

Unexpected high prevalence of metabolic disorders and chronic disease among young male draftees – the Swiss Army XXI experience

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Summary

Questions: What are the benefits of laboratory screening examinations entailed in the new army recruitment concept (Swiss Army XXI)?

Principles/methods: Between January 1 and June 30, 2004, a total of 7714 of 11 322 (68%) draftees from 6 Swiss army recruitment centres underwent clinical examination and laboratory testing.

Results: In 1.7% of the draftees we found elevated levels of the C-reactive protein (CRP) as evidence of infection or inflammation. Although we found no case of acute hepatitis, 16 draftees had active hepatitis B and 1 patient had active hepatitis C. Diseases, which were found by laboratory screening, and which forbid service in the army, included Crohn's disease, terminal renal insufficiency and essential thrombocytosis. In conditions such as anaemia (0.1%) or latent iron deficiency (7.2%), the cause may have to be elucidated before the start of military training. In other draftees (9.8%), we found elevated alanin-amino-transferase (ALAT) levels as a hint to possible alcohol

abuse, which might impair the ability to serve in special units of the army. Finally, elevated levels of ferritin (0.1%), glucose (0.4%), and cholesterol (1.4%) may indicate iron overload/haemochromatosis, impaired glucose tolerance or even overt diabetes mellitus and hypercholesterolaemia.

Conclusions: The results of our studies indicate that laboratory evaluation may confirm findings of the medical examination and may help to explain unspecific symptoms. Draftees with severe diseases and conditions caused by serious underlying disease can be excluded from military services early on the basis of laboratory testing. Future cost benefit analyses will have to show whether laboratory screening and consecutive early preventive measures are also advantageous to society as a whole and will reduce public health costs.

Key words: military recruitment; laboratory screening; population survey; prevalence; chronic disease; hypercholesterolaemia

Introduction

In 2004 a new programme of a comprehensive medical and psychological examination, including a detailed medical history and physical examination, electrocardiography, spirometry, ear and eye tests, a psychological questionnaire, as well as vol-

untary laboratory testing was started in the Swiss Army as part of the recruitment process. Since January 1, 2004, all Swiss draftees were subjected to these medical, psychological and laboratory examinations, which last between 2 and 3 days as a

Abbreviations

ALAT	alanin-amino-transferase
ATP III	adult treatment panel III
bcr-abl	bcr-abl re-arrangement
CRP	C-reactive protein
γ-GT	γ-glutamyltransferase
Hb	haemoglobin
HBV	hepatitis B virus
HCV	hepatitis C virus

HDL	high density lipoprotein
LDL	low density lipoprotein
MCHC	mean corpuscular haemoglobin concentration
MCV	mean corpuscular volume
NCEP	National Cholesterol Education Programme (NCEP)
NSAR	non-steroidal anti-rheumatic (drugs)
PCR	polymerase chain reaction
RNA	ribonucleic acid

part of the new "Army XXI" conscription process [1].

The aim of the "Army XXI" concept is to optimise the selection process for the young soldiers. The detailed medical, psychological, and laboratory examinations are meant to better define the draftees' ability, or inability, to serve well before they enter the army. In modern, democratic armies it is mandatory to detect hidden illnesses of soldiers in order to protect those who are unfit from the physical or psychological strains, that the service in the army entails, and thereby from potential hazards to their health.

In addition to the benefits to the individual draftee, the army command hopes by selecting the fit early to reduce the number of later drop-outs. The costs of administration, logistics, training, and the soldiers' individual weaponry and apparel, are lost for those soldiers who have to quit the army service prematurely, for whatever medical reason. Similarly, matching the soldiers individual abilities and preferences with the demands that the assignment to different army units imposes, will not only improve the individual soldier's attitude and efficiency, but actually may help to save costs, as motivated men will use machinery and material with more caution. Last, but not least, more precise knowledge of the soldiers' physical and psychological qualities will help to guide army officers in leading these men.

Laboratory screening was included in the medical evaluation in order to answer questions which are not necessarily answered by a person's history and his physical examination: serum creatinin and alanin-amino-transferase (ALAT) were

chosen to detect hidden renal and hepatic disease, with additional, more specific testing for hepatitis B (HBs antigen) and hepatitis C (HCV antibodies). While the CRP may point to infectious and inflammatory disease, pathological changes in the whole blood count may disclose additional medical disorders and haematological disease, most prominently anaemia. Ferritin was included in the testing panel to both diagnose iron deficiency and clinical significant haemochromatosis. CRP and ALAT also served to validate ferritin in the diagnosis of iron deficiency. Blood glucose levels, either fasting or postprandial, and cholesterol levels served as markers of diabetes mellitus and hypercholesterolaemia, endemic disorders of metabolism with growing significance even among the young, which pre-dispose to atherosclerosis and, possibly, pre-mature death.

The new conscription concept was introduced in January 2004 in 7 recruitment centres located all over Switzerland (Lausanne, Sumiswald, Nottwil, Windisch, Rüti, Mels and Mte. Ceneri). In one of these centres laboratory data could not be obtained for logistical reasons (Mte. Ceneri). We report here our experience of the first 6 months in the laboratory screening of Swiss army draftees. Conscription is compulsory in Switzerland, so that recruitment examinations reach more than 95% of a year's Swiss male population. Since more than 68% of the draftees opted to participate in the voluntary "Army XXI" laboratory testing, the results of our investigation are representative not only of the study population, but are significant with respect to the state of health among young Swiss males.

Methods

According to Swiss federal law, and starting from January 1, 2004, a more comprehensive medical psychological and voluntary laboratory examination was introduced during general conscription for Swiss draftees [1]. The draftees were offered the choice of 3 different laboratory test blocks: biochemical/metabolic testing + haematological testing (ferritin, C-reactive protein (CRP), alanin-amino-transferase (ALAT), glucose (postprandial and fasting [12h]), total cholesterol; total blood count and differential); infectious disease serological testing (Hepatitis B HBs antigen, Hepatitis C total antibodies); and blood grouping. By providing three different options from which the draftees could choose, the Swiss army's medical service, despite its own and the Swiss society's interest in excluding infective men from service, wanted to give the draftees the opportunity to protect their privacy.

