Impact of short-duration lifestyle intervention in collaboration with general practitioners in patients with the metabolic syndrome

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Abstract

Aim. – As the constantly progressing metabolic syndrome is accompanied by an increased risk of type 2 diabetes and cardiovascular complications, it is essential to take appropriate, non-pharmacological, cost-effective measures immediately after the diagnosis has been made. The purpose of our prospective, non-controlled, 6-month study was to determine the impact of lifestyle interventions involving patients’ behaviour in collaboration with their general practitioners (GPs).

Methods. – We recruited 95 patients (46 men and 49 women, aged 45 to 60 years) who presented with the metabolic syndrome. Each patient received a copy of the national French recommendations (PNNS) leaflet, containing guidelines aimed to balance dietary intake and increase daily physical activity. Socioeconomic status was estimated using the EPICES score. Following a less than 1 hour face-to-face interventional session with each patient to present the lifestyle-modification goals, we contacted each patient’s GP by phone to advise on measures to reinforce these lifestyle modifications.

Results. – The percentage of patients presenting with the metabolic syndrome decreased by 52.4% after 6 months. Hypertension, triglycerides and waist circumference decreased by 30.5, 29.3 and 22.0%, respectively, in the study patients. Rates of compliance to PNNS goals at the last follow-up versus baseline were: for drinks, 63.0% versus 22.2%; for sweet products, 91.4% versus 49.4%; for fat, 91.4% versus 80.3%; and for increased exercise, 26.9% versus 6.4%.

Conclusion. – Short-term, single lifestyle modifications targeting the metabolic syndrome in collaboration with GPs was effective in decreasing most of the parameters of the syndrome. However, no factors predictive of success were identified.

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Keywords: Metabolic syndrome; Type 2 diabetes; Cardiovascular risk; Lifestyle; Prevention

Résumé

Impact d’une intervention hygiénodiététique de courte durée en collaboration avec les médecins généralistes chez des patients atteints de syndrome métabolique.

Le syndrome métabolique (SM) est en progression constante et s’accompagne d’une augmentation du risque de diabète de type 2 et de complications cardiovasculaires. Il est essentiel de prendre, dès que le diagnostic a été établi, des mesures précoces, adaptées, non pharmacologiques et coût-efficaces.

Objectif. – L’objectif de cette étude d’intervention prospective non randomisée de six mois était d’évaluer l’impact d’une intervention sur le mode de vie, en collaboration avec les médecins généralistes (MG), sur le comportement des patients.

Méthodes. – Nous avons sélectionné 95 patients (46 hommes, 49 femmes) de 45 à 60 ans présentant un syndrome métabolique. Chaque patient a reçu un guide nutritionnel national français (programme national de nutrition et de la santé [PNNS]), incluant des conseils diététiques et des conseils pour majorer l’activité physique. Le niveau socioéconomique a été évalué (score Epices). Au cours d’un entretien individuel de moins d’une heure, les objectifs de modification de mode de vie ont été exposés et le médecin généraliste de chaque patient a été contacté par téléphone pour l’informer du diagnostic et l’inciter à renforcer les conseils de modifications du mode de vie.

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1. Introduction

Eighty percent of cases of heart disease, stroke and type 2 diabetes could be avoided by a combination of a healthy diet, regular physical activity and refraining from tobacco use [1]. This fact has led to integrated policies that focus on prevention, such as the WHO Global Strategy on Diet, Physical Activity and Health, together with calls for innovative, cost-effective models of care in adults with chronic disease that focus on self-management [2]. The Diabetes Prevention Program (DPP) showed that lifestyle modifications that achieved a 5 to 7% reduction in weight that was sustained for an average duration of 2.8 years reduced the risk of developing diabetes by 58% among patients with impaired glucose tolerance compared with controls [3,4].

For this reason, we conducted a study to evaluate the impact of simple, short-term lifestyle interventions on the metabolic syndrome by counselling patients on diet and physical activity according to the objectives of the French National Food Health Plan (programme national nutrition santé; PNNS) guidelines [5] in collaboration with general practitioners (GPs). After 6 months, we analyzed the outcomes of the metabolic syndrome parameters (persistence or regression) against the baseline data in terms of gender, physical and nutritional habits, and deprivation status (évaluation de la précarité et des inégalités de santé dans les centres d’examens de santé [EPICES] score).

