



## Original Article

# Effect of patient education on metabolic syndrome components among females in Zagazig University outpatient clinics, Egypt: An intervention study

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## ABSTRACT

**Background:** Metabolic syndrome (MS) is a major health problem worldwide. This study aimed to assess the effectiveness of lifestyle modification regarding MS components among adult females.

**Methods:** An intervention study performed on 120 adult females with MS (60 intervention and 60 controls) selected randomly from Zagazig University outpatient clinics. Intervention group received patient education program while controls received traditional management. MS components were compared with three months interval representing Pre-Post follow up results.

**Results:** Two groups showed significant improvement in all MS components but mean change was significantly higher in intervention group. Three months follow up demonstrated that 63.4% of intervention group had reversal of their MS versus 15% of control group.

**Conclusion:** Patient education improved all MS components and considered significantly more effective than traditionally adopted management. So, we recommend its application on all MS patients.

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## 1. Introduction

Metabolic syndrome (MS) is group of abnormalities including obesity, hyperglycemia, dyslipidemia, and hypertension, which increases the risk of cardiovascular diseases (CVD) and diabetes mellitus (DM) [1], with two and five fold risk respectively [2,3].

Worldwide prevalence of MS increases vastly in parallel with high caloric diet, inactive lifestyle, and increasing obesity. Egyptian prevalence among males, females, and total population was 38.7%, 46.2%, and 42.5%, respectively [4].

High prevalence of MS among Middle East population (15–60%) and its related risks require national and international prevention programs [5].

The lifestyle intervention through Diabetes Prevention Program among MS patients made significant risk decline greater than in

placebo and metformin groups. Also, this intervention had reversal effect on 38% of MS patients selected randomly [6].

This study aimed to assess the effectiveness of lifestyle modification regarding MS components among adult females.

## 2. Material and methods

### 2.1. Study Design&Setting

An intervention study conducted in Zagazig university internal medicine outpatient clinics from July 2015 to February 2017.

#### 2.1.1. Patients

This study performed on MS patients [7] with the following inclusion criteria:

- Adult female (18–<65 years).
- Central Obesity; optimal Egyptian waist circumference (WC) cutoff for females was 96.25 cm [4].

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- Triglycerides (TG)  $>150$  mg/dl or therapy, High density lipoprotein (HDL)  $<50$  mg/dl in women or treatment, Systolic blood pressure (SBP)  $\geq 130$  mmHg or diastolic blood pressure (DBP)  $\geq 85$  mmHg or treatment, Fasting blood glucose (FBG)  $> 100$  mg/dL or previously diagnosed DM.
- Patients' pharmacological treatment not changed during the study.

### 2.1.2. Sample Size & Technique

One hundred and twenty females (60 intervention and 60 controls) calculated using epi6 program with power 80%, confidence interval (CI) 95%, and effect size 35%. The sample frame consisted of list of all clinic attendants fulfilling inclusion criteria then random selection of 120 patients from basket of random numbers who were randomly allocated into intervention or control groups by picking paper marked "IN" or "CON".

### 2.1.3. Intervention methods

The intervention started by patient interview with average 20–30 min for questionnaire filling, physical examination and ordering investigations.

Then the patients were divided into intervention and control groups; investigations were done at the start and three months post intervention to compare outcome of both groups.

**2.1.3.1. Data collection.** Clinical parameters: height (m), weight (kg), body mass index (BMI), WC (cm), SBP and DBP (mm Hg).

Laboratory tests: Total cholesterol (mg/dl), TG (mg/dl), HDL (mg/dl), Low density lipoprotein (LDL) (mg/dl), and FBG (mg/dl) levels.

**2.1.3.2. Patient education tools.** Personalized education in form of message included MS definition, risks, and relationships between diet, physical activity, fat levels, blood glucose, body weight, blood pressure, and CVD risk. Dietary education included general advice about healthy diet, changing eating habits, self-monitoring, and stimulus control.

Individualized low caloric diet had been done according to patient weight, clinical and laboratory data, level of activity and personal preferred foods.

Education in physical activity area focused on the needs to reduce sedentary lifestyle and increase physical activity (brisk walking at least 30 min three-five days/week).

A more active lifestyle was encouraged through changing daily activities (e.g., walking instead riding, stairs instead escalators/elevators, public transportation instead private car).

Following verbal education, printed summary diet plan and follow-up card were designed and given to intervention group patients.

### 2.1.4. Outcome measures

Difference between patient centered lifestyle modification and traditional management on MS components: WC, SBP, DBP, TG, HDL, and FBG levels.