During the reference period, blood was taken at 6 of the 7 Swiss conscription centres located in different parts of Switzerland and was shipped to the laboratory centre in Basel to be tested generally within 12 h of sampling. For logistic reasons one of the conscription centres could not participate in 2004. For the purpose of this study, only male draftees (median age 19.3 ± 1.0 years) were evaluated (conscription is compulsory only for men in Switzerland).

Ferritin was tested on an ADVIA Centaur, Bayer, using fully automated immunsorbent and chemiluminescence techniques, while ALAT, CRP, glucose, and total cholesterol were measured on a Roche Integra system. Serological testing (HBs antigen, HCV antibodies) was performed on an Abbott AxSYM system. HBs antigen reactive samples were preliminarily confirmed by HBc total antibodies (Abbott AxSYM). Samples showing weak reactivity (<10 S/CO) for HCV antibodies were further confirmed by recombinant immunoblot (InnoLIA HCV, Innogenetics), while samples showing strong reactivity (>10 S/CO) for HCV antibodies were confirmed by HCV-RNA polymerase chain reaction (Cobas Amplicor, Roche). The total blood count was determined on both the Gen S Coulter/Beckmann and on the Bayer-ADVIA 120. Results were reported back to the conscription centre and formed part of the medical conscription report. The draftees were informed directly by the Swiss army medical service of all pathological findings. In 5 cases we sought follow up information for the sake of the present publication.

Statistical analysis was performed using StatView v. 5 (SAS Institute). We report here the analysis of data taken between January 1 and June 30, 2004.

Results

In the period between January 1 and June 30, 2004 11,322 draftees were seen and examined at the 6 participating recruitment centres. The percentage of draftees who participated in the voluntary laboratory-testing programme varied between the different conscription centres between 53 and 84%. In all, in 7,714 of a total of 11,322 draftees a laboratory test was performed (68.2%). As the draftees could choose either one of the 3 different test blocks, 2 of 3, or all 3, not all tests were performed in the same number (individual numbers are given for each individual test). The response rate for block 1 (ferritin, CRP, ALAT, glucose (postprandial or fasting, total cholesterol, total blood count and differential), was 67.2%, block 2 (HBs antigen, HCV antibodies) 65.7%, and finally, block 3 (blood grouping) 64.1%.

Acute and chronic inflammatory diseases

In addition to the clinical judgement of the recruitment centre physician, CRP concentrations in serum were determined as measures of acute or chronic inflammation. 1.7% (129/7485) of the draftees had minor elevations of CRP (10–50 mg/l), 0.1% (9/7485) had moderate elevations of the CRP (50–100 mg/l) which had to be judged and possibly repeated according to the clinical circumstances by the attending physician. They were probably mostly due to minor viral infections. Most cases, which presented with a lymphocy-

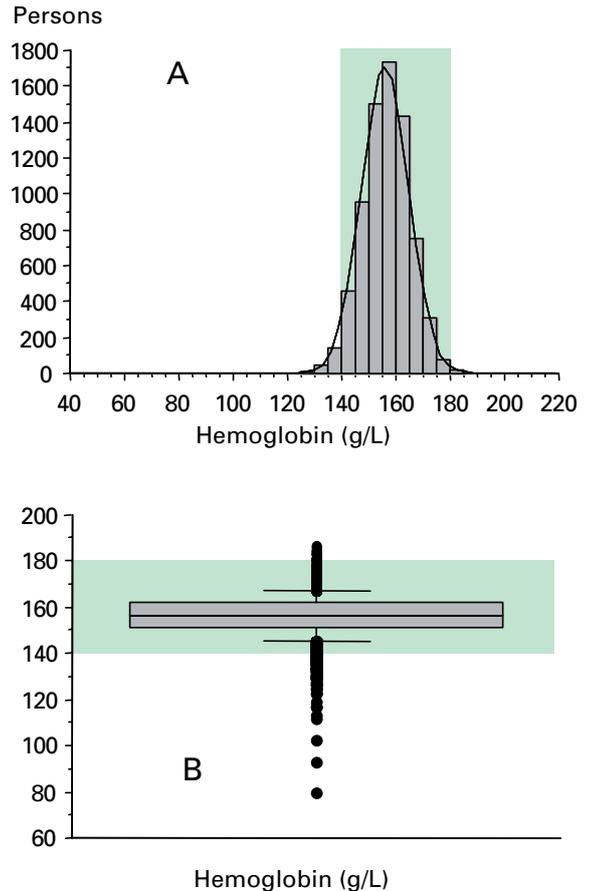


Figure 2
Hemoglobin and anemia. Hemoglobin values were normally distributed (A). While only a few results lied above the upper reference value, a substantial number of cases ranged below the lower limit of normal (140 g/L) and 9 cases showed a significant degree of anemia (<120 g/L, B). The area shaded in green indicates the normal range.

tosis (>4.0 G/l; 0.4%, 30/7409), may surely be interpreted similarly. 16.7% of draftees with a lymphocytosis had a concurrent elevation of CRP (>3 mg/l).

Hepatitis B and Hepatitis C were the 2 viral infections that were serologically tested for. Of the draftees, 0.26% (19/7327) tested reactive for the HBs-antigen, of whom 16 were confirmed by HBc antibodies and thus had an active hepatitis B infection, 9 with elevated ALAT levels. HCV total antibodies tested reactive in 1.13% (83/7364) of the draftees. Of these, 78 were negative and 4 were indeterminate in the recombinant immunoblot. However, 1 patient tested positive for HCV RNA (Case 1).

