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Assessment of physical activity in an outpatient obesity clinic in southern Italy: Results from a standardized questionnaire

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Abstract *Background and aim:* Sedentary lifestyle contributes to increased body weight in western societies. We evaluated physical activity (PA) and its association with some clinical and biochemical parameters in overweight and obese outpatients.
Methods and results: Two hundred and seventy-eight overweight obese outpatients, aged 18—65 years, were recruited in this cross-sectional study. Patients were interviewed about their usual PA, using a standardized questionnaire. A total metabolic index (TMI) was derived estimating weekly energy expenditure. In Class III obese patients, fasting serum HDL-cholesterol (HDL-Chol) and resting heart rate (HR) were also measured.

BMI was inversely related to TMI in the whole group ($r = -0.123$, $p = 0.041$). Dividing the patients into groups 1 and 2 according to median BMI (30.3 kg/m^2), group 1 had a significantly higher TMI than group 2 ($p = 0.003$), mainly due to the difference in weekly walking time ($p < 0.001$). Among Class III obese patients, despite similar BMI, the group with longer walking time had both significantly higher HDL-cholesterol ($p = 0.046$) and lower HR ($p < 0.001$).
Conclusion: In overweight and obese individuals BMI is inversely related to PA energy expenditure. This relationship can be, at least in part, ascribed to the reduction of weekly walking time with increasing BMI. In Class III obese patients, even a low level of PA can positively affect both HDL-Chol and resting HR. It appears useful to focus on obese patients in also in general practice in order to recognize sedentary life styles and encourage PA through individualized programs.

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Introduction

Obesity is a major public health issue in both developed and developing countries [1]. In most industrialized countries approximately half of the adult population is currently overweight or obese. Therefore, the condition represents a major reversible risk factor for increased metabolic, cardiovascular and respiratory morbidity and mortality [2,3]. Body weight is influenced by a sophisticated homeostatic system influencing calorie intake (food and drink) and energy expenditure (mainly due to basal metabolic rate and physical activity) [4—6].

Recent changes in lifestyle in western and developing countries—wide availability of public and private transport (car, motorcycles), office automation and widespread use of heating at home and at work, reduced physical work in manufacturing, use of elevators, computers, playstations, television watching, use of electric appliances at home, etc.—have contributed to the dramatic reduction of everyday physical activity, both in leisure and working time, compared to the activity usually performed by our species up to the second half of the twentieth century. On the other hand, several epidemiological studies have demonstrated a link between reduced physical activity and increased body weight in the population, particularly in children [7,8]. Over hundreds of thousands of years of natural selection has given rise to a genetic pattern that favours saving excess energy intake as fat stores (the so called thrifty genotype). This genotype, in combination with easily available high calorie foods and sedentary lifestyle, nowadays appears to have detrimental and maladaptive consequences with unfavourable metabolic effects [9,10]. One of the components of total energy expenditure is the thermic effect of exercise (TEE) linked to effective physical activity. TEE represents, even though to a limited extent, a voluntarily modifiable component of energy expenditure. It may be therefore a key factor affecting body weight, in particular body fat stores, as being inversely related to increased or decreased physical activity [11]. Actually several studies support the hypothesis that prevention and treatment of overweight and obesity require regular and prolonged although not strenuous physical exercise [12]. Nevertheless there are only a few studies assessing physical activity levels in obese outpatients and relating the amount of physical activity to body weight [13]. The aim of this cross-sectional study has been to evaluate the qualitative and quantitative features of physical activity among overweight and obese outpatients using a standardized questionnaire. Furthermore the association between physical activity levels and some modifiable cardiovascular risk factors has been assessed specifically in Class III obese outpatients.

Methods

In 2002, 278 patients (113 men and 165 women), age range 18—65 years, were recruited from patients attending the outpatient clinic for obesity at the Department of Internal Medicine of the Federico II University Hospital: 209 were overweight or Class I and II obese (defined as having a body-mass index (BMI; the weight in kilograms divided by the square of the height in meters) $\geq 25 < 40$ kg/m^2, 69 were Class III obese (with a BMI $\geq$ 40). None of the participants had symptoms of cardiovascular diseases, osteoarthritis or other diseases sufficient to limit their everyday activities. Patients' mean age ($\pm$SD) was 41.5 $\pm$ 13.3 years; mean BMI ($\pm$SD) 33.9 $\pm$ 9.3 kg/m^2.

