

Contents lists available at [ScienceDirect](http://ScienceDirect)

## Preventive Medicine Reports

journal homepage: [www.elsevier.com/locate/pmedr](http://www.elsevier.com/locate/pmedr)

## Short Communication

## The association of Mediterranean diet and exercise modifications with anthropometric parameters in a psychiatric community population: A pilot study

Rosaria Di Lorenzo<sup>a,\*</sup>, Jessica Pedretti<sup>b</sup>, Letizia Grossi<sup>a</sup>, Benedetta Cuoghi<sup>c</sup>, Cinzia Varni<sup>c</sup>, Giulia Landi<sup>d</sup>, Ludovica Spattini<sup>d</sup>, Chiara Visentini<sup>d</sup>, Paola Ferri<sup>e</sup>, Francesca Carubbi<sup>f</sup><sup>a</sup> Mental Health Department, Az. USL-Modena, Italy<sup>b</sup> Nursing Home Cialdini, 41121 Modena, Italy<sup>c</sup> University of Modena and Reggio Emilia, Italy<sup>d</sup> Socio-Rehabilitative Community "La Barca", via Borelle, 176, 41126 Cognento, Modena, Italy<sup>e</sup> School of Nursing, University of Modena and Reggio Emilia, Italy<sup>f</sup> Department of Medicine, Endocrinology, Metabolism and Geriatrics, AOP Modena, University of Modena and Reggio Emilia, Italy

## ARTICLE INFO

## Keywords:

Weight gain and metabolic syndrome  
 Antipsychotic drugs  
 Chronic psychiatric disorders  
 Rehabilitative community  
 Mediterranean diet and mild physical activity

## ABSTRACT

Weight gain and related metabolic syndrome (MS) are major current issues in public health. MS consists of abdominal fat, atherogenic dyslipidemia, hypertension, hyperglycemia, insulin resistance, pro-inflammatory and pro-thrombotic state, and accounts for both cardiovascular diseases and type II diabetes mellitus risk factors. Patients affected by psychiatric illness present a prevalence of 35–40% of MS. Many studies have shown that Mediterranean diet is associated with the reduction of mortality due to cardiovascular and malignant diseases, potentially preventing both obesity and type II diabetes mellitus. Our pilot study explores the effects of a 12-month healthy lifestyle program (Mediterranean diet and mild physical activity) on metabolic and anthropometric parameters of patients affected by chronic psychiatric disorders who live in a psychiatric community facility. A Mediterranean diet was provided by a senior nutritional clinician and adapted by two dietitians, according to the needs and preferences of the community population. Concomitantly, a program of moderate physical activity, consisting in 30-min walks on level ground 4 days a week, and psycho-educational group sessions with educational and therapeutic purposes were implemented. The metabolic and anthropometric parameters of our patients improved after both 6 (T6) and 12 (T12) months. Body Mass Index was statistically significantly reduced at T6 and T12, with patients perceiving good quality of life. These positive outcomes suggest that a low-cost healthy lifestyle program can produce good adherence and feasibility even among patients with chronic psychiatric diseases, reducing their risk for MS, cardiovascular diseases and other complications.

## 1. Introduction

Weight gain and related metabolic syndrome (MS) are major recent issues in public health. The main components of MS are abdominal fat, atherogenic dyslipidemia, hypertension, hyperglycemia, insulin resistance, pro-inflammatory and pro-thrombotic state, accounting for both cardiovascular diseases and type II diabetes mellitus risk factors (Grundy et al., 2004). Patients affected by psychiatric illness present an increased risk for MS if compared with the general population, showing a MS prevalence of 35–40%, further increased in female gender (McEvoy et al., 2005). In particular, the prevalence of obesity, with an unfavorable ratio of lean and fat mass (Saarni et al., 2009), is almost

doubled among patients affected by psychiatric illness compared to the general population (Allison et al., 2009). Although the causes that may increase MS prevalence among patients with chronic psychiatric disorder are not fully known, many risk factors are indicated: altered lifestyle habits induced by psychiatric disorders, high-fat diets, glucose and lipid metabolism alteration induced by antipsychotics, a genetic tendency to accumulate intra-abdominal fat, poor glucose control (Chaggar et al., 2011), hypercortisolemia and related central obesity induced by hypothalamic pituitary abnormalities. This high prevalence of MS is responsible for organic co-morbidities and premature death among patients affected by psychiatric disorders, who present an average life expectancy decreased by 20% (Kilbourne et al., 2009;

\* Corresponding author.