2. Patients and methods

This prospective, non-controlled cohort study of lifestyle changes was conducted at a health examination centre in Bobigny (France) over the course of 6 months (from January to October) in 2006. The metabolic syndrome was screened for in patients attending the Health Testing Centre (centre d’examens de santé; CES) for a global health examination, including lab-

result evaluations) and clinical data as well as self-questionnaires. Baseline covariates included biological (glycaemia and lipid evaluations) and clinical data as well as self-questionnaires. Lipids were determined by automated enzymatic methods (ADVIA 1650 autoanalyzer, Bayer). The questionnaires evaluated nutritional habits (NAQA PNNS), physical activity [7], PNNS objectives [5] and deprivation status, and the patients’ psychological profiles [8]. NAQA PNNS diaries were used to evaluate the patients’ daily or weekly intake of nutrients [9]. The self-administered Baecke physical activity questionnaire (BQ) evaluated physical activity according to three indicators [8]:

- during work (work activity index (WAI), range 1 to 5, where 1 = no activity and 5 = intense exercise during working hours);
- during leisure time (hobbies activity index (HAI), range 0.33 to 5);
- physical exercise (sports activity index (SAI), range 0.25 to 6.14).

In addition, we evaluated the patients’ eating habits and physical activity to compare their results with the nine objectives of the PNNS guidelines; for each item, the patient was identified as being either compliant or not [5,10].

The study patients were classified as having the metabolic syndrome based on the National Cholesterol Education Program Adult Treatment Panel III (NCEP–ATP III) [6], which defines the syndrome as the presence of three or more of the following five criteria:

- central obesity: waist circumference greater than 102 cm in men and greater than 88 cm in women;
- hypertriglyceridaemia: greater or equal to 150 mg/dL (≥ 1.69 mmol/L);
- low HDL: less than 40 mg/dL (< 1.03 mmol/L) in men and less than 50 mg/dL (1.29 mmol/L) in women;
- high blood pressure: greater or equal to 130/85 mmHg or the use of drugs for high blood pressure;
- high fasting glucose: greater or equal to 110 mg/dL (≥ 6.05 mmol/L) [6].

Diabetic patients or those taking hypolipidaemic therapy were excluded.

2.1. Covariates

Baseline covariates included biological (glycaemia and lipid evaluations) and clinical data as well as self-questionnaires. Lipids were determined by automated enzymatic methods (ADVIA 1650 autoanalyzer, Bayer). The questionnaires evaluated nutritional habits (NAQA PNNS), physical activity [7], PNNS objectives [5] and deprivation status, and the patients’ psychological profiles [8]. NAQA PNNS diaries were used to evaluate the patients’ daily or weekly intake of nutrients [9]. The self-administered Baecke physical activity questionnaire (BQ) evaluated physical activity according to three indicators [8]:

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In addition, we evaluated the patients’ eating habits and physical activity to compare their results with the nine objectives of the PNNS guidelines; for each item, the patient was identified as being either compliant or not [5,10].
Table 1
The nine dietary guidelines of the programme national nutrition santé (PNNS).