All patients had a full medical history and received a complete physical examination. Patients were interviewed about their usual physical activity through a validated standardized questionnaire derived by CNR (National Research Council) project FATMA (Factors of Diseases) (CNR Progetto FATMA, 1994).

The questionnaire represents a 1-year recall of commonly performed physical activities divided into five sections to assess the following types of activity:

(a) at work
(b) non-sporting activity (particularly related to household duties)
(c) sport undertaken during leisure time
(d) average time spent walking in a week
(e) number of flights of stairs climbed in a week

For each type of activity usual frequency, duration and intensity were recorded and an estimate of energy expenditure (e.g. metabolic index or score) was determined.

Each activity yields a score according to the intensity and the time spent on that activity. The total sum of all the scores corrected by a standardized factor (0.1) provides the total metabolic index expressed in MET (ratio of metabolic rate during the activity to the resting metabolic rate) for each patient. The total metabolic index estimates the patient's weekly physical activity energy expenditure during the 1-year recall period.

One MET is the amount of O_2 consumed at rest (about 3.5 ml/min per kg). The equivalent energy expenditure of a MET is about 4.186–5.023 kJ/min (1–1.2 kcal/min) in a man weighing 70 kg.

In Class III obese patients, fasting serum cholesterol, triglycerides and HDL-cholesterol levels were measured by routine biochemical tests; resting heart rate (as pulse rate) and waist circumference were also recorded.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS 11.0, SPSS Inc., Chicago, IL, USA). The mean values and standard deviations of the continuous variables were calculated for the sample as a whole and the two categories of BMI. Results are presented as mean ± SD.

Analysis of variance was used as a global test for differences between groups.

The two-sided *t*-test was used to analyze the differences in continuous variables between groups. Two-sided chi-square test was used to analyze the differences in dichotomous variables between groups. The association between variables was determined using linear regression analysis.

The differences between groups were considered significant when $p<0.05$.

Results

BMI was inversely related to total metabolic index in the whole group of patients ($r=-0.123$, $p=0.041$). Among the various types of physical activity assessed by the questionnaire, only the average weekly walking time was found to be inversely related to BMI ($r=-0.232$, $p<0.001$).

All the patients were, thereafter, divided into two groups according to the median BMI of our population (30.3 kg/m^2):

(a) patients ($n=136$) with BMI < 30.3
(b) patients ($n=142$) with BMI ≥ 30.3

No age differences (42.6 ± 13.4 vs 40.5 ± 13.2 years) and no significant differences for sex (63 males and 73 females vs 50 males and 92 females) of smoking prevalence (30.2% vs 31.8%) among the two groups were observed (Table 1).

The total metabolic index was significantly higher in group 1 than in group 2 (10,549 ± 9748 vs 7658 ± 5953, $p=0.003$).

If we consider the metabolic index or score for each type of physical activity assessed by the questionnaire, we notice that there were no significant differences between the two groups in all the scores except for the one derived from the amount of walking per week (e.g. index D). The index is indeed 18,605 ± 19,968 in group 1 vs 10,716 ± 14,244 in group 2 ($p<0.001$) (Fig. 1).

Table 1 Baseline characteristics of the two groups of patients divided according to the median BMI in our population (30.3 kg/m^2)

	Group 1[a] ($n=136$)	Group 2[b] ($n=142$)	p[c]
Age (years)	42.6 ± 13.4	40.5 ± 13.2	ns
Men (n)	63	50	ns
Women (n)	73	92	ns
Smokers (%)	30.2	31.8	ns

[a] Group 1 having a BMI < 30.3 kg/m^2.
[b] Group 2 having a BMI ≥ 30.3 kg/m^2.
[c] Two-sided *t*-test was used to analyze the differences in continuous variables between groups. Two-sided chi-square test was used to analyze the differences in dichotomous variables between groups; ns, not significant.