### 2.1.5. Statistical design

Statistical Package for Social Science software (version 22, SPSS Inc., Chicago, IL) was used for data management and analysis. Mean and standard deviation (SD) described quantitative data. Mixed model ANOVA was used with repeated measures analysis to account time and group effect (interaction) Pairwise testing was done using paired and independent *t*-test with Bonferroni adjustment to number of comparisons. Mean difference with 95% CI described change in each group.

Data measured on ordinal scale or distribution-free data median

with range described data with non-parametric *t*-test for dependent and independent groups made comparisons with downward adjustment of alpha for number of comparisons. (*P value*  $\leq 0.05$ ) was significant.

### Ethical approval

Official permissions were obtained from family medicine department at Zagazig University, the director of outpatient clinics and the scientific ethical committee of college. Informed written consents were obtained from all patients.

## 3. Results

The studied groups were matched in socio-demographic characters with no statistically significant differences between them in all baseline clinical parameters and laboratory tests. Significant improvement had been noticed in both groups regarding all clinical parameters and laboratory tests with statistically significant differences between both groups at the end of study.

Final follow up showed 63.4% of intervention group had reversal of their MS versus 15% of control group. Baseline median score and range were similar in both groups. Though median score significantly dropped in both groups, it was more significant in intervention group [Fig. 1].

WC, SBP, TG, and FBG dropped significantly in both groups and the mean drop of them were significantly higher in intervention group than controls. However, HDL increased significantly in both groups and the mean increase was significantly higher in intervention group compared with controls [Table 1].

## 4. Discussion

### 4.1. Summary

The current study demonstrated significant improvement among intervention group regarding body weight, WC, and other cardiometabolic factors, and significant reversal in MS components. The control group had significant improvements as well as an expected effect of medical treatment.

### 4.2. Strengths

The study highlights that the lifestyle modification education is cornerstone in MS prevention and control.

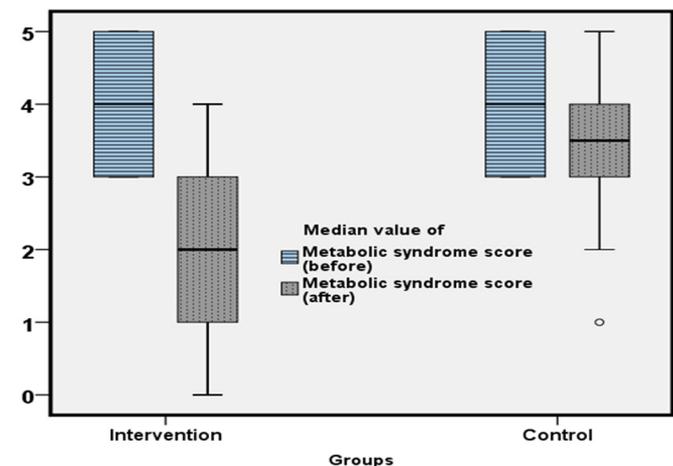


Fig. 1. Metabolic syndrome score (Pre-Post) follow up among intervention and control groups.

**Table 1**

Waist circumference (WC), Systolic blood pressure (SBP) High density lipoprotein (HDL), Triglycerides (TG), and Fasting blood glucose (FBG) among intervention and control groups (Pre-Post) follow up.

WC	Intervention (n = 60)		Control (n = 60)		*P value For effect of intervention	*P value for treatment & group interaction
	Pre	Post	Pre	Post		
Mean ± SD**	116.88 ± 14.29	107.33 ± 13.50	115.63 ± 8.90	113.68 ± 8.64	< 0.001	< 0.001
Mean change with 95% CI	9.55 (8.72–10.38)		1.95 (1.64–2.26)			
SBP	Pre	Post	Pre	Post		
Mean ± SD	133.50 ± 19.45	119.67 ± 13.50	133.50 ± 11.87	128.42 ± 11.29	< 0.001	< 0.001
Mean change with 95% CI	13.83 (10.87–16.78)		5.08 (3.71–6.46)			
HDL	Pre	Post	Pre	Post		
Mean ± SD	39.57 ± 7.61	44.98 ± 7.77	37.20 ± 8.98	38.48 ± 8.99	< 0.001	< 0.001
Mean change with 95% CI	5.42 (4.49–6.35)		1.28 (0.92–1.65)			
TG	Pre	Post	Pre	Post		
Mean ± SD	178.35 ± 55.67	130.58 ± 32.86	190.58 ± 60.71	182.43 ± 60.27	< 0.001	< 0.001
Mean change with 95% CI	47.77 (38.62–56.91)		8.15 (6.41–9.89)			
FBG	Pre	Post	Pre	Post		
Mean ± SD	116.12 ± 35.70	97.83 ± 15.79	117.22 ± 30.82	110.90 ± 27.56	< 0.001	< 0.001
Mean change with 95% CI	18.28 (12.45–24.12)		6.32 (4.21–8.43)			

\*P ≤ 0.05 considered significant \*\*Standard Deviation.