<table>
<thead>
<tr>
<th></th>
<th>Dietary Guidelines</th>
<th>At each meal and as a snack</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fruit and vegetables</td>
<td>At least 5 per day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raw, cooked, in natural state or prepared</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fresh, frozen or canned</td>
</tr>
<tr>
<td>2</td>
<td>Bread, cereals, potatoes and fried beans</td>
<td>At each meal according to appetite</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Choose whole grains and wholegrain breads more often</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Include a variety</td>
</tr>
<tr>
<td>3</td>
<td>Milk and dairy products</td>
<td>3 per day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Include a variety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Favour dairy products rich in calcium, and lower in fat and salt</td>
</tr>
<tr>
<td>4</td>
<td>Meat and poultry, seafood and eggs</td>
<td>1 to 2 per day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quantity should be less than a side dish of vegetables and starch</td>
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<tr>
<td></td>
<td></td>
<td>Meats: vary types and choose the least fatty pieces</td>
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<tr>
<td></td>
<td></td>
<td>Fish: at least twice a week</td>
</tr>
<tr>
<td>5</td>
<td>Added fats</td>
<td>Limit consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Favour fats of vegetable origin (olive oil, canola oil, etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Include a variety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limit fats of animal origin (butter, cream, etc.)</td>
</tr>
<tr>
<td>6</td>
<td>Foods with added sugar</td>
<td>Limit consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limit sweetened drinks and candies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limit intake of foods with added sugars and fats (pastries, cream desserts, chocolate, ice cream)</td>
</tr>
<tr>
<td>7</td>
<td>Beverages</td>
<td>Drink water as desired</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During and between meals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limit sweetened beverages (choose light beverages)</td>
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<tr>
<td></td>
<td></td>
<td>Alcoholic beverages: women(^\text{a}) are advised to drink no more than 2 glasses of wine (10 cl) per day and, for men, no more than 3 glasses per day. Two glasses of wine are equivalent to two 50 cl of beer or 6 cl of strong alcohol</td>
</tr>
<tr>
<td>8</td>
<td>Salt</td>
<td>Limit consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Choose iodized salt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Avoid salting foods before tasting</td>
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<tr>
<td></td>
<td></td>
<td>Reduce amount of salt added to water used for cooking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limit intake of high-fat and high-salt products (cheese, deli meats and salted snacks)</td>
</tr>
<tr>
<td>9</td>
<td>Physical activity</td>
<td>At least the equivalent of 30 min of brisk walking per day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integrate any type of physical activity into your daily life: walking, cycling, gardening, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limit inactivity and sedentary activities (television, computer or video games, etc.)</td>
</tr>
</tbody>
</table>

\(^{a}\) Pregnant women are advised to abstain from all alcohol consumption for the entire duration of their pregnancy.

Deprivation was estimated by the EPICES score, which was calculated on the basis of each individual’s deprivation status. Social deprivation was defined as an EPICES score greater than 40.2. Data and comments regarding social deprivation have been detailed elsewhere [11].

The final questionnaire estimated the participants’ psychological profiles (internal locus of control, belief in chance), and the compliance and motivation of each patient [9].

At 6 months, each patient attended the CES for a repeat of the initial evaluations (biological and clinical data, and two questionnaires: the NAQA PNNS and the BQ). The impact of the interventional measures was evaluated by the differences in the biological and clinical criteria of the metabolic syndrome between baseline and 6 months, as well as by changes in diet and physical activity.

2.2. Intervention

Intervention consisted of two parts: the first was the medical interview with a single practitioner, usually at the health centre; the second were phone calls to both the GPs and the patients. The medical face-to-face interviews lasted from 15 min to 1 hour. The beginning of the interview focused on the metabolic syndrome and its probable consequences (cardiovascular risk and type 2 diabetes) on health. The interview then covered the management of the metabolic syndrome, which involved setting up the recommended lifestyle modifications during a 15- to 20-minute discussion of two documents in accordance with the PNNS recommendations (Table 1). At the end of the interview, the patients were given the two documents to be passed on to their GPs.

The results of the examination (clinical and biological data) were sent to the patients’ GPs, and the patients were encouraged to consult their GPs during the following 2 months as a specific follow-up. Patients who had not chosen or declared a GP were encouraged to do so.

At 3 months, a practitioner working at the CES contacted all GPs by phone to evaluate their follow-up of their patients as well as to obtain the GPs’ opinions of the importance of the metabolic syndrome and the implications of their attitude in their daily practice, counselling and treatments. The phone calls lasted from 10 to 30 minutes. The aim of the call was to encourage and promote interaction between the GP and his patient. In addition, we called each patient to
reinforce the educational message regarding the metabolic syndrome.

2.3. Statistical analysis

Two applications and one statistical programme were used: Access for reporting the data; Excel for database integration, graphics and calculation of the observed odd ratios (OR); and SPSS for the statistical analyses. One analysis category allowed examination of the data, including the average standard deviation, median, and first and third quartiles. Scores were also calculated for the various questionnaires (NAQA, BQ).

All analyses were performed on the patients who completed the follow-up and responded to all of the questionnaires. Two-sided r and McNemar tests were used to analyze the differences between the groups at baseline and at the final follow-up. A logistic-regression analysis was performed to test the association between the outcome of the metabolic syndrome and the various parameters of the study intervention.