In Class III obese patients ($n=69$), mean serum cholesterol was 197.6 ± 40.0 mg/dl, triglyceride was 123.4 ± 58.9 mg/dl and HDL-cholesterol was 44.9 ± 11.9 mg/dl. HDL-cholesterol was directly related ($r=0.278$, $p=0.032$), and resting HR was inversely related, to the weekly walking time ($r=-0.275$, $p=0.029$). In this group of patients serum HDL was inversely related ($r=-0.216$, $p=0.049$), and HR was directly related, to BMI ($r=0.352$, $p=0.002$).

We also divided this group of extremely obese patients according to the median of weekly walking time:

(a) patients ($n=33$) whose weekly walking time was < 120 min
(b) patients ($n=36$) whose weekly walking time was ≥ 120 min

No significant differences between these two groups were observed in the following variables: age (35.8 ± 9.9 vs 32.5 ± 10.4 years), BMI (49.0 ± 9.3 vs 45.7 ± 6.6 kg/m^2), waist circumference (134.8 ± 14.1 vs 126.7 ± 16.8 cm), sex (11 males and 22 females vs 13 males and 23 females), or cigarette smoking prevalence (42.5% vs 28%).

However, significant differences in the HDL-cholesterol levels were observed between the two groups, with group A showing lower HDL levels than group B (41.77 ± 11.99 vs 47.83 ± 11.24 mg/dl, $p=0.046$); whereas resting HR was significantly higher in group A compared to group B (85 ± 11 vs 73 ± 10 bpm, $p<0.001$).

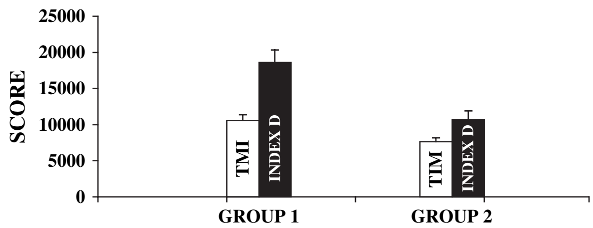

Figure 1 Total metabolic index (TMI) reported in MET and index D score in the two groups of patients divided according to the median BMI (group 1 < 30.3 vs group 2 ≥ 30.3 kg/m^2; $p=0.003$ and $p<0.001$ respectively). Mean ± SEM.

We also performed a sub-analysis on female obese patients (BMI ≥ 30; $n=97$).

The female obese patients were divided into two groups according to BMI:

(a) BMI ≥ 30.0 and ≤ 34.9 kg/m^2 ($n=48$)
(b) BMI ≥ 35.0 kg/m^2 ($n=49$)

Unpaired *t*-test revealed significant differences between these two groups in the following variables:

- Index B (e.g. the score linked to physical activity related to household duties): 31,072 ± 29,465 vs 19,466 ± 23,616 ($p=0.035$)
- Index D (e.g. the score derived from the amount of walking per week): 14,919 ± 19,603 vs 7754 ± 9756 ($p=0.024$).
- Age: 46 ± 13 vs 34 ± 11 years ($p<0.001$) (Fig. 2)

Differences between males ($n=26$) and females ($n=48$) of corresponding BMI (≥ 30.0 and < 35.0 kg/m^2) were also analyzed. The two groups were similar for age (46 ± 13 vs 46 ± 13 years, p = ns) and BMI (31 ± 1 vs 32 ± 1 kg/m^2, p = ns) but showed significant differences in the following variables:

- Index A (e.g. the score derived from the physical activity at work): 87,183 ± 78,359 in males vs 22,770 ± 46,857 in females ($p<0.001$)
- Index B (household duties): 5683 ± 11,762 vs 31,072 ± 29,465 ($p<0.001$)
- Total metabolic index: 10,913 ± 8667 vs 7079 ± 5587, ($p=0.024$)

