Epidemiology of the metabolic syndrome in 2045 French military personnel (EPIMIL study)

B Bauduceau¹, F Baigts², L Bordier¹, P Burnat¹, F Ceppa¹, V Dumenil², O Dupuy¹, J P Le Berre¹, H Mayaudon¹, S Paillasson², for the Epimil group.

SUMMARY

Context: The Metabolic syndrome is considered to be an important public health problem, but few epidemiological studies have defined the present situation in France. EPIMIL is a prospective epidemiological study that began on February 1, 2003.

Subjects and methods: This study was designed to identify the clinical and laboratory parameters of metabolic syndrome and cardiovascular risk factors in a population of 2045 male military personnel based in the Paris region. The initial 1-year cross-sectional study will be followed by a 10-year follow-up and patient care.

Results: The 2045 subjects included 185 (9%) presented at least 3 of the 5 NCEP ATP III criteria defining metabolic syndrome. They were significantly older (42.2 vs 8.5 yrs) than the other subjects (37.3 vs 8.7 yrs, P < 0.001), had a higher BMI (29.5 vs 3.4 vs 24.8 kg/m², P < 0.001) and a greater body weight at age 20 (75.4 vs 11 vs 70.4 vs 8.5 kg, P < 0.01). Smoking, little physical activity and family histories of diabetes and arterial hypertension were more frequent in these men. While levels of the cholesterol and CRP were higher, Lp(a) and homocysteine concentrations were normal. Plasma insulin and BMI (r = 0.456 P < 0.0001) and plasma insulin and waist circumference (r = 0.446 P < 0.0001) were well correlated. Lastly, plasma insulin, free fatty acids and cardiovascular risk increased steadily with the increase in the number of metabolic syndrome criteria.

Conclusions: These results in a large and particularly uniform population of men show the prevalence of metabolic syndrome in adult men, and demonstrate its link with insulin resistance. Men with several risk factors require specific care, particularly for hypertension and dyslipidemia; the effectiveness of this care will be evaluated during the follow-up period.

Key-words: Cardiovascular risk factors · Metabolic syndrome · Insulin resistance · Obesity · Epidemiology.


Diabetes Metab 2005;31:353-359

RÉSUMÉ

Épidémiologie du syndrome métabolique dans une population de 2 045 militaires français : Étude EPIMIL

Contexte : L’importance du syndrome métabolique en terme de santé publique est soulignée par tous mais peu d’études épidémiologiques françaises permettent d’approcher la réalité du terrain. EPIMIL est une étude épidémiologique prospective qui a débuté le 1er Février 2003.

Sujets et méthodes : Cette étude vise à rechercher les paramètres cliniques et biologiques du syndrome métabolique et des facteurs de risque cardiovasculaire dans une population ciblée de 2045 militaires de sexe masculin de la région parisienne. La période d’inclusion qui a duré 1 an sera suivie d’une période de 10 ans de surveillance et d’intervention.

Résultats : Parmi ces 2045 sujets, 185 (9%) présentent au moins 3 des 5 critères du NCEP ATP III et répondent à la définition du syndrome métabolique. Ces derniers sont significativement plus âgés (42.2 vs 8.5 vs 37,3 vs 8.7 ans, P < 0.001), leur IMC est plus élevé (29.5 vs 3.4 vs 24.8 vs 2.9 kg/m², P < 0.001) ainsi que leur poids à 20 ans (75.4 vs 11 vs 70.4 vs 8.5 kg, P < 0.01). L’exposition au tabac, un faible niveau d’activité physique et des antécédents familiaux de diabète et d’HTA sont plus souvent observés chez ces malades. Si les taux du cholestérol et de la CRP ulträsensible sont plus élevés, on n’observe en revanche aucune différence des taux de Lp(a) et d’homocystéine. Il existe une excellente corrélation entre l’insulinité et l’IMC (r = 0.456, P < 0.0001) et l’insulinité et le tour de taille (r = 0.446, P < 0.0001). Enfin, l’insulinité, le taux des acides gras libres, les différents marqueurs de risque et le risque cardiovasculaire absolu croisent régulièrement avec le nombre de critères du syndrome métabolique.