E-mail address: [r.dilorenzo@ausl.mo.it](mailto:r.dilorenzo@ausl.mo.it) (R. Di Lorenzo).<https://doi.org/10.1016/j.pmedr.2017.12.013>

Received 30 March 2017; Received in revised form 7 December 2017; Accepted 20 December 2017

Available online 27 December 2017

2211-3355/ © 2018 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Hennekens, 2007). One of the most important strategies aimed at reducing cardiovascular and diabetics risk consists of an early lifestyle modification through a balanced diet and increased physical activity (Rosenbaum et al., 2014). This strategy combined with or without pharmacological therapy (statins and oral hypoglycemic agents) remains the main goal of primary intervention (Halcox and Misra, 2015). Lifestyle changes can be easily implemented in different cultural and social backgrounds, representing a primary cost-effective intervention in MS prevention. Nevertheless, this approach does not appear feasible in patients with chronic mental illness, who often show low therapeutic compliance (Ratliff et al., 2012), since self-determination in changing lifestyle is necessary (Vancampfort et al., 2013). In particular, it is essential that patients with MS be aware of the benefits gained from lifestyle modification, not only to significantly decrease cardiovascular risks but also to improve their perceived well-being and quality of life (Lin et al., 2014; Kolotkin et al., 2008; Lakka and Laaksonen, 2007). Prospective studies and clinical trials have shown that the Mediterranean diet is associated with a reduction in MS risk factors, preventing increases of waist circumference, systolic and diastolic pressure and sugar, triglyceride and LDL cholesterol blood levels (Kastorini et al., 2011). Mediterranean diet is positively related to health improvement in terms of mortality reduction from cardiovascular and malignant diseases, preventing both obesity and type II diabetes mellitus (Babio et al., 2014).

## 2. Aims

To evaluate the association of Mediterranean diet and mild physical activity on metabolic and anthropometric parameters, and, concomitantly, on quality of life and global functioning of patients with chronic psychiatric illness, residents in a socio-rehabilitative community.

## 3. Methods

The current pilot study explores the effectiveness of a healthy lifestyle program (Mediterranean diet and mild physical activity) over a 12 month period for improving metabolic and anthropometric parameters in patients affected by chronic psychiatric disorders who live in a psychiatric community facility. It represented an intervention aimed at raising awareness for a healthy lifestyle among patients and staff of a community where no other similar programs had ever been implemented previously. This study was approved by the Local Ethical Committee (Prot. 4458) and was conducted over a 1-year period (01/04/2015–1/4/2016).

A Mediterranean diet, which represents a proper nutritional educational model in accordance with the literature (Willett et al., 1995), was provided by a senior nutritional clinician and adapted by two dietitians according to the needs and preferences of community population. The daily diet included proteins (17%), fats (28%), carbohydrates (55%), cholesterol (152 mg/day), fibres (38 g/day) and consisted of fresh vegetables and fruits, beans, nuts, grains and seeds, olive oil as a main source of fats, cheese and yogurt, small amounts of fish and poultry, very small amounts of red meat per week. A percentage of between 25 and 35% of energy source intake was represented by fats, of which only 7% saturated ones. In our study, dietary intake normally consisted in 3 main meals and two snacks provided by the community. Additional food was available and could be purchased by patients at the community café. Only occasionally did patients spend meal time outside the community with their family and friends. The integrated indexes of nutritional assessment were analysed to assess the possible risk of the subjects' malnutrition during the study period. Concomitantly, a program of moderate physical activity was implemented: walking on level ground supervised by the community professionals for 30 min a day, 4 days a week. Psycho-educational group sessions conducted by the two dietitians were implemented with double aims: educational (in

terms of nutrition) and therapeutic (in terms of motivation and relationship with others). These psycho-educational groups met bi-monthly for the first three months, then monthly for the remaining period of the study. In addition, the professionals and the cook working in the community and the co-investigators of this study also participated in group management. The dietitians, during the psycho-educational groups, motivated patients to reduce extra-meal food consumption and involved them in changing their lifestyle. In particular, they suggested that patients rearrange the community café, reducing the availability of most caloric foods, the quantity of food displayed on the shelves, etc.