We finally analyzed the differences between males ($n=27$) and females ($n=49$), with BMI > 35.0. The two groups were similar for age (36 ± 10 vs 34 ± 11 years) and BMI (47 ± 7 vs 47 ± 8 kg/m^2) but different for:

- Index A: 74,815 ± 49,314 in males vs 37,453 ± 49,110 in females ($p=0.002$)
- Index B: 5568 ± 11,935 vs 19,466 ± 23,616 ($p=0.006$)

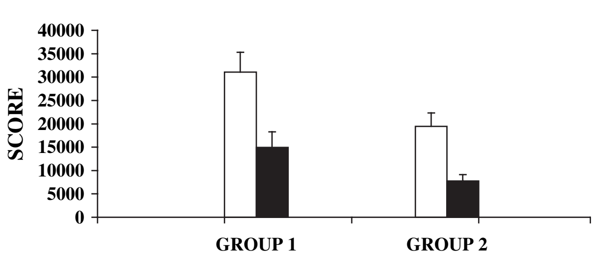

Figure 2 Metabolic index B (white bars) and metabolic index D (black bars). Scores in the two groups of obese female patients divided according to the BMI (group 1 ≥ 30 < 35 vs group 2 ≥ 35 kg/m^2; $p=0.035$ and $p=0.024$ respectively). Mean ± SEM.

Discussion

This cross-sectional study clearly shows that in overweight and obese individuals attending an outpatient clinic the estimated BMI is inversely related to energy expenditure from physical activity. In particular the difference in estimated physical activity related energy expenditure between overweight and obese patients can be largely ascribed to the average weekly walking time. The evidence from these activity pattern data supports the view that obese individuals are not likely to spend their leisure time in an active way. In other words they seem to avoid any voluntary form of physical activity either carried out as a pleasant break or as part of the obesity treatment [13]. On the other hand previous studies evaluating physical activity and energy expenditure examined mainly normal weight or overweight subjects; data on mild—moderate obese are rather poor and data on severe obese patients are lacking [8,13]. In particular Prentice et al. showed a reduction of physical activity level in a small number of moderately severe obese and a non-unequivocal change in activity energy expenditure derived as TEE—BMR in men and women [8]. Leisure time physical activity appears to be a key factor to try to increase the energy expenditure in obese patients and its role is becoming essential since most occupations and jobs tend to be extremely sedentary [14]. The progressive increase in body weight, through overweight to extreme obesity, is the result of a cumulative effect of even a small daily caloric excess [1], at least partially due to a progressive reduction in physical activity documented in general as well as in patients, population studies [15]. It has been reported that only sustained regular physical training affects body composition, muscle tone and growth, nutrient utilization, increases RMR as well as lipid oxidation at rest and during acute muscular exercise [16,17]. There is increasing evidence that physical activity, particularly the distance walked daily, is an independent and modifiable risk factor for overall mortality [18,19]. In our study there is a clear association between degree of obesity and weekly walking distance, as the main index of physical activity in our group of overweight and obese outpatients of all categories. These data contribute to understand the very high rate of fatal and non-fatal events, particularly cardiovascular ones, reported in obese patients and generally related to sedentary lifestyle [20—23]. It is clear that physical exercise is a modifiable risk factor: it should therefore be encouraged with appropriate programs of activity adequately individualized to age and attitude for each patient, often starting from pure rehabilitation through regular physical exercise [24,25]. Our data on physical activity among obese women and men of all categories show also a different pattern of physical activity between sexes. Women of our geographical area appear to spend more time at home and their activity energy expenditure (AEE) is mainly related to household duties. Men, on the other hand, seem to have more AEE related to job duties. In the obese female group it also appears that there is a decreasing trend in physical activity levels with increasing BMI. In our sample the mildly obese individuals appear to be more physically active than the moderately obese ones, even though the latter are younger; as this trend confirms what has already been seen in the whole group of patients and supports the accuracy of our questionnaire, originally planned only for detecting physical activity levels in female patients [26,27]. The different activity pattern among women and men in our study could just reflect the socio-economical background of our sample population. There are in fact in southern Italy still many families where only the husband works and the wife looks after household duties. Nonetheless it is important to show and confirm this different activity pattern in order to individually tailor strategies on how to increase physical activity levels. With regard to this point, it is clear that even a few questions focusing on the time spent walking per week, the number of stairs climbed per week and other similar simple questions, could help to understand the level of physical inactivity and give prompt encouragement for these simple activities at a general practice level [28]. Moreover, a recent paper has clearly shown the sedentary life style of male workers of our geographical area and its relationship with overweight and increased cardiovascular risk factors, thus confirming the need for specific interventions [29]. Our data also show that, in the high risk group of Class III obese patients, even a low level of voluntary physical activity (e.g. 120 or more minutes of walking in a week) can positively affect both serum HDL and resting heart rate. These data are in keeping with a recent prospective study that demonstrated a close relationship between exercise and blood lipid pattern [30]. This study demonstrated also that the amount of exercise per se appears to make a greater difference than the intensity of exercise on plasma lipoprotein profile. This is also in keeping with our observation that even very mild activity, such as walking for more than 120 min a week, can be beneficial for cardiovascular risk profile in Class III obese patients.