In one case, we found the CRP elevated to 21 mg/l and a concurrent thrombocytosis (514 G/l), a border-line neutrophilia (7.83 G/l) and a slight normochromic, normocytic anaemia (Hb 130 g/l, MCHC 337 g/l, MCV 83 fl). This case was subject to a more detailed follow-up (Case 2).

Inflammation may also have been responsible, at least in part, for neutrophilia (>8.0 G/l; 4.8%, 356/7409), monocytosis (>1.0 G/l; 1.1%, 85/7409) as well as thrombocytosis (>400 G/l; 1.5%, 110/

Figure 1

Myeloproliferative disorder, essential thrombocytosis. One draftee presented with markedly elevated levels of thrombocytes (1636 G/L) and border-line elevated levels of neutrophils (7.72 G/L), while his CRP was <3 mg/L. Giant thrombocytes and hyper-segmented neutrophils could be demonstrated in his blood smear (A, May-Grünwald Giemsa), and giant megakaryocytes were found in his bone marrow (biopsy, B). Chronic myeloid leukemia was ruled out both by PCR and cytogenetics (data not shown).

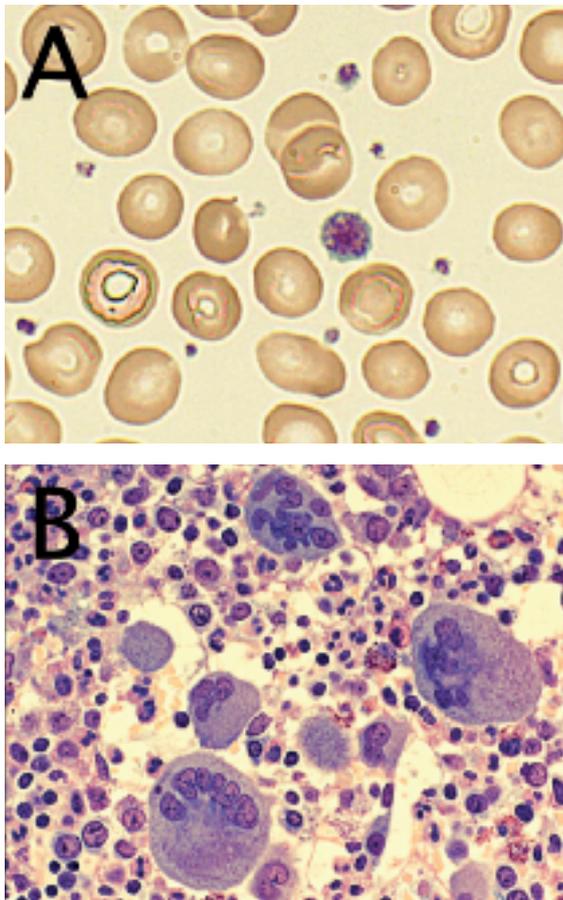


Figure 3

Ferritin: Iron deficiency and iron overload. Ferritin values showed more of a poisson-type distribution (A). Remarkably, 7.8% (587/7484) draftees presented with ferritin values <30 µg/L (B). They could be regarded as having latent iron deficiency. In 51 of these samples, either CRP and/or ALAT values were elevated. On the opposite side of the spectrum, a remarkable 0.1% (10/7484) had ferritin values which indicate iron over-load (>300 µg/L, with normal CRP/ALAT values, B). The area shaded in green indicates the normal range.

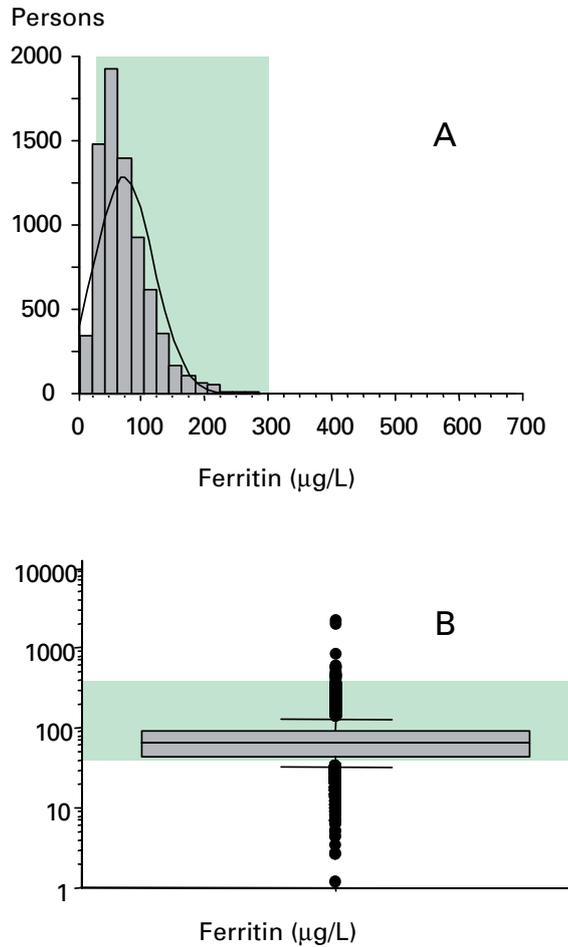
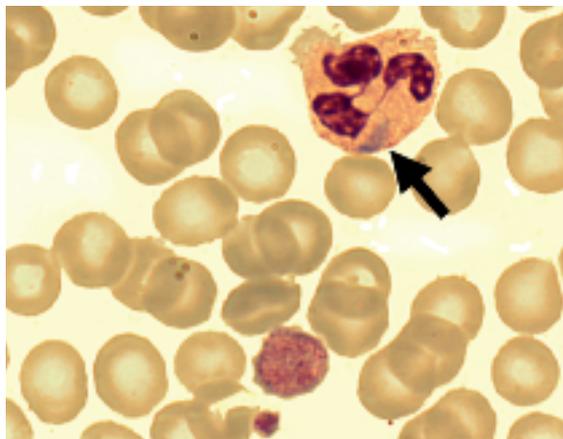


Figure 4

Thrombocytopenia – May-Hegglin anomaly. One draftee presented with only 53 G/L thrombocytes. On a blood smear, which was prepared routinely, as in all other cases of hematological abnormalities, morphological aberrations could be depicted that are diagnostic of the May-Hegglin anomaly: The neutrophils often showed Döhle-like bodies (arrow). The thrombocytes were often atypical in form and hypogranulated, and there were giant thrombocytes.