The sample for this pilot study was collected according to our selection criteria. Inclusion criteria: all patients living in the community during the study period affected by chronic and severe psychiatric diseases and treated with multiple anti-psychotic drugs; they also suffered from organic diseases treated with cardiovascular and metabolic medicines. Exclusion criteria: patients with special dietary needs due to severe organic diseases and patients unable to give a valid and informed consent.

The community where the program was implemented is a psychiatric facility with a maximum of 19 patients who need rehabilitative programs in a residential setting for a long period of time (on average 18 months). The community is managed by 9 professionals in rehabilitative programs, two nurses and a cook, who prepares meals in the community kitchen. Medical and psychiatric treatment is provided by the general practitioner and each Patient's Mental Health Service psychiatrist. Many volunteers and the Patients themselves participate in all rehabilitative activities normally aimed at developing their daily life skills.

For each patient the following variables were selected:

1. Demographic variables collected: age, gender, nationality, marital status, education.
2. Psychiatric variables:
  - psychiatric disorder
  - years of psychiatric illness
  - substance abuse comorbidity
  - psychiatric drug therapy
  - number of admissions in the observation year
3. Organic variables:
  - blood pressure, heart rate and ECG
  - Body Max Index (BMI), waist circumference
  - total cholesterol, LDL, HDL, triglycerides, blood glucose, uric acid, homocysteine and TSH reflex
  - cardiovascular and metabolic therapy.

The mentioned data were collected from patient medical records and Department Health Service clinical information systems and were reported in an Excel database. Additional information was obtained from the psychiatrists who treated the patients.

The following tests were administered to the patients:

- Global Assessment Functioning (GAF), (Rush et al., 2008) at T0 and T6.
- Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962) at T0 and T6.
- EuroQuol-5D (EQ-5D) at T6 and T12 (Brooks et al., 2010).

### 3.1. Statistical analysis

The descriptive statistical analysis and comparison of endpoints between T0, T6 and T12 (mean  $\pm$  standard deviation, paired *t*-test for continuous variables; percentages and Chi2 test for categorical variables) were carried out.

**Table 1**  
Demographic and clinical characteristic of our Patients at T0 (n = 19).

Demographic and clinical characteristics of our population	
<b>Age</b>	<b>m ± SD</b>
Years	66 ± 13.65
<b>Nationality</b>	<b>n (%)</b>
Italians	19 (100%)
<b>Gender</b>	<b>n (%)</b>
Males	8 (42%)
Females	11 (58%)
<b>Schooling</b>	<b>n (%)</b>
Intermediate school	15 (79%)
High School	3 (16%)
Degree	1(5%)
<b>Marital status</b>	<b>n (%)</b>
Single	19 (100%)
<b>Psychiatric Diagnosis (ICD-9-CM)</b>	<b>n (%)</b>
Schizophrenic Disorders	9 (47%)
Personality Disorders	4 (21%)
Bipolar Disorders	3 (16%)
Mental Retardation	3 (16%)
<b>Psychiatric comorbidity (ICD-9-CM)</b>	<b>n (%)</b>
Substance Abuse	3 (16%)
Mental Retardation	3 (16%)
<b>Organic Comorbidity (ICD-9-CM)</b>	<b>n (%)</b>
Patients affected by an organic disease	17 (89%)
<b>Organic comorbidities</b>	<b>n (%)</b>
Metabolic Syndrome	10 (53%)
Anaemia	3 (16%)
Chronic obstructive pulmonary disease (COPD)	3 (16%)
Cholethiasis	3 (16%)
Arthrosis	3 (16%)
Parkinson syndrome and epilepsy	3 (16%)
Cancer	2 (10%)
<b>Period of psychiatric treatment</b>	<b>n (%)</b>
Patients > 10 years for all patients	19 (100%)
<b>Pharmacological therapy</b>	<b>n (%)</b>
Patients with politherapy	19 (100%)
<b>Psychiatric drugs</b>	<b>%</b>
typical antipsychotics	68%
atypical antipsychotics	74%
mood stabilizers	53%
benzodiazepines	74%
antidepressants	5%
<b>Other drug therapies</b>	<b>n (%)</b>
Patients treated with other drugs	16 (84%)
<b>No-psychiatric drugs</b>	<b>n (%)</b>
antihypertensives	(31%)
anti-ulcerans	(31%)
hypolipids	(25%)
antidiabetics	(6%)
<b>Smokers</b>	<b>n (%)</b>
Patients	6 (32%)

