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Original Research Article

BODY MASS INDEX VARIATION OF THE NURSING OFFICERS IN A TERTIARY CARE INSTITUTE OF NORTH INDIA: BEFORE AND AFTER INTERVENTION STUDY

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ABSTRACT

Background: Overweight and obesity have emerged as major global public health concerns, contributing significantly to the burden of non-communicable diseases such as cardiovascular disorders, and diabetes mellitus. Healthcare professionals, particularly nursing officers, play a crucial role in promoting healthy behaviors among patients. However, paradoxically, they themselves are often unable to maintain optimal health standards due to demanding work environments.

Materials and Methods: This was a Quasi-experimental before–after interventional study conducted over a period of four months with sample size was calculated for a pre–post study design using the formula $n= (Z_{\alpha/2}+ Z_{\beta})^2*\sigma^2/\Delta^2$ 105 subjects were included in the study. Appropriate statistical tests were used for calculation of various parameters.

Results: After the intervention the proportion of obese participants (BMI≥25 kg/m^2) reduced from 33.92% to 27.68% and participants having normal BMI (18.5 - 22.9 kg/m^2) increased from 33.04% to 40.18%, but the change is not statistically significant.

Conclusion: In conclusion, the mobile health education intervention acts as a feasible strategy resulted in a statistically significant decrease in BMI among nursing officers.

Keywords: Obesity, Health education, Healthy behavior.

INTRODUCTION

Overweight and obesity have emerged as major global public health concerns, contributing significantly to the burden of non-communicable diseases such as cardiovascular disorders, and diabetes mellitus.[1] The prevalence of increased body mass index (BMI) is rising not only in the general population but also among healthcare workers.[2] Nursing officers often experience irregular work schedules, occupational stress, and limited time for healthy lifestyle practices. These factors predispose them to unhealthy dietary habits, physical inactivity, and subsequent weight gain, thereby affecting both their personal health and professional productivity.[3,4]

Healthcare professionals, particularly nursing officers, play a crucial role in promoting healthy behaviors among patients. However, paradoxically, they themselves are often unable to maintain optimal health standards due to demanding work environments. This highlights the need for targeted

interventions aimed at improving their lifestyle behaviors and anthropometric outcomes, including BMI.[5]

Over the past decade, mobile health (mHealth) interventions have gained increasing attention as innovative, scalable, and cost-effective strategies for health promotion. The widespread availability of mobile phones has made mHealth interventions particularly suitable for delivering continuous health education and lifestyle modification support across diverse populations.[6] Evidence suggests that mHealth-based interventions can positively influence health behaviors such as diet, physical activity, and self-monitoring.[7,8]

Although obesity-related interventions are traditionally targeted at overweight and obese individuals, preventive strategies aimed at maintaining optimal body mass index (BMI) and promoting healthy lifestyle behaviors are equally important.[9] Nursing officers serve as role models for patients, and improving their health behaviors may have a positive influence on patient care and health promotion practices. Therefore, the present study aims to assess the effect of a mobile health education intervention on body mass index by increasing physical activity among nursing officers in a tertiary care institute in North India.

MATERIALS AND METHODS

Study Design and study setting

This is a Quasi-experimental before–after interventional study conducted over a period of four months from August 2024 to November 2024. This study was conducted among nursing officers working at a tertiary care institute of Haryana, India.

Sample Size

The sample size was calculated for a pre–post study design using the formula $n= (Z_{\alpha/2}+ Z_{\beta})^2*\sigma^2/ \Delta^2$, Where, n = required sample size, $Z_{\alpha/2}$ = standard normal deviate corresponding to the desired level of significance, Z_{β} = standard normal deviate corresponding to the desired power, σ = standard deviation of the difference in the outcome variable before and after the intervention and Δ = expected mean difference between pre- and post-intervention values.[10]

The expected mean difference was taken as 1.20 based on a previously published meta-analysis comparing intervention and control groups, which reported a 95% confidence interval (CI) of −1.95 to −0.46.[11] The standard error (SE) was derived from the CI using the formula SE= (Upper−Lower limit)/ (2×1.96), yielding an SE of 0.38.[12] With equal group sizes (n = 120 per group) in the meta-analysis, the pooled standard deviation (SD) was estimated as 4.16. For the paired design, the SD of the change was approximated by incorporating a correlation coefficient of 0.5 between pre- and post-intervention measurements, resulting in an SD of 4.16.