Conclusions : Ces résultats confirment la forte prévalence du syndrome métabolique dans une population d’adultes de sexe masculin particulièrement homogène et montrent la réalité de son lien avec l’insulinorésistance. Ces sujets qui concentrent ainsi de nombreux facteurs de risque nécessitent une prise en charge particulière notamment de l’HTA et des dyslipidémies, dont l’efficacité sera évaluée par l’étude de suivi.

Mots-crés : Facteurs de risque cardiovasculaire · Syndrome métabolique · Insulinorésistance · Obésité · Épidémiologie.

Address correspondence and reprint requests to:
bernard.bauduceau@wanadoo.fr
Received: October 10th, 2004; revised: May 21st, 2005

Diabetes Metab 2005;31:353-359 • © 2005 Masson, all rights reserved
Several recent studies have led to the identification of risk factors responsible for cardiovascular accidents, which are the main cause of death and disability in France. Reaven [1] in 1988, followed up the original study of Vague [2] and identified a combination of hypertension, android obesity, glucose intolerance, dyslipidemia and hyperinsulinemia that led to a state of insulin resistance. He called this situation “syndrome X”. This combination of factors, now called metabolic syndrome (MetS), has recently been redefined and become the object of considerable research. It is now considered to be a metabolic disease in the United States [3]. The MetS is triggered by android obesity and embodies a wide range of risk factors; it seems to be an essential contributor to the occurrence of cardiovascular events [4, 5]. Very few French studies are suitable for determining the contributions of the various risk factors involved and their clinical consequences [6-10]. Thus, while the MetS has been the focus of many scientific meetings, there is a singular lack of fundamental clinical and epidemiological data for France. EPIMIL ("Étude Epidémiologique des Facteurs de Risque et du Syndrome Métabolique en Milieu Militaire") is designed to provide these data.

Materials and methods

The objectives of this two-part, 11-year long prospective study are:

— To produce a one-year cross-sectional evaluation of the frequency and importance of the cardiovascular risk factors and their association within the framework of the MetS.

— To monitor the population concerned for a period of 10 years and compare the results obtained with the predictions of equations for calculating cardiovascular risk and evaluate the impact of patient education developed.

— This study was approved by the Bégin hospital Ethics Committee and has been registered with the CNIL.

Cross-sectional study

The armed forces provide an ideal environment for this type of study because its members all undergo annual routine medical check-ups (AMC). These AMC are particularly useful for detecting risk factors. A cross-sectional study carried out on the “gendarmes” and “garde républicains” of the Île-de-France (Paris région) in 1993 showed that this type of study is quite feasible, largely because of the motivation and professional approach of the medical staff [11]. The EPIMIL study was carried out on the three military units based in the Paris region, “gendarmes”, “gendarmes mobiles” and “gardes républicains”, because the turnover of personnel is low. The study required a total of at least 2000 participants in order to be statistically relevant. The subjects were informed orally and by letter of the importance of the study and all gave their consent. The following information was collected during the 2003 annual medical check-up and recorded on a standard form.

• The following interview data was collected: tobacco and alcohol consumption, sporting activities, personal and family histories. The declared numbers of cigarettes smoked, in packs per year, was used to define nonsmokers, former smokers and active smokers.

• Alcohol consumption was estimated in grams per day from the interview. This was generally adequate; previous studies have shown it to be well correlated with other markers of alcohol intake.

• Examination data. Height and weight data were used to calculate the Body Mass Index (BMI). Waists were measured (in cm) at the umbilicus and hip circumferences at the level of the greater trochanter. Mean systolic and diastolic blood pressures were determined with an automatic device on subjects who had been seated quietly for 5 min from two blood pressure readings taken at 5 min intervals.