7446). A simultaneously elevated CRP was shown in 23.6% of cases with neutrophilia (84/356), in 41.2% of cases with monocytosis (35/85), and finally in 20.0% of cases with thrombocytosis (22/110). For thrombocyte counts, however, neither a correlation between CRP levels nor ferritin levels, as a marker of iron deficiency, could be demonstrated (data not shown).

Eosinophilia (>0.5 G/l) was found in 2.6% draftees (189/7409, 11.6% of which also had elevated CRP levels) and is usually associated with a subsiding infection, allergic pre-disposition, asthma, dermatological disease or helminthic infestation.

Haematological disorders

In contrast to the cases discussed in the previous section, 1 draftee presented with a highly elevated thrombocyte count (1636 G/l) and borderline neutrophilia (7.72 G/l) without any signs of inflammation (CRP <3 mg/l). Even without further morphological evidence, this constellation of laboratory data was highly suggestive of a myeloproliferative disorder [2] and the patient was strongly advised to consult his general practitioner (Case 3; figure 1).

Cytopenias were relatively rare, the most common being anaemia. In most cases the Hb was only slightly decreased (<140 g/l, 2.8%, 208/7446; <120 g/l, 10/7446, 0.1%; figure 2). Although in these patients the necessity for further diagnostic procedures depends very much on the clinical judgement of the attending physician, iron deficiency (ferritin <30 µg/l; [4]) could already be proven in a substantial number (16.8%) of these cases based on our screening data. Functional iron deficiency, as judged by a relative insensitive parameter, MCHC, was more prevalent than iron deficiency anaemia (<320 g/l; 1.0%, 73/7446), with latent iron deficiency (ferritin <30 µg/l, normal Hb and MCHC) being even more frequent (7.2%, 536/7484; figure 3). Interestingly, no correlation between ferritin levels and the degree of hypochromia could be demonstrated (data not shown).

In cases with more severe anaemia (<120 g/l; 0.1%, 10/7446), we found iron-deficiency in 50%. In the rest of the cases, the anaemia in itself might initiate further investigations. The most severe anaemia (Hb 82 g/l) could be diagnosed as most likely renal in origin based on the results of our screening examinations (see below). Similarly, in patients with a MCV <78 and a ferritin value >30 µg/l and no signs of inflammation (CRP <3 mg/l) or liver cell destruction (ALAT <41 IU/l), a diagnosis of thalassaemia or haemoglobinopathy is highly suggestive (0.4%, 32/7446).

Only 1 patient presented with neutropenia (0.96 G/l, <0.1%, 1/7446). 22 draftees presented with slight (<140 >100 G/l; 0.3%, 24/7446), 2 with a moderate thrombocytopenia (<100 >50 G/l; <0.1%, 2/7446). One of these patients could be diagnosed only on account of our screening examinations, as in all cases with haematological aberrations, a blood smear was routinely prepared and microscopically controlled (Case 4; figure 4).

Renal insufficiency

A total of 1.8% (136/7484) draftees presented with an elevated creatinin between 115 and 160 µmol/l (figure 5). These findings have to be interpreted within the draftees' clinical presentation and will possibly have to be repeated. The most likely explanations for most of these cases were exsiccation, possibly following strenuous physical exercise and/or excessive abuse of alcoholic beverages [5, 6], or, they were the result of the side effects of non-steroidal anti-rheumatic drug therapy (NSAR).

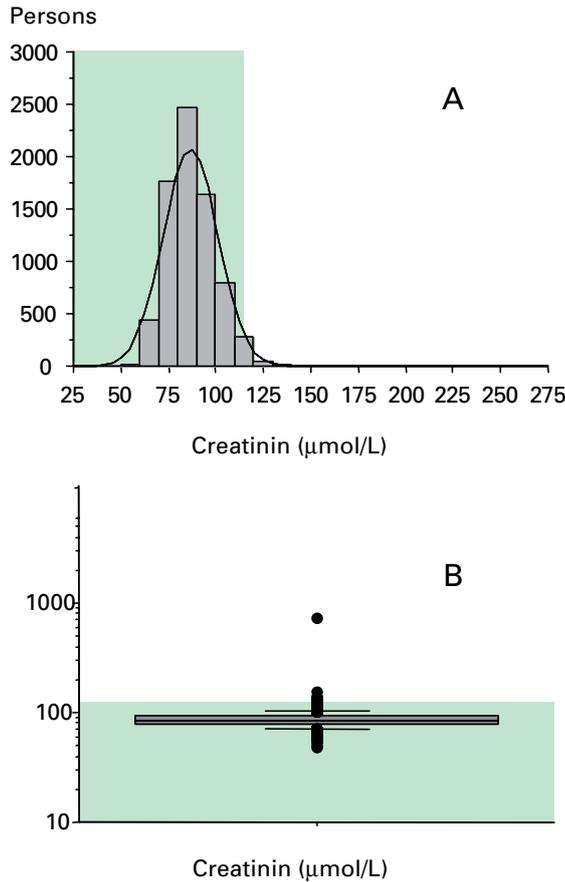


Figure 5
Creatinin: acute or chronic renal insufficiency. Creatinin values were distributed normally (A). 1.8% (136/7484) of draftees showed elevated creatinin values between 115 and 200 µmol/L. One patient presented in terminal renal failure (creatinin 740 µmol/L) and renal anemia (82 G/L, see fig. 3B). The area shaded in green indicates the normal range.