On the other hand, alcohol intake has been described to be the major determinant of HDL-cholesterol concentration [31], but our patients reported a very limited consumption, and this is not unusual in our area particularly for women.

In conclusion our data demonstrate very low levels of physical activity in both overweight and obese patients, well below the limit of sedentary lifestyle. This partially accounts for the increasing prevalence of obesity (and failure of treatments) in the populations of developed countries, as also shown in a recent study on young girls during adolescence [32]. It seems therefore reasonable and pivotal to encourage increase in physical activity levels through individualized plans based on short bouts of physical activity throughout the day and a more active lifestyle. Low levels of physical activity in fact are not expected to affect body weight, nevertheless they may improve some major associated cardiovascular risk factors. Moreover longitudinal studies on the long term effects on body weight and cardiovascular risk of increased daily physical exercise in obese patients would certainly help to better understand this complex issue.

References

[1] Rosenbaum M, Leibel RL, Hirsch J. Obesity. N Engl J Med 1997;337:396—407.

[2] Stevens J, Cai J, Pamuk ER, et al. The effect of age on the association between body-mass index and mortality. N Engl J Med 1998;338:1—7.

[3] Wolf C, Tanner M. Obesity. West J Med 2002;176:23—8.
[4] Leibel RL, Rosenbaum M, Hirsch J. Changes in energy expenditure resulting from altered body weight. N Engl J Med 1995;332:621—8.
[5] Cummings DE, Weigle DS, Scott Frayo R, et al. Plasma ghrelin levels after diet-induced weight loss or gastric bypass surgery. N Engl J Med 2002;346:1623—30.
[6] Pi-Sunyer XF. Obesity. In: Cecil textbook of medicine. 21st ed. W.B. Saunders; 2000. p. 1155—62.
[7] Andersen RE, Crespo CJ, Bartlett SJ, et al. Relationship of physical activity and television watching with body weight and level of fatness among children. JAMA 1998;279: 938—42.
[8] Prentice AM, Black AE, Coward WA, Cole TJ. Energy expenditure in overweight and obese adults in affluent societies: an analysis of 319 doubly-labelled water measurements. Eur J Clin Nutr 1996;50(2):93—7.
[9] Neel JV. Diabetes mellitus: a ''thrifty'' genotype rendered detrimental by ''progress''? Am J Hum Genet 1962;14: 353—62.
[10] Murgatroyd PR, Goldberg GR, Leahy FE, et al. Effects of inactivity and diet composition on human energy balance. Int J Obes Relat Metab Disord 1999;23:1269—75.
[11] Schmitz KH, Jacobs Jr DR, Leon AS, et al. Physical activity and body weight: associations over ten years in the CARDIA study. Int J Obes Relat Metab Disord 2000;24:1475—87.
[12] Saris WHM, Blair SN, van Baak MA, et al. How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement. Obes Rev 2003;4:101—14.
[13] Cooper AR, Page A, Fox KR, Misson J. Physical activity patterns in normal, overweight and obese individuals using minute-by-minute accelerometry. Eur J Clin Nutr 2000;54: 887—94.
[14] Kromhout D, Bloemberg B, Seidell JC, et al., for the Seven Countries Study Group. Physical activity and dietary fiber determine population body fat levels: the Seven Countries Study. Int J Obes Relat Metab Disord 2001; 25:301—6.