• ECGs were interpreted by a staff doctor to record any abnormalities or left ventricular hypertension.

• Blood and urine samples were taken and sent within 4 hours to the Bégin hospital laboratory for assays. Samples were not transported on ice because the transfer time was very short. Plasma triglycerides and glucose were measured enzymatically (OLYMPUS™ reagents, France), as was total cholesterol (BIOGENET™ reagent, France), on an AU600™ analyser. HDL cholesterol was determined directly using polyanions and detergent (BIOGENET™ reagent, France), non-esterified fatty acids colorimetrically (RANDOX™ reagent, France) on an AU600™ analyser and insulin by Immulite 2000 (DPC™ France). LDL cholesterol was calculated using the formula of Friedewald.

The degree of insulin resistance was evaluated by HOMA [homeostasis model assessment - fasting insulin mU/l x fasting blood glucose (mmol/l) /22.5] and insulin secretion by the HOMA β cell index (fasting insulin mU/l x 20) / (fasting blood glucose (mmol/l) — 3.5) [12].

Microalbuminuria was assayed on a urine sample, and all samples with values over 20 mg/l or with a microalbuminuria / creatinine ratio greater than 30 mg/g were considered to be abnormal.

High values of ultra sensitive CRP (CRP us) were not taken into account (7 values over 10 mg/l).

• Blood serum and DNA banks were set up for later assays and genetic analyses.

All the clinical and laboratory data were assembled by the Endocrinology department of Bégin hospital for statistical analysis. The criteria defining the MetS, as set out by the NCEP ATP III, were used to select a group of patients with this disorder and to compare them with the other subjects [13] (Tab I). Subjects having 3 or more of the 5 NCEP ATP III criteria were considered to have the MetS and the data for these subjects were compared to those for the subjects not having MetS. As very few subjects (only 4) had all
five MetS criteria, they were all included in the 4 criteria group. The overall population was divided into 5 subgroups.

All data are given as means ± SD for continuous variables and numbers of subjects (%) for categorical variables. Dichotomous variables were compared by chi2 tests. Student’s t-test and analysis of covariance were used to compare the other variables. Linear regression was used to determine the correlation between certain parameters. All analyses were done using Statview, version 5.0.

**Longitudinal study**

The follow-up study requires the recording of annual data on cardiovascular events and the development of risk factors like hypertension, diabetes and dyslipidemia for 10 consecutive years. This extremely important part of the study will be the most difficult, but also the most informative; it requires the active cooperation of all concerned.

The medical staff will take steps to correct problems of smoking, obesity and dyslipidemia during the routine visits. These measures will be complemented by the work of a part-time dietician. The effects of these measures will be evaluated by comparing the follow-up data for each subject to those for subjects not so treated. The criteria taken into account will be the body weight and the number of subjects developing diabetes, or requiring treatment for hypertension or dyslipidemia, as required by good clinical practice.

The study will thus be considered to have begun during the period when the subjects were not assigned to groups, which limits the study.

**Results**

The 2045 subjects were all military men aged 20 to 58 years (mean: 38.6 ± 8.8 yrs). Of these, 185 (9%) had more of 3 of the 5 NCEP criteria defining the MetS. The differences in the parameters defining the MetS were, as expected, highly significant (Tab II), and they remained so after correction for age. The most frequently encountered abnormality was high blood pressure (51%), followed by high plasma triglycerides (17%), enlarged waist circumference (17%), low HDL (9.6%), and high blood glucose (5%). Only 36% of all subjects showed none of the NCEP criteria. Among the men with the MetS there were 9.7% who had been treated for hypertension, 8.6% who had been treated for dyslipidemia, and 3.2% who had been treated for diabetes. The comparable figures for MetS-free subjects were 1.5%, 4% and 0.5%.