3. Results

3.1. Baseline characteristics

During the 10-month recruiting period, 4511 subjects attended the CES for a health examination. Prevalence of the metabolic syndrome was 11.8% (386/3250 patients; Fig. 1). Altogether, 97 patients were recruited (46 men and 49 women, aged 45 to 60 years). During the investigations, two patients were excluded because of diabetes. Of the study participants, 23.2% met four and 3.2% met five of the NCEP criteria. The main criterion of the metabolic syndrome was hypertension, seen in 88.4% of our patients, followed by a large waist circumference (84.2%) and hypertriglyceridaemia (66.3%) (Table 2, Fig. 2). Also, 61% were obese (BMI > 30 kg/m²), and around 60% were in a state of deprivation according to the EPICES score (> 40.2), which was more commonly seen in women than in men (63.3% vs 54.3%, respectively).

Our results at baseline showed that the objectives of PNNS were not achieved in terms of consumption of fruit and vegetables, and daily physical activity equivalent to 30 minutes of speed walking (Table 3). The objective for lipid consumption was achieved by 80.9% of our study population while 25% reported that they had afternoon snacks every day, with 19% admitting to doing so more than once a day.

The three indicators of physical activity (WAI, HAI and SAI) were 1.16, 2.33 and 0.65, respectively. In fact, 52% of the patients had a WAI equal to zero, particularly among the women (59.2% vs 43.5% of the men); 61% of the patients reported no hobbies or a poor HAI (≤ 2.33) and around 78% had a low SAI (≤ 0.5), with no differences between the men and women (71.7% and 83.7%, respectively; not significant [P = 0.37]). Less than 11% of the patients had a high SAI (> 1).

![Fig. 1. Flow chart of the study population.](image-url)
3.2. Outcome at 6 months

At 6 months, 13 patients were lost to follow-up (Table 4). Ten patients were in a precarious state (EPICES > 40.20). More precisely, their average and median EPICES scores were 52.48 and 56.80, respectively, compared with 44.45 and 43.49, respectively, for the other patients who completed the study (differences not significant). The other characteristics (clinical data, prevalence of the metabolic syndrome criteria) were not significantly different between completers and non-completers.

This means that the outcome of the metabolic syndrome was evaluated in only 82 patients. At 6 months, median weight had decreased from 90.1 ± 13.7 to 88.4 ± 13.0 kg in men, and from 84.2 ± 16.9 to 83.1 ± 16.0 in women. Only 43 of the patients still presented with signs of the metabolic syndrome after intervention, giving a decreased prevalence of 52.4%. The main positive outcomes were seen in systolic blood pressure (−30.5%; median blood pressure: −8.89 mmHg), waist circumference (−29.3%) and triglyceride levels (−22.0%) in both genders (Table 4 and Fig. 2). Three GPs prescribed medical treatment—two with glitazone, and one with a cholesterol-lowering drug.

3.2.1. Modification of nutritional habits

At 6 months, improvements according to PNNS recommendations were seen significantly with the intake of drinks, sweet products and fat (Table 3). Altogether, 31% admitted to still having snacks every day, whereas 77% of men and 63% of women reported that they no longer had snacks compared with 69 and 44%, respectively, at baseline.

3.2.2. Physical activity

Mean values for WAI, HAI and SAI were low at 1.38, 2.86 and 0.87, respectively. However, physical activity in accordance with PNNS objectives did increase (Table 3), particularly in leisure activities. The proportion of high-to-moderate leisure activities increased from 39.5% at inclusion to 70.4% at 6 months. An increase in high-to-moderate sports activities was seen mostly in men, rising from 31% at inclusion to 59% at 6 months.

3.3. Phone interview at 3 months

Of the 67 GPs who could be reached and interviewed by phone, more than 55% declared that the metabolic syndrome approach helped them to discuss cardiovascular risk in a more global way, and 46% (n = 31) gave their patients recommendations regarding diet, exercise and smoking.

In addition, 87% of patients declared that they had consulted their doctor for the metabolic syndrome diagnosed at the CES, while 78% had the metabolic syndrome confirmed by their GP during a following consultation. At the end of the study, all patients (except for six) reported having a GP (80.5%).

3.4. Factors determining outcome of the metabolic syndrome

We hypothesized that certain factors, such as employment or compliance, would explain the positive outcome regarding the metabolic syndrome. Although such a tendency could be seen, the results were not significant. We performed analyses between the extreme classes for each variable in all patients, as evaluated by their GP: EPICES score (≤ 40.2 vs > 40.2; OR 1.45; 95% CI 0.60–3.49); occupation (no vs yes; OR 2.20; 95% CI 0.86–5.65); psychological profile (internal locus of control ≤ 25 vs > 25; OR...
Table 4

Comparison of parameters of the metabolic syndrome between patients followed at 6 months (baseline and 6-month data) and those who did not complete the study.

