

Sexual health, adherence to Mediterranean diet, body weight, physical activity and mental state: factors correlated to each other

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ABSTRACT

Introduction: Mediterranean diet has shown a protective role against cardiovascular disease, diabetes, cancer onset, microvascular damage and dementia in many trials. Our purpose is the assessment of a correlation between physical activity, Mediterranean diet, body mass index (BMI), depression and erection disorder (ED).

Methods: After having signed disclaimer to the study participation, we administered the IIEF 15 questionnaire (International Index of Erectile Function), the Hamilton questionnaire for major depression, the Med-Diet Questionnaire, the Ipaq Questionnaire (International Index of Physical Activity) to 245 patients and calculated the BMI. Only 141 were eligible. We excluded patients with a history of smoking, with obesity from the second grade to rise, anorexia, hyperlipidemia, Induratio Penis Plastica, diabetes, cardiovascular and neurological disease, hypogonadism, prostatitis, diabetes, hypertension, psychiatric diseases and the history of radical prostatectomy and finally age >72 and <50 years or who were taking cholesterol-lowering medication. Patients were divided into two groups: 65 patients without ED and 76 patients with ED.

Results: We found a statistically difference in BMI between the groups. Adherence to Med-Diet showed a significant difference between the two groups at Student t-test and the Chi-square test. The Ipaq test and Hamilton test did not show statistical differences between the two groups neither for Student t-test nor for Chi-square test, but high levels seem to be protective factors.

Conclusions: Body weight and a healthy diet are protective factors against the ED, more than a sufficient physical activity. Depression has shown only a worsening tendency of the erection.

Keywords: Erectile dysfunction, Mediterranean diet, Physical activity, Sexual health

Introduction

The Mediterranean diet is characterized by a balanced supply of nutrients, a high amount of micronutrients, vitamins and a low intake of unsaturated fatty acids, of red meat, salt and low energy intake and no sugary drinks, and it is recommended by the World Cancer Research Fund/American Institute for Cancer Research (WCRF/AIRC). This diet, as soon as its begun, has shown a protective role against cardiovascular disease, diabetes, cancer onset, against the microvascular damage and dementia in many trials (1-3). Some new

evidences in the literature associate the consumption of vegetables to a preventive role against the erection disorder (ED) (4, 5) reducing microvascular damage. Frequently, nonadherence to the Mediterranean diet is linked to obesity and ED mediated by estrogen (6). An interesting correlation considers the healthy nutrition and the prevention of the onset of depressive symptoms (7, 8) that in turn can be a cause of ED (9). A good lifestyle includes good levels of physical activity that positively affect the sexual (10) and mental health (11). From this evidence, it seems that physical activity, Mediterranean diet, body mass index (BMI), depression and ED are closely related to each other. We wanted to assess this correlation in patients referred to our outpatient clinics. As a post hoc analysis, we analyze the correlation between the Mediterranean diet, physical activity, BMI and levels of physical activity with the onset of depression symptoms.

Materials and methods

We administered all patient referrals to our department of andrology from September 2016 to May 2017, after having

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signed disclaimer to study participation, the IIEF 15 questionnaire (International Index of Erectil Function), the Hamilton questionnaire for major depression, the Med-Diet Questionnaire, the Ipaq Questionnaire (International Index of Physical Activity) and calculated the BMI. Of a total of 245 patients, only 141 were judged eligible for study participation due to lack of data or because they do not respect the inclusion parameters. All patients were Italian and Caucasians. Most of the enrolled subjects came from the center and from the south of Italy. The visit in which they were administered questionnaires included physical examination and collection of personal data, personal interviews and laboratory measurements. We excluded patients with a history of smoking, with obesity from the second grade to rise or subjects with anorexia, hyperlipidemia, diabetes, cardiovascular and neurological disease, hypogonadism, prostatitis, Induratio Penis Plastica and the history of radical prostatectomy and finally age over 72 years and under 50 years. In addition, we excluded those who were treated for diabetes mellitus, hypertension, psychiatric diseases or who were taking cholesterol-lowering medication. The choice to have very tight parameters of inclusion is due to the reason that the comorbidities or drugs in chronic therapy may have effects on ED. For the same reason, for example in patients with myocardial infarction or diabetes, the type of diet could change on medical advice.

Given that a large part of the study is based on questionnaires for the flexibility, we used 14 items of the med diet questionnaire. The med diet test evaluates the weekly intake levels of legumes, grains, fruits, nuts, vegetables, fish intake, the prevalence of intake of white meat than red meat, the presence in the diet of a healthy intake of wine and the absence from the diet of fizzy drinks and sugary. A value of less than 5 points was identified as poor adherence to the Mediterranean diet, while a value between 6 and 9 has been identified as moderate adhesion, while a value greater than 10 has been identified as such a strict adherence to the Mediterranean diet.