Using a two-sided alpha of 0.05 and 80% power, Δ = 1.20 and SD as 4.16, the required sample size was calculated using above-mentioned formula, which yielded a minimum sample size of 95 participants. After accounting for a potential 10% attrition rate, the final sample size was adjusted to 105 participants.

Study Participants: Nursing officer working in the tertiary care hospital on either regular or contractual basis.

Inclusion Criteria

Those who had a working smartphone and were willing to install the application in their phone were included in the study.

Exclusion Criteria

Those who didn't consent for the study and who were not able to walk due to temporary or permanent physical disability. Female participants who were pregnant or got pregnant during the intervention were also excluded from the study.

Sampling Strategy

As the total number of nursing officers in the institute was 120 and final sample size calculated was 105, we decided to do universal sampling.

Study tools

The study tools used were Google fit application in smartphones, electronic weighing machine, stadiometer, measuring tape, electronic B.P. instrument and a pre-designed, pre-tested semi-structured schedule. This schedule was used to collect data on demographic details, questions related to lifestyle like tobacco and alcohol intake. Google fit is smartphone-based application which measures average number of steps/days. This is a valid and more accurate application to count steps in different populations as compared to wrist worn Actigraphs.[13,14,15]

Height and weight were measured using Stadiometer and digital weighing scale, respectively. Overweight and obesity were assessed by calculating BMI. For the Indian population, BMI 18.5 - 22.9 kg/m^2 was taken as normal, 23 -24.9 kg/m^2 was considered as overweight and ≥25 kg/m^2 was considered as obesity.[16] Waist circumference (WC) was measured at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest. Hip circumference measurement was taken around the widest portion of the buttocks.[17] Central obesity was defined as WC ≥90 cm for men and ≥80 cm for women or waist to hip ratio (WHR) ≥0.85 for women and ≥0.95 for men.[18]

Blood pressure was measured in sitting position on the right arm using Omran automatic blood pressure monitor, after 15 min of rest. Systolic and diastolic blood pressure was taken as the means of two readings taken 5 min apart. Hypertension was defined as the study participants either having raised systolic or diastolic blood pressure (≥140 or ≥90 mmHg, respectively) or taking treatment for hypertension.[19] Current tobacco users were taken as those who were using any form of smokeless or smoked tobacco products at the time of survey. Current alcoholics were those who consumed any form of alcohol. A

person was not considered current tobacco or alcohol user if he/she has left these substances for last one year.

Intervention

The intervention included health education sessions to increase physical activity and were conducted weekly over mobile for 12 consecutive weeks. It was 10 minutes duration and included the following content:

- Why moving matters, every step counts
- Just friendly reminders to increase daily steps
- Simple ideas to increase daily steps:
  - Take the stairs,
  - walk during breaks like lunch break
  - Walk while talking
  - If possible, find your buddy
- Encouragement when they hit their targets
- Safety tips:
  - wear comfortable footwear,
  - maintain proper posture
  - stay hydrated

Data Collection:

The participants were approached through meetings called in four groups on consecutive days to include all nursing officers working in different shifts. The study and its purpose were explained to them. Then written informed consent was taken from all the participants who were willing to participate in the study and were ready to install the said application in their smartphone. Fitness application (Google Fit) was installed on the smartphones of those who consented for it.

After this, the participants were interviewed individually in next 1 week at their convenient time (mostly after their shift ended) by the investigator using interview technique and baseline measurements of weight, height, hip and waist circumference and BP were taken. Physical activity in the form of daily average steps was measured from the readings of the installed application. The participants were asked about the comfortable/convenient time and day (one fixed day in a week) to call over the phone for health education. After the baseline measurement of all eligible participants was complete, intervention was given weekly for next 12 weeks through mobile phones on every Sunday or the fixed day suggested by each participant. If any participant could not attend the call, he/she was called again after an hour and on next day. If any participant was busy at the time of call, he/she was asked a convenient time to call again. Follow-up data was collected within one week of completion of health education intervention to see the changes in the physical activity level, weight and body mass index using the same study tools and parameters.

Statistical Analysis

Collected data was entered in the MS Excel spreadsheet, coded appropriately and later cleaned for any possible errors. Categorical data was presented as frequency and percentages (%). Normality of quantitative data was checked using a histogram, Q-Q plot, skewness, and kurtosis. Normally distributed data was presented as means and standard deviations. Paired T- test was used to compare means of quantitative variables before and after intervention. All tests were performed at a 5% level of significance; thus, an association is significant if the p value was less than 0.05.