#### 4.3. Limitations

- It would be better to include newly diagnosed cases avoiding pollution by previous management.
- Attention effect in intervention group couldn't be ignored.
- Results couldn't be generalized as it was done in single center.

#### 4.4. Comparison with existing literature

Present results agreed with many studies that showed lifestyle modifications education improves all MS components [8–11].

Body weight and BMI were significantly reduced (12.4 kg and  $-4.9 \text{ kg/m}^2$ ) respectively in intervention group compared with controls ( $P < 0.001$ ). Similarly, Egyptian study on adult MS women showed that significant reduction in body weight and BMI three months after intervention on a low-calorie diet and exercise [12].

Although WC after intervention was still high, intervention group showed significant drop ( $P < 0.001$ ) than in control group. This drop is of significant importance as each one cm increase in WC proved to be associated with two% increase in future CVD risk [13].

Current results also demonstrated significant decrease in blood pressure and significant improvement in HDL, TG in intervention group compared to baseline and to controls.

Regarding the drop in % diagnosed with MS was more significant ( $P < 0.001$ ) in intervention group (36% versus 85% in controls) with significant reduction of metabolic risks number in intervention group ( $P < 0.001$ ) compared to controls. In consistent with Wang et al., study in which lifestyle intervention proved to be effective in losing weight and improving quality of life of MS populations in three months observation [14].

Regarding body weight and BMI findings, they were slightly different from Mujica et al., who observed that weight and BMI reduction were 3.9 kg and  $1.6 \text{ kg/m}^2$  respectively from initial findings with significant difference. This may be attributed to baseline weight and body composition of studied populations. Also, they reported significant WC drop by 11 cm in intervention group and 50% of them achieved significant reversion of MS, but prevalence reduction was as controls [15].

Dunnand et al., mentioned significant reduction in abdominal

adiposity and WC in intervention group compared with controls after 12-week lifestyle intervention. Additionally, they showed that glucose did not change significantly between groups but Fasting plasma insulin significantly decreased in intervention group by 34% [16].

Also, in accordance with Saboya et al., results which showed significant SBP reduction after 12-week [17].

Systematic review about lifestyle modification found that significant FBG decrease that was consistent with current results [18].

Additionally, in matching with Korean intervention study in which MS prevalence decreased to 38.1% in intervention group and 52.4% in controls with ( $P = 0.046$ ) [19].

Other studies results also demonstrated positive relationship between lifestyle change and MS symptoms reduction [9,20]. Structured educational programs, aimed at increasing physical activity and improving eating habits had clear impact on MS improvement [15,21]. Fappa et al., evaluated lifestyle intervention effectiveness by exploring patients' adherence to the recommendations, they found greater adherence correlated with greater improvements in MS components [8].

## 5. Conclusion

Patient education improved all MS components and considered significantly more effective than traditionally adopted management. So, we recommend its application on all MS patients.

### Author contributions

All the above mentioned authors met all the criteria for authorship contribution of the International Committee of Medical Journal Editors (ICMJE).

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## Conflicts of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## References

