groups, the majority of respondents were students.

Table 2. The Effect of Physical Activity Intervention on KAP of Nutrition in the Control Group

Variable	Control Group (n=27)			P-Value
	Pre	Post	$\Delta skor$	
Knowledge	7 (4-9)	7 (3-10)	-1((-4)-4)	0.477
Attitude	39 (33-44)	38 (34-43)	0 ((-10)-8)	0.935
Practice	33 (20-52)	39 (32-49)	6 ((-18)-20)	0.003

There was an increase in the nutrition practice scores in the control group; however, no increase was observed in the nutrition knowledge and attitude scores in the control group. The statistical test results indicated no significant difference in nutrition knowledge scores, with a p-value of 0.477, and no significant difference in nutrition attitude scores, with a p-value of 0.935 (both $> \alpha = 0.05$) in the control group before and after the intervention. However, there was a significant difference in nutrition practice scores in the control group, with a p-value of 0.003 ($< \alpha = 0.05$) before and after the physical activity intervention.

Table 3 The Effect of Physical Activity Intervention on KAP of Nutrition in the Intervention Group

Variable	Intervention Group (n= 29)			P Value
	Pre	Post	$\Delta skor$	
Knowledge	8 (5-9)	9 (6-10)	1 ((-2)-4)	0.009
Attitude	39 (32-44)	41 (32-44)	2 ((-11)-12)	0.021
Practice	37 (24-44)	44 (28-56)	8 ((-12)-31)	0.000

There was an increase in the nutrition knowledge, attitude, and practice scores in the intervention group after being given the tele-nutrition counselling and physical activity intervention. The statistical test results indicated a significant difference in nutrition knowledge with a p-value of 0.009, nutrition attitude with a p-value of 0.021, and nutrition practice with a p-value of 0.000 in the intervention group before and after the physical activity and tele-nutrition counselling intervention.

Table 4. Differences in the effects of physical activity and tele-nutrition counseling interventions between the intervention group and the control group after the intervention

Variable	Mean \pm SD		P Value
	Control	Intervention	
Δ Knowledge	-0.33 \pm 2.27	0.89 \pm 1.63	0.023
Δ Attitude	-0.03 \pm 4.5	2.03 \pm 5.14	0.116
Δ Practice	5.4 \pm 8.5	8.37 \pm 8.67	0.213

Based on the statistical test results, Table 4 shows a decrease in nutrition knowledge and attitude scores in the control group, indicated by a negative Δ score. The test results demonstrate a significant difference in the effect of the intervention on nutrition knowledge, with a p-value of 0.023, between the control group and the intervention group. However, there was no significant difference in the effect on nutrition attitude, with a p-value of 0.116, and on nutrition practice, with a p-value of 0.213, between the control and intervention groups.

Discussion

Interpretation of Key Findings and Comparison with Previous Studies

The study results show that most respondents in both groups were aged 19-21 years. Individuals in this age group tend to consume high-calorie foods that were not balanced with physical activity due to their busy schedules, which increases the risk of obesity (Negara, Wibawa, & Purnawati, 2015). Additionally, most respondents in both groups were female who tend to have a higher percentage of body fat compared to men due to differences in body composition and fat distribution (Halim & Suzan, 2020). In terms of occupation category, most subjects were students. Students tend to consume fast food, which was low in fiber but high in sugar and sodium. This indicates that fast food has an imbalanced nutrient content, and continuous consumption can lead to obesity (Evan, Wiyono, & Candrawati, 2017).

The Effect of Physical Activity on KAP Changes Before and After Intervention in the Control Group

In the control group, statistical test results indicated no significant difference in nutrition knowledge scores, with a p-value of 0.477, and no significant difference in nutrition attitude scores, with a p-value of 0.935 before and after the physical activity intervention. Moreover, there was a decline in both nutrition knowledge and attitude scores. This occurred because the control group did not receive any educational or counseling interventions, resulting in a lack of two-way communication addressing the respondents' nutritional issues (Azzahra & Muniroh, 2016). The lack of structured education in the control group suggests that knowledge and attitude changes may require a more comprehensive intervention, including both informational and behavioral components.