#### 4. Results

Our Patients, as shown in Table 1, were affected by severe and chronic psychiatric disorders which had required many previous hospitalizations (some of them were also hospitalized in the psychiatric asylum before its closure in 1978). All Patients were single and earned invalidity benefits. Most of them (89.5%) suffered from one (or more than one) organic disease in comorbidity, treated with multiple drug therapy. Probably due to their life maladjustment conditions, social isolation and severity of their illnesses, they had required admission to the community facility where they lived at the moment of the research. During the course of this study, our population, initially composed of 19 subjects, was reduced to 11 subjects at T12 because two patients died and others were transferred or discharged. At T0, our patients presented a mean BMI of  $29.14 \pm 7.03$ , indicating overweight condition, that showed a statistically significant reduction at T6 and T12 (Table 2). The waist circumference remained almost unchanged at T6 and T12 whereas all metabolic parameters improved either at T6 and/or T12, although without any statistically significant difference. Vital

parameters, blood pressure, heart rate and ECG remained within the normal ranges during the period of the study. The EQ-5D score at T6 and T12 showed a positive perception of life quality; GAF and BRIEF scores remained unchanged at T6 (Table 2). In Table 2, it has been reported paired *t*-test between the parameters of the 15 no dropout patients at T6 vs T0 and between the parameters of the 11 no dropout patients at T12 vs T0 and T6. The psychopharmacology and organic therapy remained almost unchanged at T12 in comparison with the therapies prescribed at T0 (Table 1). During the period of study, two patients needed to be hospitalized in a psychiatric ward for a short period.

#### 5. Discussion

The current pilot study demonstrated good adherence and feasibility. Our Patients appreciated the healthy lifestyle implemented by Mediterranean diet and mild physical activity and quite regularly participated in the group educational sessions. Overall, metabolic and anthropometric parameters showed a satisfactory improvement. Although we cannot easily separate out the potential impact of exercise from that of the diet, we can infer that Mediterranean diet, more strictly implemented than physical activity, had more contributed to this result. Patients' quality of life remained stable over time as did their global functioning and psychiatric symptoms. In our experience, both patients and health professionals found this program helpful in practicing healthy attitudes for improved physical and psychological conditions. At the beginning, the implementation of this program represented a challenge due to the severe and chronic conditions of our patients and the skepticism of the community professionals, but, with its progress, it permitted to both parties to share rehabilitative activities, providing increased satisfaction. These positive outcomes suggest that a low-cost program consisting of diet and moderate physical activity can also be implemented in a psychiatric community for patients affected by chronic psychiatric diseases, reducing the risk for MS, cardiovascular diseases and other complications. The principle limitation of our pilot study is represented by its small number of subjects, no sufficient to draw any conclusions. Moreover, since this intervention was the first healthy lifestyle program implemented in the community, it is not possible to compare our results with previous ones.