The frequency of the MetS increased with age, from 5% in men aged 25 to 29 years to 21% in those aged 50 to 54. Their geographic origin also influenced these percentages; subjects from Brittany were less frequently (5%) involved than those from eastern France (21%).
These findings do not perfectly match those obtained using the WHO definition [14, 15]. Thus, 59 of the 185 subjects fulfilling the NCEP criteria for the MetS did not satisfy the WHO criteria for this condition. Conversely, 162 of the 1860 subjects that did not satisfy any of the NCEP criteria had MetS according to the WHO criteria. Hence, the WHO criteria seem to be stricter, as their application to this population increased the percentage with MetS from 9% to 14%.

The patients with NCEP-defined MetS were significantly older, had a higher BMI and weighed more than they were 20 years old. Smoking, low physical activity level and family history of diabetes and hypertension were more frequent in these men (Tab III).

While total and LDL cholesterol, microalbuminuria and CRP us of men with the MetS were significantly higher, there were no differences in their Lp (a) or homocysteine levels (Tab IV). Plasma insulin and the HOMA index, which define the degree of insulin resistance, increased parallel to the number of MetS criteria. Plasma insulin increased from 6.6 ± 4.2 mUI/l in subjects with no MetS criteria to 20.6 ± 13 mUI/l in those with 4 criteria (Tab V). While insulin secretion was also elevated, this increase was not significant, showing the progression towards type 2 diabetes. There were good correlations between plasma insulin and all the parameters of the MetS. The most significant correlations were for BMI (r = 0.456 P < 0.0001) and waist measurement (r = 0.446 P < 0.0001) (Fig 1). There was a significant correlation between free fatty acids (FFA) and waist measurement (r = 0.216 P < 0.0001) and between the steady increase in plasma FFA and the progression of each of the criteria defining the MetS.

Lastly, the various equations used to evaluate cardiovascular risk showed regular progression and an increased cardiovascular risk with the detection of a single parameter defining the MetS (Tab VI) [16-18].

Discussion

These initial results in a large, particularly uniform population of men confirm the prevalence of the MetS. The frequency is slightly lower than, but otherwise similar to, the data for the French population obtained in the Desir

Table II
Clinical data (mean ± SD) for the parameters defining metabolic syndrome according to the NCEP ATP III criteria for subjects with and without the disorder.

<table>
<thead>
<tr>
<th>Subjects without metabolic syndrome</th>
<th>Subjects with metabolic syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 1860</td>
<td>N = 185</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td></td>
</tr>
<tr>
<td>88 ± 9</td>
<td>103 ± 10</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td></td>
</tr>
<tr>
<td>127 ± 13</td>
<td>140 ± 14</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td></td>
</tr>
<tr>
<td>77 ± 9</td>
<td>84 ± 10</td>
</tr>
<tr>
<td>Glycaemia (g/l)</td>
<td></td>
</tr>
<tr>
<td>0.89 ± 0.10</td>
<td>1.04 ± 0.26</td>
</tr>
<tr>
<td>Triglycerides (g/l)</td>
<td></td>
</tr>
<tr>
<td>0.97 ± 0.5</td>
<td>1.92 ± 0.8</td>
</tr>
<tr>
<td>HDL Cholesterol (g/l)</td>
<td></td>
</tr>
<tr>
<td>0.56 ± 0.1</td>
<td>0.43 ± 0.1</td>
</tr>
</tbody>
</table>

These findings do not perfectly match those obtained using the WHO definition [14, 15]. Thus, 59 of the 185 subjects fulfilling the NCEP criteria for the MetS did not satisfy the WHO criteria for this condition. Conversely, 162 of the 1860 subjects that did not satisfy any of the NCEP criteria had MetS according to the WHO criteria. Hence, the WHO criteria seem to be stricter, as their application to this population increased the percentage with MetS from 9% to 14%.

The patients with NCEP-defined MetS were significantly older, had a higher BMI and weighed more than when they were 20 years old. Smoking, low physical activity level and family history of diabetes and hypertension were more frequent in these men (Tab III).