There was an increase in the average nutrition practice scores, and the analysis results showed a significant difference in nutrition practice scores in the control group, with a p-value of 0.003 before and after the physical activity intervention. The improvement in nutrition practices was attributed to the physical activity intervention. Suryadinata and Sukarno (2019) stated that physical activity has a significant relationship with nutrition practices, which in turn affects nutritional status (Suryadinata & Sukarno, 2019). Physical activity is a component of balanced nutrition behavior, playing a role in nutrient balance and calorie burning (Rajuni & Riyadi, 2015).

The Effect of Physical Activity and tele-nutrition counselling on KAP Changes Before and After Intervention in the Intervention Group

The intervention group exhibited significant improvements in all three components of KAP: nutrition knowledge ($p = 0.009$), nutrition attitude ($p = 0.021$), and nutrition practice ($p = 0.000$) as evidenced by the increase in average scores across all variables. These findings align with previous studies indicating that nutrition counseling positively impacts dietary behavior by providing personalized, interactive education (Lestantina, Wahyudi, & Yuliantini, 2018). The structured two-way communication in tele-nutrition counseling allowed respondents to receive tailored information and immediate feedback, reinforcing understanding and motivation (Sukraniti, Taufiqurrahman, & Iwan, 2018). The two-way interaction in tele-nutrition counseling facilitated better engagement by allowing respondents to ask questions, clarify misconceptions, and receive individualized guidance, making the information more relevant and applicable to their daily

lives. Additionally, personalized feedback helped respondents set realistic and achievable goals, reinforcing positive behavior changes over time.

Nutrition attitudes and practices have a positive relationship with nutrition knowledge. As nutrition knowledge increases, an individual's attitude toward nutrition also improves (Parapat, Melani, Wahyuni, Nuzrina, & Sitoayu, 2021). This is consistent with the findings of this study, as there were significant differences in nutrition attitude and practice scores before and after the intervention, attributed to the increase in average nutrition knowledge scores in the intervention group after receiving tele-nutrition counselling and physical activity interventions. The structured content of the counselling, likely played a role in translating knowledge improvements into better attitudes and practices. This study found that tele-nutrition counselling and physical activity contribute to enhancing knowledge, attitude, and nutrition practices in obese adults.

While the results indicate a positive effect, it is important to consider that other potential confounding factors may have influenced the outcomes. These include baseline health status, variations in dietary habits outside the intervention, socio-economic status, and differences in access to healthy food options. Future studies should control for these variables to strengthen the internal validity of findings.

Difference in the Effect of Intervention Between the Intervention Group and the Control Group

This study also analyzed the differences in knowledge, attitude, and practice between the two groups after the intervention. A significant difference was observed in nutrition knowledge between the two groups ($p = 0.023$), with the intervention group demonstrating an increase in scores while the control group exhibited a decline. This emphasizes the role of structured counselling in reinforcing knowledge and preventing regression due to lack of reinforcement. This occurred because the respondents in the control group did not receive nutrition counselling, a two-way communication process aimed at helping respondents recognize and address their nutritional issues. As a result, there was no improvement in their knowledge, attitude, or behavior in managing a proper diet (Sukraniti et al., 2018).

However, no significant differences were found in nutrition attitude ($p = 0.116$) and nutrition practice ($p = 0.213$) between the groups, indicating that while knowledge was successfully improved, attitude and practice changes were less pronounced. This supports findings from previous study which suggest that increased knowledge alone does not always translate into behavioral change (Hestuningtyas & Noer, 2014).

The Wilcoxon test within the intervention group showed a significant improvement in knowledge, attitudes, and practices. When comparing the pre-post delta changes between groups using an independent t-test, only knowledge showed a significant difference, whereas attitudes and practices did not differ significantly between the two groups.