The levels of physical activity were evaluated by the Ipaq test, one of the most common questionnaire developed in 1996, which has assessed its use in adults. The test assesses physical activity understood as an activity in housework, in everyday job, in transporting themselves, recreational and spent time sitting. Levels of physical activity are calculated in Met according to low physical activity, moderate and high. A value of Met lower than 700 indicates that the subject is inactive, while a value between 700 Met and 2519 Met indicates that the subject is sufficiently active and a value from 2520 to rise indicates that the subject performs high level of physical activity.

The assessment of the severity of the depression was assessed with the 21 items of the Hamilton scale during a quick consultation by a psychiatrist and sex therapist. The Hamilton scale analyzes different parameters such as the presence of suicidal ideation, weight loss, the presence of anxiety, presence of somatic symptoms, genital, paranoid, hypochondriacal and obsessive symptoms. A score from 0 to 7 is considered normal, a score from 8 to 13 is considered as the presence of poor depressive symptoms, a score from 14 to 18 is considered as moderate depression, while a score from 19 to 22 is considered as severe depression and finally over 23 as very severe depression.

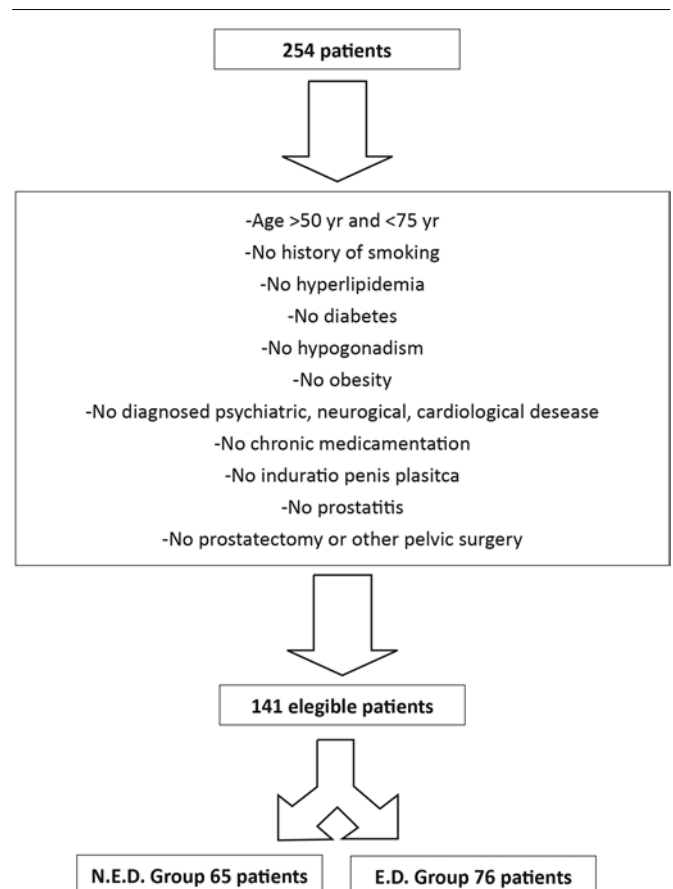
Due to the complexity of the compilation of all the questionnaires, patients could count on a lot of time to prepare tests and on the medical care especially for the Hamilton test that was administered in collaboration with a psychiatrist.

On the basis of the presence of ED, patients are divided into two groups: group ED, 76 patients, and group without ED (NED), 65 patients (Tab. I). Subsequently, the statistical difference between the means of the scores of the two groups (ED vs. NED) with regard to the Mediterranean diet field, depression fields, BMI and physical activity field was calculated using the Student *t*-test. Subsequently, the analysis was conducted with Chi-square test considering the parameters in a dichotomous way (presence vs. absence of depression, poor vs. moderate-high and poor vs. high physical activity, nonadherence vs. moderate-high and non-adherence vs. high adherence to the Mediterranean diet). As post hoc analysis, we correlated the levels of physical activity, BMI and adherence to the Mediterranean diet against the presence of depressive symptoms.

Results

The average age was 64.3 years (50 ± 72) and there was no statistically significant differences between the two groups (ED vs. NED). The mean BMI was 27.23 (20 ± 30). The ED group showed a statistically significant difference in BMI compared with NED group at Student *t*-test ($p < 0.001$).