While total and LDL cholesterol, microalbuminuria and CRP us of men with the MetS were significantly higher, there were no differences in their Lp (a) or homocysteine levels (Tab IV). Plasma insulin and the HOMA index, which define the degree of insulin resistance, increased parallel to the number of MetS criteria. Plasma insulin increased from 6.6 ± 4.2 mUI/l in subjects with no MetS criteria to 20.6 ± 13 mUI/l in those with 4 criteria (Tab V). While insulin secretion was also elevated, this increase was not significant, showing the progression towards type 2 diabetes. There were good correlations between plasma insulin and all the parameters of the MetS. The most significant correlations were for BMI (r = 0.456 P < 0.0001) and waist measurement (r = 0.446 P < 0.0001) (Fig 1). There was a significant correlation between free fatty acids (FFA) and waist measurement (r = 0.216 P < 0.0001) and between the steady increase in plasma FFA and the progression of each of the criteria defining the MetS.

Lastly, the various equations used to evaluate cardiovascular risk showed regular progression and an increased cardiovascular risk with the detection of a single parameter defining the MetS (Tab VI) [16-18].

Discussion

These initial results in a large, particularly uniform population of men confirm the prevalence of the MetS. The frequency is slightly lower than, but otherwise similar to, the data for the French population obtained in the Desir
study, where it was 12% for men and 8% for women [7, 8]. This difference reflects the method of recruitment of the EPIMIL subjects and the fact that they were younger. As in all other studies, the MetS was more frequent in older subjects. The differences in the prevalence of the MetS with the subject’s geographical origin correlated perfectly with the distribution of obesity in France. These findings are undoubtedly linked to regional differences in lifestyle [19].

A study carried out ten years ago on a similar, increasing younger (33.4 ± 9 yrs) population [11], indicates that there has been an explosion in the prevalence of the MetS, from 3% ten years ago to 9% today.

The epidemiological data indicate that the frequency of the MetS in Europe varies depending on the criteria used and the specific population studied [20], but it is much lower in Europe than in the United States, where it may now reach 50% in certain sections of the population [9].

Many of the young subjects included in EPIMIL already had some of the features of the MetS. Although the NCEP and WHO definitions of the MetS produce similar populations, they not identical. WHO criteria emphasize blood glucose and insulin resistance, so that many of these patients are frank or incipient type 2 diabetics. The NCEP criteria highlight subjects at high cardiovascular risk, despite the fact that LDL cholesterol is absent from the definition. Thus the NCEP criteria seem to be preferable because they are simpler and easier to apply in everyday practice.

Our results clearly show the close link between the MetS and insulin resistance. The prevalence of insulin resistance increased regularly with the appearance of the various criteria of the MetS and there was a very close correlation with plasma insulin, BMI, blood pressure and waist circumference. As insulin secretion did not increase at the same rate, the changes in these two parameters must result in an increased blood glucose concentration.

The implication of the amount of circulating free fatty acids (FFA) in the pathology of the MetS is illustrated by

Table IV
Laboratory data (mean ± SD) for the subjects with and without metabolic syndrome.