- [1] Grundy SM, Brewer HB, Cleeman JI, Smith SC, Lenfant C. Definition of metabolic syndrome. *Circulation* 2004;109(3):433–8.
- [2] Grundy SM. Pre-diabetes, metabolic syndrome, and cardiovascular risk. *J Am Coll Cardiol* 2012;59(7):635–43.
- [3] Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: joint scientific statement. *Circulation* 2009;120(16):1640–5.
- [4] Assaad-Khalil S, Mikhail M, Aati T, Zaki A, Helmy M, Megallaa M, et al. Optimal waist circumference cutoff points for the determination of abdominal obesity and detection of cardiovascular risk factors among adult Egyptian population. *Indian J Endocrinol Metab* 2015;19(6):804.
- [5] Sliem HA, Ahmed S, Nemr N, El-Sherif I. Metabolic syndrome in the Middle East. *Indian J Endocrinol Metab* 2012;16(1):67–71.
- [6] Orchard TJ, Temprosa M, Goldberg R, Haffner S, Ratner R, Marcovina S, et al. The effect of metformin and intensive lifestyle intervention on the metabolic syndrome: the diabetes prevention program randomized trial. *Ann Intern Med* 2005;142(8):611–9. <https://doi.org/10.7326/0003-4819-142-8-200504190-00009>.
- [7] International Diabetes Federation. The IDF consensus worldwide definition of the metabolic syndrome [internet]. 2015 [Available from: The IDF Consensus Worldwide Definition of the Metabolic Syndrome].
- [8] Fappa E, Yannakoulia M, Pitsavos C, Skoumas I, Valourdou S, Stefanadis C. Lifestyle intervention in the management of metabolic syndrome: could we improve adherence issues? *Nutrition* 2008;24(3):286–91. <https://doi.org/10.1016/j.nut.2007.11.008>.
- [9] Kastorini C-M, Milionis HJ, Esposito K, Giugliano D, Goudevenos JA, Panagiotakos DB. The effect of mediterranean diet on metabolic syndrome and its components: a meta-analysis of 50 studies and 534,906 individuals. *J Am Coll Cardiol* 2011;57(11):1299–313.
- [10] Kesse-Guyot E, Ahluwalia N, Lassale C, Hercberg S, Fezeu L, Lairon D. Adherence to Mediterranean diet reduces the risk of metabolic syndrome: a 6-year prospective study. *Nutr Metabol Cardiovasc Dis* 2013;23(7):677–83. <https://doi.org/10.1016/j.numecd.2012.02.005>.
- [11] Babio N, Bulló M, Basora J, Martínez-González MA, Fernández-Ballart J, Márquez-Sandoval F, et al. Adherence to the Mediterranean diet and risk of metabolic syndrome and its components. *Nutr Metabol Cardiovasc Dis* 2009;19(8):563–70. <https://doi.org/10.1016/j.numecd.2008.10.007>.
- [12] Ahmed MM, Rahmy AF, Abo Elfadl SA. Effect of lifestyle intervention program on metabolic syndrome in obese women [Internet]. *Bull Fac Ph Th Cairo*; 2013 [cited 2018 Jul 27];18(1). Available from: <http://www.lib.pt.cu.edu.eg/10-Magdy>.
- [13] de Koning L, Merchant AT, Pogue J, Anand SS. Waist circumference and waist-to-hip ratio as predictors of cardiovascular events: meta-regression analysis of prospective studies. *Eur Heart J* 2007;28(7):850–6. <https://doi.org/10.1093/eurheartj/ehm026>.
- [14] Wang Q, Chair SY, Wong EM-L. The effects of a lifestyle intervention program on physical outcomes, depression, and quality of life in adults with metabolic syndrome: a randomized clinical trial. *Int J Cardiol* 2017;230:461–7. <https://doi.org/10.1016/j.ijcard.2016.12.084>.
- [15] Mujica V, Urzúa A, Leiva E, Díaz N, Moore-Carrasco R, Vásquez M, et al. Intervention with education and exercise reverses the metabolic syndrome in adults. *J Am Soc Hypertens* 2010;4(3):148–53. <https://doi.org/10.1016/j.jash.2010.02.008>.
- [16] Dunn S, Boutcher SH, Freund J, Siu W. The effect of a lifestyle intervention on metabolic health in young women. *Diabetes, Metab Syndr Obes Targets Ther.* 2014;2014:437–44. <https://doi.org/10.2147/DMSO.S67845>.
- [17] Saboya PP, Bodanese LC, Zimmermann PR, Gustavo A da S, Macagnan FE, Feoli AP, et al. Lifestyle intervention on metabolic syndrome and its impact on quality of life: a randomized controlled trial. *Arq Bras Cardiol* 2017;108(1):60–9.
- [18] Yamaoka K, Tango T. Effects of lifestyle modification on metabolic syndrome: a systematic review and meta-analysis. *BMC Med* 2012;10(1):138. <https://doi.org/10.1186/1741-7015-10-138>.
- [19] Yoo S, Kim H, Cho H-I. Improvements in the metabolic syndrome and stages of change for lifestyle behaviors in Korean older adults. *Osong Public Heal Res Perspect* 2012;3(2):85–93.
- [20] Panupong J, Martina M, Tadaaki H, KB K, Farouk M. The metabolic syndrome and cardiovascular disease: Part I. *Prev Cardiol* 2008;11(3):155–61. <https://doi.org/10.1111/j.1751-7141.2008.07809.x>.
- [21] de Oliveira EP, McLellan KCP, Vaz de Arruda Silveira L, Burini RC. Dietary factors associated with metabolic syndrome in Brazilian adults. *Nutr J* 2012;11(1):13. <https://doi.org/10.1186/1475-2891-11-13>.