Ethical Clearance

Ethical approval was obtained from the Institutional Ethical Committee of the Medical College with approval number SABVGMC/ IEC/ 2024/03 dated 29/05/2024. The study was conducted in accordance with the ICMR National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017) and the principles of the Declaration of Helsinki. The study adhered to the ICMR the New Drugs and Clinical Trials Rules (2019), where applicable. Informed consent was obtained from the participants before data collection. The participants were explained the aims of the study, their rights regarding participation in the study and the confidentiality of their responses before the study was started.

RESULTS

Total 120 nursing officers were posted to the study hospital, out of which baseline data of 112 could be collected. The reasons for exclusion at the baseline were pregnancy (3), long leaves or deputation (4) and temporary disability due to accident (1). All other participants consented for the study, and all had smartphones. There was no dropout and all participants completed the intervention. Of the total 89.3% (100) participants attended all calls (12) and rest attended 10 or 11 calls of the health education intervention.

All study participants belonged to Hindu religion. Most of them were females (91.1%) and married (96.4%). None of them were separated, divorced or widowed. About two thirds of the participants were 35 years or less and the mean age of study participants was 32.95 ± 5.45. Mean family income was 165580.35 ± 66,937.85 Rs. Of the total, 4.4% of participants were current tobacco users and nearly 9% were current alcohol users. [Table 1]

Baseline anthropometric and physiological parameters of the study participants is described in Table 2. Average step count among study participants increased from baseline of 3030.00 ± 1424.51 to 3360 ± 1393.40 after the intervention which was statistically significant (p value- 0.041, paired T-test). Likewise, mean weight of participants reduced significantly from 64.46 ± 8.22 to 62.43 ± 8.39 (p value- 0.023)

Body mass index (BMI) decreased significantly from 24.62 ± 2.83 to 23.79 ± 2.42 after the intervention. On stratified analysis, BMI was significantly decreased before and after intervention among females, those more than 35 years of age, married,

having family members less than or equal to four, belonging to SC/ST (Scheduled caste/ Scheduled tribes) community, family income ≤1,00,000 Rs and not currently using tobacco or alcohol. [Table 3]

After the intervention the proportion of obese participants (BMI≥25 kg/m^2) reduced from 33.92% to 27.68% and participants having normal BMI (18.5 - 22.9 kg/m^2) increased from 33.04% to 40.18%, but the change is not statistically significant. [Table 4]

Table 1: Details of demographic and substance abuse among study participants (n = 112)

Variables		Frequency (Percentage)
Gender	Male	10 (8.9%)
	Female	102 (91.1%)
Age group	≤35 years	73 (65.2%)
	>35 years	39 (34.8%)
Marital Status	Married	108 (96.4%)
	Unmarried	04 (3.6%)
No. of Family members	≤4	67 (59.8%)
	>4	45 (40.2%)
Caste	General	83 (74.1%)
	SC/ ST	13 (11.6%)
	Other Backward Class	16 (14.3%)
Family income	≤1,00,000	53 (47.3%)
	>1,00,000	59 (52.7%)
Current Tobacco users	Yes	05 (4.4%)
	No	107 (95.6%)
Current Alcohol Users	Yes	10 (8.9%)
	No	102 (91.7%)

Table 2: Details of baseline anthropometric and physiological parameters among study participants

Variables	Mean ± SD
Average no. of daily step count	3030.00 ± 1424.51
Weight (in kg)	64.46 ± 8.22
BMI (kg/m2)	24.62 ± 2.83
Hip circumference (inch)	38.22 ± 2.88
Waist circumference (inch)	30.62 ± 2.43
Systolic BP (mmHg)	120.98 ± 5.36
Diastolic BP (mmHg)	80.05 ± 4.00

Table 3: Effect of intervention on the BMI of study participants on stratified analysis