<table>
<thead>
<tr>
<th>Subjects without metabolic syndrome</th>
<th>Subjects with metabolic syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 1860</td>
<td>N = 185</td>
</tr>
<tr>
<td>Cholesterol (g/l)</td>
<td></td>
</tr>
<tr>
<td>2.04 ± 0.4</td>
<td>2.21 ± 0.4</td>
</tr>
<tr>
<td>LDL Cholesterol (g/l)</td>
<td></td>
</tr>
<tr>
<td>1.29 ± 0.3</td>
<td>1.39 ± 0.4</td>
</tr>
<tr>
<td>Lp a (g/l)</td>
<td></td>
</tr>
<tr>
<td>0.22 ± 0.2</td>
<td>0.24 ± 0.2</td>
</tr>
<tr>
<td>Free fatty acids (mmol/l)</td>
<td></td>
</tr>
<tr>
<td>0.37 ± 0.2</td>
<td>0.44 ± 0.2</td>
</tr>
<tr>
<td>Fasting insulin mUI/l</td>
<td></td>
</tr>
<tr>
<td>7.8 ± 5</td>
<td>16 ± 11</td>
</tr>
<tr>
<td>CRP us (mg/l)</td>
<td></td>
</tr>
<tr>
<td>1.19 ± 1.97</td>
<td>2.10 ± 2.06</td>
</tr>
<tr>
<td>Homocysteine mg/l</td>
<td></td>
</tr>
<tr>
<td>1.47 ± 0.6</td>
<td>1.53 ± 0.8</td>
</tr>
<tr>
<td>Microalbuminuria (mg/l)</td>
<td></td>
</tr>
<tr>
<td>10 ± 19</td>
<td>31 ± 115</td>
</tr>
</tbody>
</table>

Table V
Relationship between the parameters of insulin resistance, plasma free fatty acids and indicators of cardiovascular risk and the number of NCEP ATP III criteria (mean ± SD).

<table>
<thead>
<tr>
<th>Number of metabolic syndrome criteria</th>
<th>Insulin mUI/l</th>
<th>HOMA Insulin resistance</th>
<th>HOMA Insulin secretion</th>
<th>Free fatty acids mmol/l</th>
<th>CRP mg/l</th>
<th>Microalbuminuria mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 735</td>
<td>6.6 ± 4.2</td>
<td>1.44 ± 1</td>
<td>117 ± 179</td>
<td>0.34 ± 0.2</td>
<td>1.11 ± 2</td>
<td>9 ± 11</td>
</tr>
<tr>
<td>1</td>
<td>7.7 ± 4.1</td>
<td>1.74 ± 1</td>
<td>109 ± 67</td>
<td>0.37 ± 0.2</td>
<td>1.16 ± 1.9</td>
<td>10 ± 24</td>
</tr>
<tr>
<td>2</td>
<td>10.8 ± 6.3</td>
<td>2.52 ± 1.6</td>
<td>146 ± 104</td>
<td>0.42 ± 0.2</td>
<td>1.44 ± 1.9</td>
<td>12 ± 21</td>
</tr>
<tr>
<td>3</td>
<td>14.5 ± 9.8</td>
<td>3.61 ± 2.6</td>
<td>165 ± 126</td>
<td>0.43 ± 0.2</td>
<td>2.34 ± 2.2</td>
<td>25 ± 122</td>
</tr>
<tr>
<td>4</td>
<td>20.6 ± 13</td>
<td>6.27 ± 5</td>
<td>158 ± 98</td>
<td>0.49 ± 0.2</td>
<td>1.49 ± 1.3</td>
<td>50 ± 91</td>
</tr>
<tr>
<td>n = 45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.01</td>
</tr>
</tbody>
</table>

HOMA insulin resistance: homeostasis model assessment (fasting insulin mUI/l x fasting blood glucose (mmol/l) / 22.5) HOMA ß cell index: (fasting insulin mUI/l x 20) / (fasting blood glucose (mmol/l) — 3.5).
the significant steady increase in plasma FFA and the development of each of the criteria defining the MetS. Lastly, these data show that there is no clear borderline between normality and disease. The same can be said of the risk of a cardiovascular accident, no matter which formula is used. The Framingham equation targets the American population and does not take into account differences in diabetes or smoking [16]. SCORE is more appropriate for European subjects but it only predicts mortality and not cardiovascular events [17]. Thus the very low incidence we find of young subjects presenting major risk factors may well be falsely reassuring. The link between the criteria for the MetS and cardiovascular complications is illustrated by the increase in risk markers like ultrasensitive CRP and microalbuminuria [21, 22]. These estimations are correlated with the epidemiological data because the presence of the MetS as defined by the WHO criteria in a large population of Northern Europeans showed a three-fold increase in the risk of a coronary accident and a 1.8-fold increase in the risk of a fatal cardiovascular accident [23].