#### 6. Conclusion

Patients affected by psychiatric illness present an increased risk for MS and premature death if compared with the general population. This pilot study showed that implementing a low impact lifestyle change can improve anthropometric and metabolic outcomes and therefore potentially decreases risk for MS, with good patients' perceived quality of life. As mental health professionals we have to care for patients by adopting a holistic approach which also focuses on physical health care. A healthy lifestyle program can represent a desirable ethical approach for patients with multiple comorbidities and therapies living in a community. A multi-professional team is essential for the implementation of a lifestyle modification in order to tailor therapeutic intervention and to meet patients' needs. We hope that similar programs can be applied in other facilities to verify their applicability and efficacy in preventing the important health issue of metabolic syndrome and its complications.

#### Acknowledgment

The authors would like to thank the patients and the professionals of the community for their participation in the study. A special thanks to the two dieticians who participated in the implementation of food program and psycho-educational group sessions.

This study was not sponsored and the authors declare no actual or potential conflict of interest.

**Table 2**  
Metabolic, anthropometric and cardiovascular parameters and scales scores of our Patients at T0, T6 and T12.

Variables	T0 (n = 19)	T6 (n = 15)	T12 (n = 11)	Statistical test Probability
BMI, m ± SD	29.14 ± 7.03	27.75 ± 6.47*	26.69 ± 6.72**	*vs BMI at T0 of 15 patients: $t = 4.93$ , $p = 0.0002$ , $t$ -test paired **vs BMI at T0 of 11 patients: $t = 2.49$ , $p = 0.03$ , $t$ -test paired
Waist circumference (cm), m ± SD	105.93 ± 13.74	104.66 ± 15.24	105 ± 12.14	$t$ -test paired Not statistically significant
Glucose mg/dl, m ± SD	78.26 ± 26	84 ± 24.96	82 ± 18.12	$t$ -test paired Not statistically significant
Homocysteine umoli/l, m ± SD	16.01 ± 5.34	14.70 ± 6.95	14.90 ± 8.79	$t$ -test paired Not statistically significant
Total cholesterol mg/dl, m ± SD	203.33 ± 47.92	209.8 ± 44.96	190.27 ± 56.04	$t$ -test paired Not statistically significant
HDL cholesterol mg/dl,	51.06 ± 11.53	50.4 ± 14.69	54.91 ± 11.77	$t$ -test paired Not statistically significant
Triglycerides mg/dl, m ± SD	141.26 ± 58.51	144.2 ± 61.06	114.73 ± 58.49	$t$ -test paired Not statistically significant
TSH	1.89 ± 0.71	1.91 ± 0.73	1.65 ± 0.56	$t$ -test paired Not statistically significant
Uric acid	5.23 ± 1.05	5.12 ± 0.95	–	$t$ -test paired Not statistically significant
Heart rate, m ± SD	85.87 ± 16.64	83.93 ± 12.02	87.64 ± 10.84	$t$ -test paired Not statistically significant
Systolic blood pressure	119 ± 8.06	121.67 ± 8.38	115.83 ± 10.17	$t$ -test paired
Diastolic blood pressure mmHg, m ± SD	72.33 ± 8.42	77.67 ± 4.17	61.66 ± 6.88	Not statistically significant
ECG (QTc, m ± SD)	0.422 ± 0.007	0.417 ± 0.02	0.412 ± 0.03	$t$ -test paired Not statistically significant
EQ-5D, m ± SD	–	80.41 ± 16.30	75.33 ± 17.44	$t$ -test paired Not statistically significant
GAF	32.55 ± 9.85	33.86 ± 12.66	–	$t$ -test paired Not statistically significant
BPRS	23.53 ± 9.24	23 ± 8.75	–	$t$ -test paired Not statistically significant