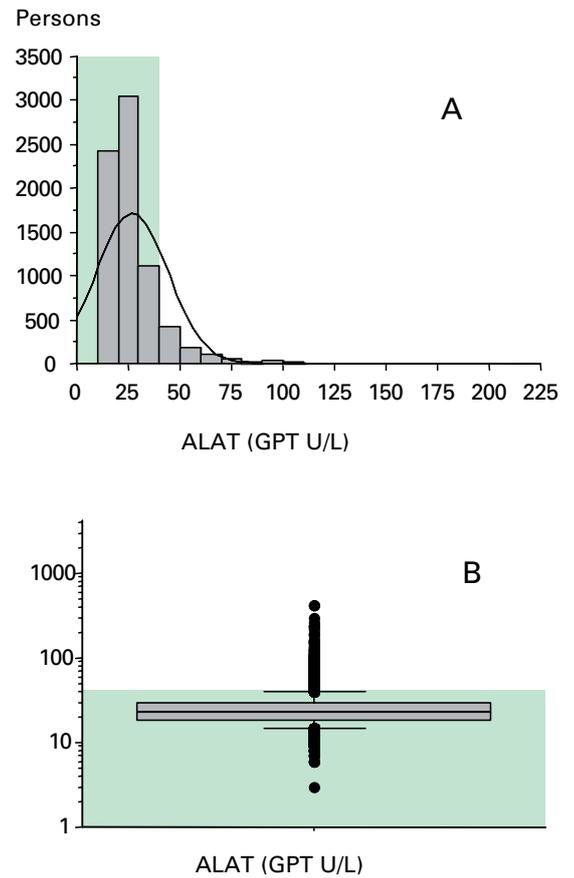


Figure 6
Liver cell destruction – ALAT. In a very high number of draftees liver cell destruction could be suspected on account of their ALAT values (A+B). Accordingly, ALAT values among draftees were not distributed normally (A). In 9 draftees the ALAT was elevated >200 µmol/L (B). The area shaded in green indicates the normal range.

One man, however, presented with a creatinin of 740 µmol/l and anaemia (82 g/l). His case was subject to a more detailed follow-up (Case 5).

Metabolic disorders

Liver cell destruction as judged by elevated ALAT levels was found in no less than 9.8% of draftees (>41 IU/l, 736/7486; figure 6), and was severe in 0.1% (>200 IU/l; 9/7486). Although patients with an active hepatitis B infection (see above) had on average higher ALAT values than their counterparts without the infection, they only showed very moderate increases in their ALAT values (mean = 49 IU/l, range 10–129 IU/l). Very remarkably, much higher individual ALAT levels were recorded in the group of draftees not infected with the hepatitis B or C virus (figure 7, see above).

We did not only find a relatively high number of draftees with iron deficiency (see above), but also, and just as surprising, 0.1% (10/7484) of draftees who had elevated ferritin values. Two had ferritin values at such levels where haemochromatosis with organ manifestations may be suspected (figure 3; CRP <3 mg/l, ALAT <41 IU/l; [7]).

In 0.4% of draftees fasting blood glucose levels indicated diminished glucose tolerance

(>7 mmol/l, 9/2064; figure 8, [8, 9]). Post-prandial/random blood glucose levels, as tested in 5372 draftees, proved to be, as expected, of less diagnostic sensitivity. In 1 case, however, post-prandial blood glucose levels suggested overt diabetes (18.2 mmol/l, >11.1 mmol/l [8, 9]).

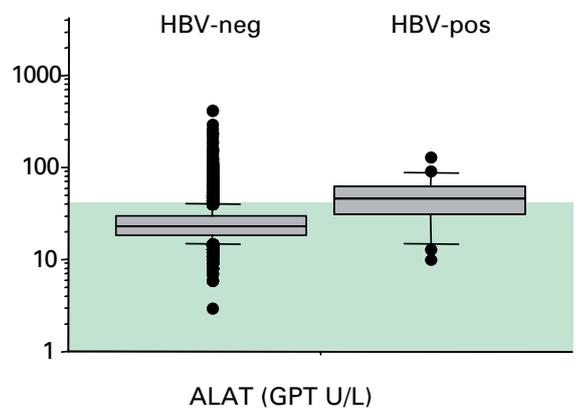


Figure 7
Liver cell destruction a consequence of chronic active hepatitis? Draftees are divided into those who showed laboratory signs of hepatitis B and those who did not. Although patients with chronic active hepatitis B had higher mean ALAT values, higher individual ALAT values were found among the group of patients without hepatitis B.

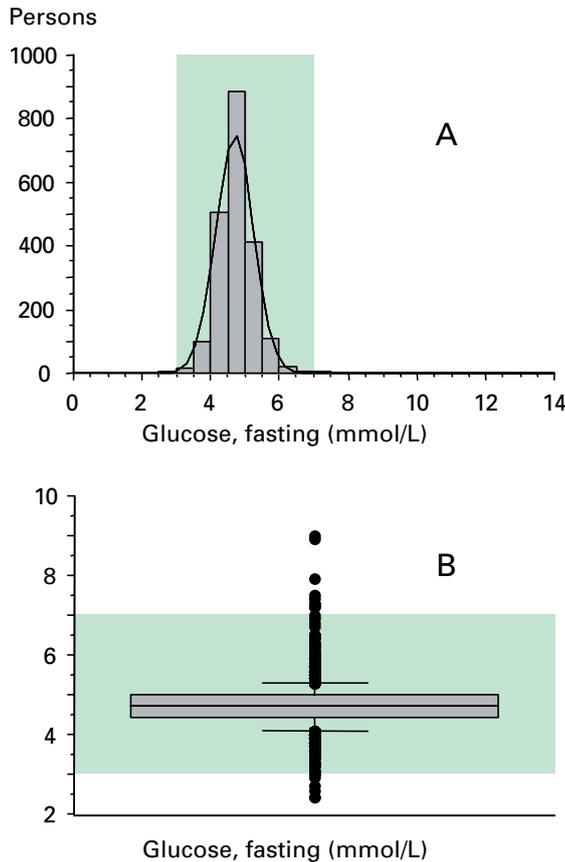


Figure 8
Elevated fasting glucose levels – indicators of a pre-diabetic state or overt diabetes? Fasting blood glucose levels were distributed normally (A). 0.4% (9/2064) of draftees had fasting glucose levels >7 mmol/L (B). The area shaded in green indicates the normal range.