The obesity epidemic can be seen as the forerunner of the MetS. The MetS precedes and accompanies hypertension and moderate fasting hyperglycaemia, as a fasting plasma glucose above 1g/l is presently considered to be abnormal [24]. This cascade of events, in which the role played by insulin resistance is not clear yet, leads to type 2 diabetes and cardiovascular consequences whose gravity is generally recognized [25]. Thus the presence of the MetS increases the risk of type 2 diabetes 4-fold in America. The WOSCOPS study found that a subject having 4 of the 5 criteria defining the MetS is 24.5 times more likely to become diabetic than are normal subjects [26]. This damaging sequence of events is, happily, not inevitable and can be disrupted by early treatment [27]. Many studies have shown the powerful effect of a change of life style involving a better diet and more physical exercise [28]. Several forms of medication have also been shown to effectively regulate the MetS parameters which require treatment. Metformine, glitazones, statins, ACE inhibitors and aspirin can all be used to treat certain patients. This potentially resistant syndrome can thus be effectively treated if diagnosis is improved, with prevention based on lifestyle changes and appropriate treatment using a range of drugs whose use has been steadily widening in recent years. Unfortunately, this apparent simplicity conceals enormous difficulties that are much broader; this is a sociological problem rather than a simple medical condition [29].

The EPIMIL study will evaluate the impact of treatment on the appearance of complications of the MetS, while determining the clinical and laboratory parameters will enable us to predict the onset of cardiovascular accidents and also to validate the various equations used to predict risk.

### Conclusion

This large epidemiological study provides data on a range of topics at several levels. It will allow the evaluation of the frequency of the MetS in a uniform population of military personnel. The follow-up will also define the contributions of the various parameters of the MetS. The setting up of a DNA databank will be used in a subsequent study of polymorphism in the genes involved. The explosive progress in genetics has opened up an infinitely large area for exploration.

All the medical personnel taking part in this study have become acutely aware of the need for better monitoring.

---

**Figure 1**

Correlation between waist circumference and plasma insulin.

**Table VI**

Relation between cardiovascular risk (mean ± SD) and the number of metabolic syndrome parameters, as defined by the 3 risk equations.

<table>
<thead>
<tr>
<th>Number of metabolic syndrome criteria</th>
<th>Framingham Events (%) 10 yrs later</th>
<th>PROCAM Events (%) 8 yrs later</th>
<th>SCORE Death (%) 10 yrs later</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2.2 ± 2.3</td>
<td>0.4 ± 0.6</td>
<td>0.2 ± 0.4</td>
</tr>
<tr>
<td>1</td>
<td>3.8 ± 3.5</td>
<td>0.8 ± 1.4</td>
<td>0.37 ± 0.6</td>
</tr>
<tr>
<td>2</td>
<td>5.3 ± 4.1</td>
<td>1.3 ± 1.8</td>
<td>0.62 ± 0.8</td>
</tr>
<tr>
<td>3</td>
<td>7.8 ± 5.2</td>
<td>2.9 ± 5.9</td>
<td>0.78 ± 1.1</td>
</tr>
<tr>
<td>4</td>
<td>11.4 ± 7.2</td>
<td>4 ± 4.9</td>
<td>1.36 ± 1.6</td>
</tr>
<tr>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td></td>
</tr>
</tbody>
</table>
and effective patient care, while the installation of intensive corrective measures is an essential part of the need to improve patient care.

Acknowledgments – The authors wish to thank all participants, specialists, GPs, and nurses on the EPIMIL staff. Their determination ensured the success of this work. The staff also thanks all the military personnel who contributed to this epidemiological study and MSD-Chibret laboratories, which provided invaluable support for these procedures.

References

42. American Diabetes Association Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 2003;27:S5-S10