## References

- Allison, D.B., Newcomer, J.W., Dunn, A.L., et al., 2009. Obesity among those with mental disorders: a National Institute of Mental Health meeting report. *Am. J. Prev. Med.* 36, 341–350.
- Babio, N., Toledo, E., Estruch, R., et al., PREDIMED Study Investigators, 2014. Mediterranean diets and metabolic syndrome status in the PREDIMED randomized trial. *CMAJ* 186, E649–57.
- Brooks, R., Rabin, R., de Charro, F., 2010. The Measurement and Valuation of Health Status Using EQ-5D: A European Perspective: Evidence from the EuroQol BIO MED Research Programme. Springer, Netherlands.
- Chaggar, P.S., Shaw, S.M., Williams, S.G., 2011. Effect of antipsychotic medications on glucose and lipid levels. *J. Clin. Pharmacol.* 51, 631–638.
- Grundey, S.M., Hansen, B., Smith Jr., S.C., et al., American Heart Association, National Heart, Lung, and Blood Institute, American Diabetes Association, 2004. Clinical management of metabolic syndrome: report of the American Heart Association/National Heart, Lung, and Blood Institute/American Diabetes Association conference on scientific issues related to management. *Circulation* 109, 551–556.
- Halcox, J., Misra, A., 2015. Type 2 diabetes mellitus, metabolic syndrome, and mixed dyslipidemia: how similar, how different, and how to treat? *Metab. Syndr. Relat. Disord.* 13, 1–21.
- Hennekens, C.H., 2007. Increasing global burden of cardiovascular disease in general populations and patients with schizophrenia. *J. Clin. Psychiatry* 68 (Suppl. 4), 4–7.
- Kastorini, C.M., Milionis, H.J., Esgosito, K., et al., 2011. 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.* 57, 1299–1313.
- Kilbourne, A.M., Morden, N.E., Austin, K., et al., 2009. Excess heart-disease-related mortality in a national study of patients with mental disorders: identifying modifiable risk factors. *Gen. Hosp. Psychiatry* 31, 555–563.
- Kolotkin, R.L., Corey-Lisle, P.K., Crosby, R.D., et al., 2008. Impact of obesity on health-

- related quality of life in schizophrenia and bipolar disorder. *Obesity* (Silver Spring) 16, 749–754.
- Lakka, T.A., Laaksonen, D.E., 2007. Physical activity in prevention and treatment of the metabolic syndrome. *Appl. Physiol. Nutr. Metab.* 32, 76–88.
- Lin, C.H., Chiang, S.L., Tzeng, W.C., et al., 2014. Systematic review of impact of lifestyle-modification programs on metabolic risks and patient-reported outcomes in adults with metabolic syndrome. *Worldviews Evid.-Based Nurs.* 11, 361–368.
- McEvoy, J.P., Meyer, J.M., Goff, D.C., et al., 2005. Prevalence of the metabolic syndrome in patients with schizophrenia: baseline results from the clinical antipsychotic trials of intervention effectiveness (CATIE) schizophrenia trial and comparison with national estimates from NHANES III. *Schizophr. Res.* 80, 19–32.
- Overall, J.E., Gorham, D.R., 1962. The brief psychiatric rating scale. *Psychol. Rep.* 10, 799–812.
- Ratliff, J.C., Palmese, L.B., Reutenauer, E.L., et al., 2012. The effect of dietary and physical activity pattern on metabolic profile in individuals with schizophrenia: a cross-sectional study. *Compr. Psychiatry* 53, 1028–1033.
- Rosenbaum, S., Tiedemann, A., Sherrington, C., et al., 2014. Physical activity interventions for people with mental illness: a systematic review and meta-analysis. *J. Clin. Psychiatry* 75, 964–974.
- Rush, A.J., First, M.B., Blacker, D.B., et al., Global Assessment Scale (GAS), 2008. Global Assessment of Functioning (GAF) Scale, Social and Occupational Functioning Assessment Scale (SOFAS). In: *Handbook of Psychiatric Measures* (ed 2). American Psychiatric Publishing, Inc., Washington DC, pp. 86–90.
- Saarni, S.E., Saarni, S.I., Fogelholm, M., et al., 2009. Body composition in psychotic disorders: a general population survey. *Psychol. Med.* 39, 801–810.
- Vancampfort, D., De Hert, M., Vansteenkiste, M., et al., 2013. The importance of self-determined motivation towards physical activity in patients with schizophrenia. *Psychiatry Res.* 210, 812–818.
- Willett, W.C., Sacks, F., Trichopoulos, A., et al., 1995. Mediterranean diet pyramid: a cultural model for healthy eating. *Am. J. Clin. Nutr.* 61 (Suppl. 6), 1402S–1406S.