<table>
<thead>
<tr>
<th>Parameters of the metabolic syndrome</th>
<th>Baseline (n = 82)</th>
<th>At 6 months</th>
<th>Patients (%)</th>
<th>Difference (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mmHg)</td>
<td>141.73 ± 16.43</td>
<td>128.15 ± 15.29</td>
<td>86.6</td>
<td>−13.58 (0.000)</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>88.61 ± 10.23</td>
<td>82.07 ± 10.11</td>
<td>61</td>
<td>−6.54 (0.000)</td>
</tr>
<tr>
<td>HDL-C (M)</td>
<td>1.17 ± 0.32</td>
<td>1.12 ± 0.21</td>
<td>61</td>
<td>−0.05 (0.048)</td>
</tr>
<tr>
<td>HDL-C (F)</td>
<td>1.29 ± 0.82</td>
<td>1.15 ± 0.21</td>
<td>61</td>
<td>−0.14 (0.022)</td>
</tr>
<tr>
<td>Tg (mmol/L)</td>
<td>1.97 ± 0.82</td>
<td>1.71 ± 0.85</td>
<td>64.6</td>
<td>−0.26 (0.000)</td>
</tr>
<tr>
<td>Waist circumference (M; cm)</td>
<td>104.21 ± 10.75</td>
<td>99.82 ± 9.88</td>
<td>84.1</td>
<td>−4.39 (0.000)</td>
</tr>
<tr>
<td>Waist circumference (F; cm)</td>
<td>102.28 ± 12.62</td>
<td>98.70 ± 11.42</td>
<td>80.5</td>
<td>−3.58 (0.004)</td>
</tr>
<tr>
<td>Blood glucose (mmol/L)</td>
<td>5.55 ± 0.63</td>
<td>5.62 ± 0.81</td>
<td>30.5</td>
<td>+0.07 (0.230)</td>
</tr>
</tbody>
</table>

SBP/DBP: systolic/diastolic blood pressures; HDL-C: HDL cholesterol; Tg: triglycerides; M: males; F: females.

a Patients with values above the threshold of the metabolic syndrome.

b Wilcoxon’s test between paired samples from baseline and 6 months.

2.58; 95% CI 0.46–14.39; belief in chance ≥ 22 vs < 22; OR 1.26; 95% CI 0.41–3.85); the notion of metabolic syndrome held by the GPs (no vs yes; OR 1.58; 95% CI 0.57–4.38); compliance (poor vs high; OR 2.06; 95% CI 0.46–9.14); and motivation (no vs yes; OR 1.31; 95% CI 0.47–3.66). We limited our analysis to blood pressure, the parameter that decreased the most during the intervention: as previously observed, neither the EPICES score (OR 1.56; 95% CI 0.64–3.76) nor compliance (OR 1.74; 95% CI 0.46–6.53) were found to be determining factors in blood-pressure reduction.

4. Discussion

Many lifestyle studies have shown a possible decrease in the metabolic syndrome using expensive and time-consuming methods offered by a specialized healthcare team [12–14]. Our study, following the objectives previously provided, offers evidence that a lifestyle-modification programme with education for reducing weight and increasing physical activity was effective and useful in the treatment of the metabolic syndrome. Over a 6-month period with GP cooperation, we improved the status of the metabolic syndrome in 52.4% of patients. These positive results were achieved by increases in physical activity (especially in men) and changes in food consumption (lower intakes of snacks, salt, sweets, fat and starchy foods).

Although being a non-controlled study limits our conclusions, such positive results are nevertheless noteworthy. There were two novel aspects to our intervention: the time spent for educational purposes was less than 1 hour, making it more likely to be cost-effective compared with other methods; and collaboration with each participant’s GP (one phone call). In addition, since 2001, all patients have become more aware of the national PNNS message as relayed by the press, television, patients’ organizations and healthcare teams. The PNNS programme was carried out nationwide from 2001 to 2005 with the purpose of improving the French population’s general health based on lifestyle counselling. The first programme in 2001 contained various messages—from promoting fruit and vegetable consumption to reduce cardiovascular risk to ways to increase physical activity (taking the dog out for walks, for example)—that were largely spread through television and the press (general, parents, feminine), and had an effective impact on the general population (24% remembered the messages) [5]. In 2002, three million copies of the PNNS guidelines were given away across France. In 2004, the programme informed the general population that new guidelines were also available on the Internet regarding diet, along with 10,000 visual aids (at bus stations, kiosks and railway stations). Thus, many of our study patients were probably already aware of these health concerns.