TABLE I - Study design



Statistical analysis of Med-Diet showed at a statistically significant difference between the two groups at Student *t*-test, $p < 0.0001$ ($p < 0.05$). Similarly, the Chi-square showed a statistical significant difference between NED versus ED group based on the difference between adherence versus nonadherence to the Mediterranean diet ($p < 0.001$; yates $p < 0.0049$; or $p = 0.02$). All statistical analyses were performed with MedCalc Statistical Software version 15.8 (MedCalc Software bvba, Ostend, Belgium; <https://www.medcalc.org>; 2015).

Although not an objective of the study, we report that the majority of enrolled members that follow a Mediterranean diet came from southern Italy (43%), a considerable part from the Central Italy (30%) and a smaller part from northern Italy (27%). We also found a greater adherence to the Mediterranean diet in people who came from coastal areas than those who came from mountainous or hilly areas (64% vs. 36%). In addition, most people who followed a Mediterranean diet had a high level of education (67%).

The Ipaq test did not show statistically significant differences between the two groups neither at Student *t*-test, $p = 0.732$, nor at Chi-square test (yates = 0.866; Odds Ratio (O.R.) = 1.4). Student *t*-test was performed considering the average of IPAQ score between the group ED and NED, while the Chi-square test was performed by grouping the sedentary against those who were sufficient and have high physical activity.

Only those who performed strenuous physical activity toward those sedentary reached significance in terms of normal sexual function.

The Hamilton test showed no statistically significant correlation between the two groups, although it shows a strong tendency to be a pejorative factor (Student *t* = 0.44; Chi-square yates = 0.14; O.R. (Odds Ratio) = 1.7).

Intensive physical activity (>2520 met), BMI <25 and a strong adherence to the Mediterranean diet (≥ 10 Met) have shown a protective effect against depression (Chi-square $p = 0.03$) (Tab. II).

Discussion

Our study is the first to correlate two diseases (weight gain and depression) and an unhealthy lifestyle (physical inactivity and unhealthy diet) with the presence of ED. The issue of a behavior of prevention arises, as more and more patients come to our clinics asking aid for these symptoms.

This is even more interesting if we consider that with a good clinical counseling, many patients tend to change their lifestyle. The results of a sporty habitude, a decreased body weight and a healthier diet are remarkable even in terms of productivity at work (12).

In our study, we reported that a high body weight is related to the ED. This assessment is independent from adherence to Mediterranean diet, as dramatically in many countries, the average weight is increasing in spite of a healthy diet. Likewise, Corona et al proved that obesity, specially the central obesity, is associated with both ED and low testosterone levels; nevertheless, ED is apparently independent from hypogonadism (13).

The causes that may correlate obesity, or at least a high BMI, compared with ED probably are still to be found. Not

TABLE II - Results

	E.D. vs. N.E.D. Group Student t-test	E.D. vs. N.E.D. Group Chi-square
Body mass index	$p < 0.001$	
Med-Diet adherence vs. nonadherence	$p < 0.001$	$p < 0.001$
Ipaq	$p = 0.732$	n.d.
Sedentary vs. sufficient physical activity	n.d.	$p = 0.866$
Sedentary vs. strenuous physical activity	n.d.	$p < 0.001$
Hamilton tests	$p = 0.44$	$p = 0.14$

only the lowering of testosterone, and the consequent estrogen increase, but also obesity, the obesity linked diseases and the effects of inflammation factors, cause of microvascular damage, are known to be risk factors for ED, in the same way as the hypertension. (14). This is demonstrated by the fact that the return to a normal weight can also affect the improved erections even after bariatric surgery (15).

Conversely, in literature, the protective role of the Mediterranean Diet against many diseases such as cancer, diabetes and especially cardiovascular diseases is reported with strong evidences, probably due to the protective role that it plays on microvascular injury and the onset of diabetes. However, few are the studies and the experiences that directly correlate to the ED (16). Most of the studies that correlate to the Med-diet and presence of erectile dysfunction were performed on patients with type 2 diabetes. Maiorino et al, in an Italian randomized clinical trial with a follow-up of 8.1 years, proved that Med-diet, in a newly diagnosed diabetic, reduced the deterioration of IIEF 5 and FSFI (Female Sexual Function Index) in man and woman, respectively (17). Esposito et al (18) enrolled 65 men with the metabolic syndrome including 35 of them who were assigned to the intervention diet, in which patients change diet to a Mediterranean type, and 30 to the control diet. In the intervention group after 2 years, men had a significant decrease in glucose, insulin, low-density-lipoprotein (LDL-cholesterol), triglycerides, and blood pressure, and a significant increase of High-density-lipoprotein (HDL-cholesterol) and in IIEF-5. The reasons called upon to explain the protective role of diet in question are mostly similar to those already analyzed for BMI and similar to the physical exercise referring to the protection of the microvascular damage. In other words, Med-diet not only ensures a low intake of unsaturated fats and a large intake of micronutrients and antioxidants but also a reduction of pro-inflammatory interleukins, especially of interleukin-18. Moreover, it is characterized by a low intake



of meat that might be contaminated by estrogen or other molecules with antiandrogenic action, nowadays even more with intensive farming (19).