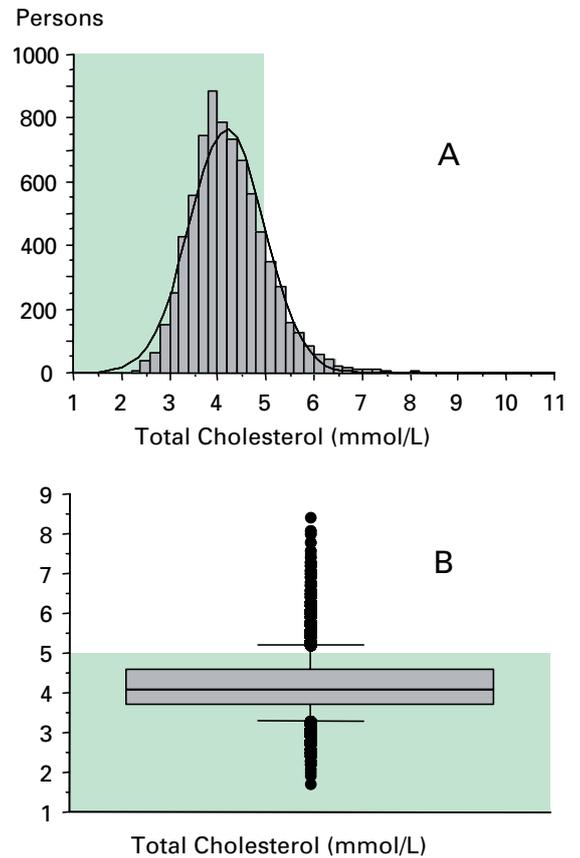


Figure 9
Hypercholesterinemia in young adult males. In contrast to most other parameters cholesterol levels were not distributed normally (A). A very substantial portion of draftees had cholesterol levels above the reference values (A+B), and 1.4% (103/7485) had cholesterol levels above 6.2 mmol/L (B). The area shaded in green indicates the normal range.

Even more importantly, significantly elevated total cholesterol levels (>6.2 mmol/l, [10]) were found in 1.4% (103/7485) of all draftees (figure 9). 9.1% (678/7485) of the young men had cholesterol

values above the limit (>5.2 mmol/l) which is judged as desirable by the National Cholesterol Education Programme’s (NCEP) updated clinical guidelines (ATP III classification [10]).

Discussion

To our knowledge, no similar population surveys, neither civilian nor military, have been undertaken or published until today. The USA, and with her many other western nations, which could afford similar laboratory testing, have abandoned general conscription. Thus, military as well as civilian population-based cross-sectional surveys try to draw conclusions from representative samples [11–15], whereas our survey included more than 2/3 of males of an entire year’s age group. Robust data obtained by survey studies such as ours are the basis both for military planning, organisation, and leadership, as well as for the design of future public health policies [11].

The results of the present study indicates that laboratory evaluation, in addition to medical and psychological evaluation of draftees, may serve 4 purposes: It may confirm findings of the medical

examination or indicate acute illnesses, point out illnesses which forbid army service, or illnesses that may impair service in the army, and, finally, direct attention of both the general public and the political body as well as that of the affected individual and that of his general practitioner to metabolic disorders that may predispose the soldier-to-be to later disease, and, possibly, pre-mature death. In addition, the military health insurance will not have to cover for a disease that existed well before the respective person ever entered the military service.

Minor infections such as acute bronchitis, pharyngitis and tonsillitis, caused either by viruses or bacteria, may already be evident on clinical examination. Leukocytosis, lymphocytosis, monocytosis, and neutrophilia as well as elevated CRP levels serve to confirm these findings. In addition,

CRP levels may help the army physician to judge the severity of the disease. In other cases, these parameters may validate more unspecific and possibly otherwise unexplained symptoms, such as headaches, listlessness or malaise. Eosinophilia is more specific as a marker, pointing to allergies or parasitic infestation as possible causes of disease.

High creatinin levels may indicate acute or chronic renal failure. In the age group of our study population, however, minor elevations of the creatinin levels were mostly due to exsiccation following, for example, strenuous physical exercise, NSAR medication, or recent bouts of vomiting and/or diarrhoea. Depending on the clinical context, however, it may be wise to repeat the test, in order to exclude a more serious medical disorder, as in one of the patients who is discussed in this study (case 5, who presented with grossly elevated creatinin levels indicating end-stage renal failure and renal anaemia).

The case of this patient demonstrates the value of laboratory testing of draftees to exclude young men from recruitment who are not at all fit to serve in the army. Had this man commenced his training as a soldier, his health and possibly his life would have been put at risk. The same holds certainly true for the patient, who was diagnosed to suffer from Crohn's disease based on our laboratory screening, and, possibly, for the patients who were shown to have thrombocytopenia or neutropenia. Essential thrombocytosis poses only rarely immediate threats to a person's life. However, patients suffering from the disease should be treated with aspirin to prevent thrombosis and embolism. An individual diagnosed with the disease, as within our screening protocol, is certainly not fit for military training.

Iron deficiency in itself, and even more so iron deficiency anaemia, may cause tiredness, listlessness and impair physical performance (see below). Moreover, it is essential to elucidate the causes of iron deficiency, which at times may be less serious such as runner's anaemia, haemoglobinuria, hook worm infestation or acute gastritis caused by NSAR. However, there are more serious causes of iron deficiency also among the young, such as peptic stomach and duodenal ulcers [16]. In any case, the cause of iron deficiency should be determined and corrected before the young soldier commences with his military training. Similar considerations hold true for anaemia of aetiologies other than iron deficiency.