[15] Heini AF, Weinsier RL. Divergent trends in obesity and fat intake patterns: the American paradox. Am J Med 1997; 102:259—64.
[16] Hill JO, Drougas H, Peters JC. Obesity treatment: can diet composition play a role? Ann Intern Med 1993;119:694—7.
[17] Weigle DS. Contribution of decreased body-mass to diminished thermic effect of exercise in reduced-obese men. Int J Obes Relat Metab Disord 1998;12:567—78.
[18] Paffenbarger RS, Hyde RT, Wing AL, et al. The association of changes in physical-activity level and other lifestyle characteristics with mortality among men. N Engl J Med 1993;328:538—45.
[19] Hakim AA, Petrovitch H, Burchfiel CM, et al. Effects of walking on mortality among nonsmoking retired men. N Engl J Med 1998;338:94—9.
[20] Lee CD, Blair SN, Jackson AS. Cardiorespiratory fitness, body composition, and all-cause and cardiovascular disease mortality in men. Am J Clin Nutr 1999;69(3): 373—80.
[21] Blair S, Kohl III HW, Paffenberger Jr RS, et al. Physical fitness and all-cause mortality: a prospective study of healthy men and women. JAMA 1989;262:2395—401.
[22] Blair SN, Kohl III HW, Barlow CE, et al. Changes in physical fitness and all-cause mortality: a prospective study of healthy and unhealthy men. JAMA 1995;273:1093—8.
[23] Manson JE, Greenland P, LaCroix AZ, et al. Walking compared with vigorous exercise for the prevention of cardiovascular events in women. N Engl J Med 2002;347: 716—25.
[24] Andersen RE, Blair SN, Cheskin LJ, Bartlett SJ. Encouraging patients to become more physically active: the physician's role. Ann Intern Med 1997;127:395—400.
[25] Andersen RE, Wadden TA, Bartlett SJ, et al. Effects of lifestyle activity vs structured aerobic exercise in obese women: a randomized trial. JAMA 1999;281:335—40.
[26] CNR Progetto FATMA. Identificazione e monitoraggio del rischio cardiovascolare nella popolazione femminile mediterranea. In: Strumenti di indagine epidemiologica. Prodotti del progetto finalizzato FATMA. FATMA CNR Press; 1994. p. 107—8.
[27] Roeykens J, Rogers R, Meeusen R, Magnus L, Borms J, de Meirleir K. Validity and reliability in a Flemish population of the WHO-MONICA Optional Study of Physical Activity Questionnaire. Med Sci Sports Exerc 1998;30(7):1071—5.
[28] Mezzani A, Giannuzzi P. Test ergometrico e livello di attività fisica quotidiana nello scompenso cardiaco cronico. Ital Heart J 2000;(Suppl. 1):384—92.
[29] Della Valle E, Stranges S, Trevisan M, Strazzullo P, Siani A, Farinaro E. Self-rated measures of physical activity and cardiovascular risk in a sample of Southern Italian male workers: The Olivetti Heart Study. Nutr Metab Cardiovasc Dis 2004;14:143—9.
[30] Kraus WE, Houmard JA, Duscha BD, et al. Effects of the amount and intensity of exercise on plasma lipoproteins. N Engl J Med 2002;347:1483—14.
[31] Ellison RC, Zhang Y, Qureshi MM, Knox S, Arnett DK, Province MA, et al. Lifestyle determinants of high-density lipoprotein cholesterol: the National Heart, Lung, and Blood Institute Family Heart Study. Am Heart J 2004;147: 529—35.
[32] Kimm SYS, Glynn NW, Kriska AM, et al. Decline in physical activity in black girls and white girls during adolescence. N Engl J Med 2002;347:709—15.