These results suggest that while nutritional counselling effectively enhances knowledge, its impact on attitudes and practices may vary due to factors such as individual behavioural responses, sample variability, etc. Furthermore, although the sample size was determined based on a minimum sample calculation, it remains relatively small, making it difficult for the independent t-test to detect significant differences despite an observed increasing trend. Additionally, the independent t-test compares the mean difference between groups, and if one group exhibits high variability, where some individuals show significant changes while others do not, the standard deviation increases, reducing statistical significance. In contrast, the Wilcoxon test within groups is more sensitive in detecting changes, as it compares individuals to their own baseline.

In the other hands, changes in attitude and practice sometime require longer-term reinforcement and environmental support. Factors such as peer influence, accessibility to healthy food, and individual readiness to change may have influenced the results. Future studies should incorporate longer intervention periods and follow-up assessments to determine whether sustained engagement leads to more significant behavior change.

Implications for Public Health

The findings suggest that integrating physical activity and tele-nutrition counselling into public health strategies can be an effective approach to improving nutrition knowledge, attitudes, and practices, particularly among young adults at risk of obesity. Public health programs should prioritize these interventions to address the growing issue of poor dietary habits and inactivity, especially among students. The use of tele-nutrition counselling allows for personalized, two-way communication, making it easier for individuals to understand and adopt healthier behaviour. This approach can be scaled up to reach a broader population, leveraging technology to overcome barriers such as time and accessibility. Ultimately, promoting balanced nutrition and regular physical activity through these interventions could significantly reduce the prevalence of obesity and its related health complications. Previous study showed that tele-nutrition education can increase physical activity level, reduction in body weight, energy adequacy, fat adequacy and improve food group diversity score (Bwar, Kriengsinyos, Tapanee, & Prachansuwan, 2024; Prasetyo, Khoiriani, Wicaksari, & Ramadhan, 2025).

However, while statistical significance was achieved, effect sizes and practical significance should also be considered in future research to assess the real-world impact of these interventions.

Limitations and Cautions

This study had several limitations that should be considered. First, the sample size was relatively small, with only 56 respondents completing the program, which may limit the generalizability of the findings to a broader population. A larger sample would enhance the statistical power and reliability of conclusions. Second, the duration of the intervention, particularly for tele-nutrition counselling, was short, and a longer intervention period might yield different results in terms of sustained behaviour change. Third, the focus on a single geographic area (Banyumas Regency) may limit the applicability of the findings to other regions with different socio-economic conditions. Lastly, the study did not account for potential confounding factors such as participants' baseline motivation or external support systems, which could have influenced the outcomes. Caution is advised when interpreting the results, especially in translating these findings to larger or more diverse populations. To improve internal validity, future studies should implement a more rigorous design, including randomized controlled trials with longer follow-up periods.

Recommendations for Future Research

Future studies should consider a larger and more diverse sample size to enhance the generalizability of the findings. Extending the intervention duration may provide better insights into the long-term effects of tele-nutrition counselling and physical activity on nutrition knowledge, attitudes, and practices. Additionally, incorporating more objective measures of nutrition behaviour, such as dietary intake or physical activity monitoring, could reduce potential bias from self-reported data. Lastly, exploring the role of other factors, such as social support or motivation, may help to understand the broader influences on nutritional behaviour change.

Conclusion

In conclusion, there was an effect of the intervention on nutritional practices in both groups. The intervention had an effect on the nutritional knowledge and attitudes of the intervention group but not in the control group. There was a difference in the effect of the intervention on knowledge, but no difference in the effect on attitudes and nutritional practices between the two groups

Conflicts of interest

The authors declare that there are no conflicts of interest.

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Author's contribution statement

Teguh Jati Prasetyo initiate the research idea and proposal; Teguh Jati Prasetyo, Aqilah Arum Pramesti, Katri Andini Surijati and Arfin Deri Listiandi carried out the intervention. Gumintang Ratna and Afina Rachma Sulistyaning helped supervised the project. Izzati Nur Khoiriani, Sifa Aulia Wicaksari and Aqilah Arum Pramesti worked out technical details, and performed the statistical analysis. All authors provided critical feedback and helped shape the research, analysis and manuscript.

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