Acute hepatitis due to HBV infection was not seen in our study population. However, a substantial number of HBs antigen positive patients (63%) had signs of active hepatitis, as demonstrated by elevated ALAT levels (figure 7). Further evaluation regarding replicative activity of the virus and close follow-up of these patients is warranted. Although the decision to treat, based on further clinical and laboratory work up, must be left to the individual patient's physician [17], it is of great importance from an epidemiological point of view to inform

the infected individuals to prevent further transmission of the infection. In addition, as new therapies will be available, this information may also become more and more relevant to the patient himself [17]. At present, it is Swiss army policy that young men with active hepatitis B are still drafted, unless there is evidence of a high viral load (high HBs antigen and HBV DNA levels) and/or high infectivity (HBe antigen positive and elevated ALAT levels). In view of our results however, it may prove more effective in the future to test primarily the draftees' vaccination status. Only those men without immunity would then be tested for hepatitis B antigen.

The detection of only 1 proven HCV infection among young, male Swiss adults is in stark contrast to current estimates of 0.5 to 1% of active HCV infection in the general Swiss population [18]. According to these estimates, up to 60 cases could be expected in our study population. Although our finding of a very low prevalence of hepatitis C among young Swiss male adults (0.01%) was based on very robust data, the design of our study does not allow us to conclude whether this finding represents a shift in HCV prevalence (despite new and frequent risks such as tattoos and piercings) or an overestimate of HCV prevalence in earlier surveys.

Remarkably, a high number of draftees had ALAT levels that were much higher than those of patients with chronic active hepatitis B. It is beyond the scope of this study to elucidate the causes of the sometimes severe liver cell destruction (ALAT >200 IU/l). However, knowing the social behaviour of young men in this age group, alcohol abuse appears to be one of the most likely causes [19]. Although alcohol abuse and alcoholism have long been defined as problems in modern armies [20], elevated ALAT levels may point out those soldiers most at risk. It may be advisable to further examine draftees with elevated liver enzymes for chronic alcoholism (e.g. by carbohydrate-deficient transferrin) or other substances of abuse. Thus, by early identification of these draftees, problems at some later time between a soldier and his superiors may be prevented.

Hepatitis and alcoholism not only affect a person's ability to serve in the army, but may also impair his future health. Here, early medical intervention, such as vaccination and education, as in the case of our patient with hepatitis C, may prevent later disease. The same holds true for the early diagnosis of patients with iron overload and haemochromatosis, respectively, within the Swiss army's screening programme. Similarly, a patient's and his general practitioner's knowledge of reduced glucose tolerance or even overt diabetes mellitus will prompt early therapy which will probably prevent or at least delay secondary complications. Together with obesity, type 2 diabetes is becoming epidemic among the young [21], and may very well be influenced by cost effective lifestyle changes [22, 23]. It is remarkable in this context, that most patients with type 2 diabetes are asymp-

tomatic at presentation, that the disease has usually been present for more than 10 years, and that these patients thus present already with 1 or 2 diabetic complications at diagnosis [24]. All this appears even more regrettable when one considers that effective therapies are available.

The finding which might entail the greatest relevance for public health is probably the fact that 9.1% of Swiss young men at the age of 18–20 have serum cholesterol levels termed “not desirable” by the American National Cholesterol Education Panel (NCEP, [10]). Cholesterol levels (>6.2 mmol/l) which are judged by the NCEP [10] and according to American (Framingham, [25–27]) and European (PROCAM [28–30], CUORE [31], British heart study [32]) longitudinal population studies as clinically significant and associated with an increased risk of developing atherosclerosis at an later age were found in 1.4% of young Swiss men. While LDL-cholesterol represents the pathogenetic principle in atherogenesis more closely, and certainly is the primary target of all cholesterol lowering therapeutic efforts, total cholesterol is the most prominent risk factor within the Framingham coronary heart disease risk score [10]. In contrast to LDL cholesterol, total cholesterol is relatively independent from prior food intake, and its laboratory determination is technically easier and less costly. HDL cholesterol, on the other hand, acts only as a risk modifier [10].

Except for cases with extremely high total cholesterol levels such as in familial hypercholesterolaemia, the 10-year probability for coronary heart disease is low in the age group. However, it is in the age between 20 and 40 that atherosclerotic plaques develop, and it is in this age group that long-term primary prevention might prove most effective [10, 33]. The little longitudinal population study-based long-term data which exist sug-

gest, that the current risk factors even underestimate the risk for coronary heart disease in young adults [34]. Early medical and laboratory screening and the army setting offer a unique opportunity to initialise primary prevention of coronary heart disease: the young men at risk are identified by the medical and laboratory conscription examinations (confirmed later after the commencement of military training). For the vast majority of soldiers in whom congenital or secondary forms of dyslipidaemia, which have to be treated differently, have been excluded [10], the army medical service could develop educational programmes that inform soldiers about risk factors and risk prevention. Therapeutic lifestyle changes, including a cholesterol lowering diet, weight reduction, smoking cessation and increasing physical activity could be induced in classes offered by the military medical service. As no additional facilities or personnel would be required for these measures, primary prevention of coronary heart disease could prove very cost-effective in Switzerland. Additional drug therapy for those patients with overt diabetes mellitus, hypertension or very high cholesterol levels which persist despite therapeutic lifestyle changes have to be taken into consideration, although their cost-effectiveness is less clear [10].

Taken together, the findings of the present study appear, at least in part, both unexpected and important. The most prominent finding of these may prove to be the high prevalence of hypercholesterolaemia among the young. The consequences of these findings, especially regarding early preventive therapy, will most certainly be a matter not only of medical but also of public debate, while our data and that of planned longitudinal population studies form the basis on which future corrective public health measures may be founded.