In our study, we have shown that even the mere adherence to the Mediterranean diet plays a protective role against the onset of sexual disorders even in nondiabetic patients.

Furthermore, with regard to the correlation between diet and psychic disturbances, many studies in literature show that a diet rich in micronutrients and unsaturated fatty acids, such as omega 3, can prevent the onset of depression (20). The evidence that a high BMI may cause depression are not so strong, but its correlation with schizophrenia and bipolar disorder is clarified (21, 22). Conversely, in our study, we reported that a Mediterranean diet and a low BMI may protect against the onset of depression.

Similar to the followed diet, there are many evidences on the role of physical activity on the protection of the onset of many diseases, from metabolic syndrome and cardiovascular diseases to an increased risk of cancer and many other comorbidities (23). As well as the body weight, it would seem that physical activity can increase levels of nitric oxide, protect from microvascular damage, improve cardiopulmonary performance, tissue vascularization, blood oxygenation via erythropoietin production and can improve insulin resistance by increasing muscle mass and reducing body weight (24). Nevertheless, there are some conflicting evidence in literature about the fact that strenuous physical activity can lead to sexual disorders; most of those works have been performed on professional or agonistic athletes; a study on marathon runners showed that testosterone levels came down just before and just after the race as they were returning to normal after 1 week. In our study, however, only the strenuous physical activity has been shown to be a protective factor against the ED, although patients who achieved classification as 'vigorous physical activity' did not have a very high score and were not professionals or agonistic athletes. In fact, these patients take many 'Met' points in daily activities, in transport of themselves and performed regularly a sport activity but were not professional or agonistic athletes (25). Probably, as well as testosterone may vary in young women with amenorrhea, so the decline of testosterone may be due to stress induced by intensive training or competitions via the hypothalamic-pituitary system. Rastrelli et al proved that a decrease in testosterone levels is often a consequence of obesity or weight gain (26) and the milestone of treating testosterone deficiency in obese men is encouraging substantial lifestyle changes, including physical activity and weight loss. Corona et al (27) have similarly proved that a low calorie diet or bariatric surgery can induce a significant increase in testosterone plasma levels, reaching 10 nmol/l with the most invasive surgical procedures. Weight loss induced testosterone rise is more evident in young individuals; therefore, it must be strongly recommended in this age band (27).

Regarding the correlation between depression and ED, Araujo et al found an important association, and they found that this association is robust and independent of important aging and para-aging confounders, such as demographic, anthropometric and lifestyle factors, health status, medication use and hormones (28). Thase et al (29) demonstrated a significant reduction in nocturnal penile tumescence time

and decreased penile rigidity of 34 depressed men compared with nondepressed control. However, most studies considered the correlation between depression and erectile disorder in diabetic patients such as Furukawa et al who proved that depressive symptoms were independently positively associated with moderate to severe ED (30). In an Italian study of 499 patients with newly diagnosed type 2 diabetes mellitus, depressive symptoms based on the CES-D (Center for Epidemiological Studies Depression Scale) score were significantly positively associated with both ED and hypoactive sexual desire (31). Probably, the reasons that correlate the ED and depression should be sought in the reduction of testosterone levels or in the hyperactivity of the parasympathetic system, which would result in a reduction of blood inflow into the penis. Considerable is the Finnish study about the possible bidirectional correlation between erectile dysfunction and depression (32). Despite some strong evidences in literature of a strong correlation between depression and ED (33), our study does not individuate a significant difference between the two groups, but it only demonstrates (od = 1.7) an important and strong tendency to be a pejorative factor. Probably, if the ratio was maintained to a larger study sample, a significance could be reached.

In other words, only the adherence to the Mediterranean diet, low BMI and strenuous physical activity have been identified as protective factors for ED in our cohort. A sufficient physical activity and mental state of the subject showed only a strong tendency to be of the factors, protective and pejorative, respectively.

Conclusions

Body weight and a healthy diet are protective factors against the ED. The psychic state, understood as the presence of depressive symptoms and physical activity, showed only a tendency to be, respectively, pejorative and protective factors against the ED. The Mediterranean diet, a regular body weight and the physical activity, on the contrary, have been shown to protect against the onset of depression.

Disclosures

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Conflict of interest: All authors declare that there is no conflict of interest regarding the publication of this paper.

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