Variables		BMI		
		Before Intervention (Mean ± SD)	After Intervention (Mean ± SD)	P value (Paired T-test)
Total		24.62 ± 2.83	23.79 ± 2.42	0.004
Gender	Male	26.02 ± 1.90	25.87 ± 2.24	0.413
	Female	24.48 ± 2.87	23.58 ± 2.35	0.004
Age group	≤35 years	24.03 ± 3.14	23.27 ± 2.46	0.064
	>35 years	25.72 ± 1.66	24.76 ± 2.05	0.001
Marital Status	Married	24.73 ± 2.81	23.79 ± 2.41	0.001
	Unmarried	21.56 ± 0.54	23.79 ± 3.11	0.182
No. of Family members	≤4	24.58 ± 2.76	23.88 ± 2.16	0.010
	>4	24.68 ± 2.95	23.65 ± 2.78	0.082
Caste Category	General	24.39 ± 2.85	23.82 ± 2.32	0.078
	SC/ ST	25.84 ± 3.44	22.73 ± 2.66	0.002
	Other Backward Class	24.80 ± 1.90	24.49 ± 2.61	0.602
Family income	≤1,00,000	24.74 ± 3.53	23.48 ± 2.57	0.007
	>1,00,000	24.51 ± 2.02	24.06 ± 2.26	0.196
Current Tobacco Users	Yes	24.75 ± 2.81	23.99 ± 2.27	0.070
	No	21.75 ± 0.96	19.42 ± 1.18	0.009
Current Alcohol Users	Yes	24.13 ± 2.23	23.51 ± 2.38	0.070
	No	24.66 ± 2.88	23.81 ± 2.43	0.006

Table 4: Effect of intervention the category of BMI of the study participants

		After Intervention				
	BMI Category	**Normal**	**Overweight**	**Obese**	**Total**	**P value**
Before Interventions	**Normal**	23	09	05	37 (33.04%)	**0.513 (McNemar Bowker' Test)**
	Overweight	12	16	09	37 (33.04%)	
	Obese	10	11	17	38 (33.92%)	
	Total	45 (40.18%)	36 (32.14%)	31 (27.68%)	112	

DISCUSSION

This study demonstrates that a mobile health (mHealth) education intervention can lead to significant improvements in physical activity and anthropometric outcomes among nursing officers. A significant reduction in both body weight and body mass index (BMI) was observed after the intervention. The magnitude of BMI reduction (approximately 0.8 kg/m²) aligns with findings from previous mHealth and lifestyle intervention studies, which have reported modest yet statistically significant decreases in BMI.[11,20] Although the absolute reduction appears small, such changes are considered meaningful at the population level and are associated with reduced risk of non-communicable diseases.[21,22] These findings support the role of mHealth educational interventions as an effective tool for facilitating behavior change leading to weight reduction.

A significant reduction in BMI was observed among participants aged more than 35 years. This finding suggests that with increasing age, nursing officers may be more responsive to lifestyle interventions, possibly due to increased health awareness, greater perceived susceptibility to non-communicable diseases, and higher motivation to adopt healthy behaviors.[23] Married participants showed significant improvement compared to unmarried participants. Social support within marital relationships may contribute to greater adherence to lifestyle modification behaviors, as family encouragement is known to influence physical activity engagement in adults.[24,25] Participants with four or fewer family members demonstrated significant decreases in BMI, whereas those with larger families did not. This may reflect reduced domestic responsibilities and time constraints among individuals with smaller households, allowing greater opportunities for engagement in physical activity and hence reduction in BMI.[26]

Similarly, participants with lower family income and those belonging to SC/ST community showed significant reduction which may reflect. It might also be due to higher baseline value or increased susceptibility to illness or differences in responsiveness to lifestyle interventions, as reported in earlier studies.[27,28] Socioeconomic disparities in physical activity patterns have been documented globally, with lower-income groups often reporting lower baseline activity levels. Structured behavioral guidance may particularly benefit individuals who may not otherwise prioritize leisure-time physical activity.[29,30] Non-alcohol and non- tobacco users exhibited significant reduction in BMI as health behaviors often cluster together, and individuals engaging in one healthy behavior are more likely to adopt others.[31] The high adherence to the intervention supports the feasibility and acceptability of mHealth approaches among healthcare professionals. Mobile-based delivery offers flexibility and sustained engagement, which are critical in populations with demanding work schedules.

Strengths and Limitations

The study has several strengths, including complete follow-up, high adherence to intervention calls, and objective measurement of step count reflecting physical activity. However, certain limitations should be acknowledged. The predominantly female and homogeneous religious composition of the sample restricts generalizability. Additionally, the short duration of follow-up does not permit assessment of long-term sustainability of behavior change. Information on other forms of physical activity was not collected, which may represent a potential confounding factor and could have affected the observed study outcomes.

CONCLUSION

In conclusion, the mobile health education intervention acts as a feasible strategy resulted in a statistically significant decrease in BMI among nursing officers. BMI reduction is statistically significant among females, those more than 35 years of age, married, having family members less than or equal to four, belonging to SC/ST community, family income ≤1,00,000 Rs and not currently using tobacco or alcohol. Future studies employing randomized controlled designs and longer follow-up periods are recommended to evaluate sustained impact of the intervention.

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