Cases

Case 1: Hepatitis C. This subject was good at sports and had initially enlisted as a grenadier in the army. His laboratory screening tests (anti-HCV antibodies) suggested hepatitis C, which was confirmed by PCR (HCV-RNA 349000 IU/ml, HCV-Genotype 1a). His liver enzymes were not elevated (ALAT 38 U/l, γ GT 10 U/l) and he tested negative for hepatitis A and B, HIV 1 and 2. A more detailed history revealed a heterosexual, unprotected contact as a potential route of transmission. Ultrasonography gave no indication of liver steatosis or of parenchymal changes suggestive of fibrosis or cirrhosis. A liver biopsy showed discrete signs of chronic active hepatitis with minimal portal fibrosis. Thus, a “wait and see” policy was adopted, with clinical and laboratory follow-up every 6 to 12 months. In addition, the patient was vaccinated against hepatitis A and B, and he was carefully instructed about risks of transmission of viral hepatitis and the precautionary measures to be taken. He was also advised to strictly control his alcohol consumption.

Case 2: M. Crohn. At the time of conscription, the

patient had presented with an unremarkable medical history and had been asymptomatic. A careful physical examination had revealed no localising signs or other pathological findings. Based on laboratory results however, the patient was referred to his family doctor and the laboratory results were confirmed. Although hypochromic anaemia and elevated CRP values persisted, no further diagnostic measures were taken. During the next 2 months the patient experienced recurrent episodes of diarrhoea and he lost 3 kg of weight. A colonoscopy was performed which revealed deep mucosal ulcers in the distal part of the ileum (20% of the surface involved), superficial small aphthous ulcers in the colon (1% of the surface involved), and 2 long superficial ulcerations in the rectum. Biopsies were taken which were compatible with the diagnosis of Crohn's disease. The patient responded only poorly to two courses of prednisone. An immunosuppressive therapy with azathioprin had to be stopped because the patient developed a low grade pancreatitis. The patient complains presently only of intercurrent diffuse abdominal pain, but the sensitive

laboratory parameters for Crohn's disease remain elevated. Presently, therefore, the patient receives a second line treatment with ciprofloxacin.

Case 3: Essential Thrombocytosis. Again, the patient's history and physical examination had been unremarkable. As he remained asymptomatic, he consulted his family doctor only 10 months after the conscription examination, in spite of written advice. The results of the conscription laboratory testing were confirmed and the patient was referred to a haematologist. Splenomegaly was suspected on physical examination and confirmed by ultrasound. A bone marrow aspirate and biopsy were taken and the diagnosis of essential thrombocytosis was made (figure 1). Chronic myeloid leukaemia was ruled out both by bcr-abl PCR and by cytogenetics [3]. The patient was started on aspirin to prevent thrombo-embolic complications and remains under close haematologic supervision.

Case 4: May-Hegglin Anomaly. This patient, whose history and physical examination had been totally unremarkable, had thrombocytopenia (53 G/l), a normal haemoglobin (157 g/l) and leukocyte differential (neutrophils 6.42 G/l, eosinophils 0.05 G/l, basophils 0.09 G/l, monocytes 0.35 G/l, and lymphocytes 3.39 G/l). On microscopic examination of his blood smear hypogranular and giant thrombocytes were found as well as Döhle-like bodies in his neutrophils (figure 4). This morphologic picture is pathognomonic of the May-Hegglin anomaly [2]. On account of these results, a more detailed history was taken which did not reveal any bleeding disorder. The patient was instructed that he does not require therapy for his inherited haematological anomaly. He also was told to inform all his future physicians and, especially surgeons, of his anomaly, so that his thrombocytopenia need not be further investigated or surgical treatment withheld.

Case 5: Focal segmental glomerulosclerosis, renal insuffi-

ciency and anaemia. On conscription day the draftee had given an unremarkable medical history and the physical examination had yielded no pathological findings. Only, when the results of laboratory testing (haemoglobin 82 g/l, creatinin 740 µmol/l) came in, the patient was re-questioned and it was learned that he had experienced an episode of macrohaematuria about 2 years previously. Since then he had felt increasingly tired and listless, so that he had to reduce his physical activities. During the last few months he had noted an itching, which increased over time.

Chronic renal insufficiency, renal anaemia, and on the ground of additional laboratory data secondary hyperparathyroidism were diagnosed and the patient was immediately referred to a nephrology polyclinic where a renal biopsy revealed a focal segmental glomerulosclerosis. Haemodialysis had to be started and was performed 3 times weekly. Two months later, the patient underwent a successful renal transplantation. Creatinin levels decreased to 128 µmol/l on day 7 post-transplant and have remained in this range ever since.

Acknowledgements

The authors wish to thank Drs. M. Hagen and G. Weymuth for providing follow-up data of their patients, and Ms. C. Gerber for her excellent assistance with secretarial work.

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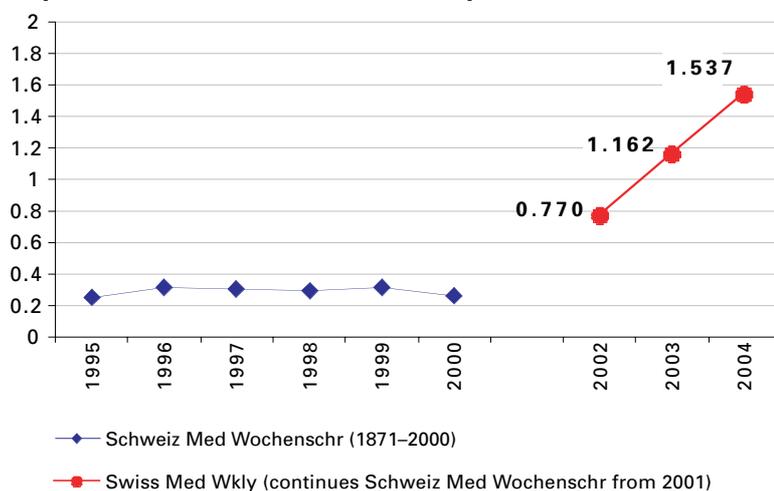
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