The nutritional objectives of our intervention were similar to those of other studies. Dietary counselling aimed to decrease fat consumption and reduce overall energy (calorie) intake. We noticed that, unexpectedly, fat consumption was already reported to be low in a large percentage of our study participants. Our objectives for physical activity were easier to achieve than in most other interventional studies, which have included training sessions or aimed to increase leisure activity by at least one unit per day, which was not achievable by all patients [12,15]. In contrast, our advice was easy to take home: 30 minutes per day of walking (Table 1).

In our intervention, each patient received an initial face-to-face healthcare message from a physician that took less than an hour, together with information regarding the metabolic syndrome. After that, more preventative measures and counselling were provided to patients by their GP. This approach was not as time-consuming as with other studies, being less than 1 hour. In the Tuomilehto et al. study, consultation with a dietitian was required seven times during the first year—or nearly once a month [13]. In the Da Qing study [16], dietary information was delivered weekly for 1 month, then monthly for the next 3 months and, finally, once every 3 months for the remainder of the 6-year study. This achieved a reduction in the incidence of diabetes of 33 to 47%, depending on whether or not exercise-counselling sessions were also offered. In the DPP [14], patients had to follow 16 sessions of counselling on dietary measures—in other words, once a week. When coaching was organized to increase physical activity, the results were still inadequate: only two-thirds of the patients improved their physical activity levels by the end of the interventional study, which comprised five sessions of physical training (Nordic ski, aquagym) over a period of 8 weeks with a professional physical trainer and a final session at 8 months [15].

Another major objective of our study was to involve GPs in the educational programme, thereby replacing...
group-counselling sessions. The goal of such an approach was to make GPs aware of the impact of the metabolic syndrome on their patients and to facilitate counselling of these patients as well as of other patients not included in the study. Such a long-term approach could prove to be ultimately useful for all patients. We found that the more the GP was convinced of the importance of the metabolic syndrome in practice, the greater the reductions obtained in the various parameters of the metabolic syndrome (although changes were not necessarily statistically significant). Only one practitioner on our staff made the phone calls to GPs. The importance of such contact between healthcare-system hospitals and GPs has been confirmed by other studies in maternity wards [17] and emergency services [18,19]. The intervention was also apparently helpful as many GPs were initially sceptical of the effectiveness of lifestyle interventions [20].

Regression of hypertension was the most important result of our study intervention, followed by reductions in triglycerides and waist circumference. The high prevalence of hypertension may reflect the seriousness of the health status in our patients and might explain the good response to our recommendations. In the recent interventional study PREMIER, the authors reported similar results—with a decrease in systolic blood pressure of 8.4 mmHg—following 18 face-to-face interventional doctor–patient contacts [21]. Several possible mechanisms by which lifestyle modifications might reduce blood pressure have been suggested by other studies, including reduced oxidative stress due to a lower intake of saturated fats, and endothelium-dependent vascular relaxation due to increased potassium intake, and increased magnesium and calcium intakes due to greater fruit and vegetable consumption [21].

The main limitation of our study was the lack of a control group. This means that we cannot conclude that the improvement of the metabolic syndrome was due to our intervention (dietary measures, physical activity counselling and phone calls) alone nor what the comparative health concerns were for the population attending the CES for the first evaluation. However, our results are similar or better than those of other controlled studies. Other limitations of our study that could affect the interpretation of our results include the small sample size and the short duration of follow-up. Thus, further randomized studies are needed to better understand the contribution of patients’ profiles to the changes in obesity-related metabolic disturbances following lifestyle interventions.

In conclusion, simple healthcare measures integrated with GP practices, together with external help for therapeutic education and counselling, may be as effective as more time-consuming lifestyle interventions. Our surprisingly good results are probably due to the face-to-face interventions with a GP and the fact that the population is now generally more health-conscious. A randomized study in future is necessary to confirm the value of such a simple intervention.

Conflicts of interest

There is no potential conflict of interest relevant to this article among the study authors.

References