The Clinical Journal of Pain
17:129–137 © 2001 Lippincott Williams & Wilkins, Inc., Philadelphia

Cardiorespiratory Fitness, Physical Activity Level, and Chronic Pain: Are Men More Affected Than Women?

Henri Nielens, M.D., and Léon Plaghki, M.D., Ph.D.

Department of Physical Medicine and Rehabilitation, Cliniques Universitaires St-Luc, Brussels, and Université catholique de Louvain, Louvain, Belgium

Abstract

Objective: To evaluate the cardiorespiratory endurance (CRE) and physical activity level of patients with chronic pain compared with healthy subjects.

Design and Subjects: Cross-sectional study, with a consecutive sample of 55 patients with chronic pain (20 men, 35 women). Comparison of CRE and physical activity indices obtained in patients with data available in the literature for age-matched healthy subjects.

Setting: A multidisciplinary pain center in a city of more than 1,000,000 inhabitants.

Outcome Measures: A physical working capacity index ($PWC_{65\%}$/kg) and physical activity level scores and subscores obtained with two questionnaires (the Baecke and the Five-City Project questionnaires).

Results: The physiological gender difference in CRE indices that characterizes healthy subjects was not observed in patients with chronic pain. When compared with values previously obtained in controls, male patients presented with a very significant 34% reduction in $PWC_{65\%}$/kg. The 17% reduction found in women hardly reached significance level. The Baecke total physical activity score was significantly higher in female than in male patients, a finding not observed in healthy controls. There was no significant difference between male and female patients in the Five-City Project total physical activity score expressed in kilocalories per day per kilogram (i.e., normalized for body weight), although data from the literature show that healthy men present with a significantly higher level of physical activity compared with healthy women.

Conclusions: Data on CRE and the physical activity level of patients with chronic pain obtained in this study show that chronic pain may have a greater impact on male than female patients. Sociocultural factors are probably at the origin of this phenomenon.

Key Words: Cardiorespiratory endurance—Chronic pain—Cycle ergometer test—Fitness evaluation—Physical activity.

Many studies have investigated the impact of chronic pain states on patients' functional capacities.[1–3] Several of these studies focused on indicators of cardiorespiratory endurance (CRE),[2–5] and all reported a significant reduction in CRE in most patients with chronic pain. To account for the reduced CRE, investigators usually hypothesize that the level of physical activity is reduced in relation to job loss, rest prescribed by physicians, or learned activity avoidance behaviors caused by actual enhancement of pain by activity or simply to the fear of inducing activity-related pain. Some investigators have termed this condition a "deconditioning syndrome,"[1] whereas others call it a "disuse syndrome."[6] However, the hypothetical relation between the reduction in CRE and reduced physical activity as a consequence of the chronic pain state has, to our knowledge, never been assessed directly in patients with chronic pain.

Received August 30, 1999; revised December 22, 2000; accepted January 2, 2001.

Address correspondence to Prof. H. Nielens, Department of Physical Medicine and Rehabilitation, Cliniques Universitaires St-Luc, 1200 Brussels, Belgium; email: nielens@read.ucl.ac.be

In previous studies, we observed in two separate cohorts of patients with chronic pain that CRE, as measured by a submaximal cycle ergometer test, was significantly reduced only in men when compared with age- and sex-matched controls.[4,5] It was hypothesized that sociocultural factors could possibly account for a greater level of inactivity in men with chronic pain than in women. Indeed, retrospectively, it was found that more male patients had a physically demanding occupation, and more male patients lost their use as a consequence of chronic pain. Moreover, at home, women seemed to be more physically active than men as they were more often responsible for household tasks and child care.

The aim of the current study was to test this hypothesis directly by measuring CRE using a submaximal multistage cycle ergometer test and assessing the level of physical activity by two reliable and validated physical activity questionnaires in a cohort of 55 patients with chronic pain.

MATERIALS AND METHODS

Subjects

Fifty-five consecutive patients with chronic pain (20 men, 35 women) were included in this study after initial clinical evaluation, before any assessment of physical capacity was conducted or any therapeutic program initiated. All patients had been referred to the Chronic Pain Unit of the Multidisciplinary Pain Center of the Cliniques Universitaires St-Luc, a university hospital in Brussels, Belgium (a city with more than 1,000,000 inhabitants). Patients were referred by general practitioners or specialists (e.g., orthopedic surgeons, rheumatologists) of the region. All patients participating in the study gave their informed consent, and the rules of the Ethics Committee of the Faculty of Medicine (Université catholique de Louvain) were followed.

According to the International Association for the Study of Pain[7] and classification of chronic pain syndromes, and on the basis of available clinical and laboratory data, the patient group was composed of 20 male and 35 female patients: 30 (10 men/20 women) patients with chronic low back pain with or without sciatica, 13 (5 men/8 women) with fibromyalgia syndromes, and 12 (5 men/7 women) with miscellaneous other chronic musculoskeletal pain conditions such as cervical or dorsal pain, neuropathic pain often secondary to surgery, and headache.

The mean age of the patients was 44 ± 9.3 years, and they had previously undergone an average of 1.0 surgical procedures related to their pain. All patients had suffered for more than 1 year, most for several years, when the study was initiated.

CRE assessment

A variety of testing procedures is used to assess fitness in patients with pain. Some methods include exhaustive evaluation of all major components of fitness (i.e., strength, flexibility, coordination, and CRE).[1] However, most testing protocols used in studies of patients with pain have been validated in healthy subjects only. Such protocols often require maximal effort and sophisticated as well as expensive equipment. Hence, the validity and reliability of many fitness testing procedures (maximum oxygen uptake [$\dot{V}O_2max$] evaluation, maximal back extensor strength, flexibility, etc.) may certainly be questioned in the context of the evaluation of patients with chronic pain, since most maximal protocols tend to be rather symptom-limited and may thus underestimate the patients' true physical capacities.[8]

CRE is generally considered to be the most fundamental component of fitness.[8,9] Moreover, it can be reliably assessed by submaximal testing protocols not requiring sophisticated and expensive equipment (gas analyzers, isokinetic torque meters, etc.). It would thus seem preferable to focus only on CRE when assessing the fitness of untrained subjects, particularly of patients with chronic pain.[8]

Some submaximal protocols allow calculation of several well-known submaximal physical working capacity indexes (PWC_{170}, $PWC_{75\%}$, etc.) that are considered as reliable indicators of CRE.[2,10,11]

In this study, only the most fundamental component of fitness (i.e., CRE) was evaluated. A submaximal working capacity index that has been shown to be a valid and reliable index of CRE in patients with chronic pain[4] was obtained by means of a simple submaximal cycle ergometer test suitable for routine clinical use.

Cycle ergometer test

The methodology of this test has been described in detail previously.[5] The test is conducted on a Monark cycle ergometer (model 818E, Vansbro, Sweden). After a brief warm-up period of a few minutes during which the subject gets familiar with the imposed pedaling cadence (60 rpm), the subject is asked to perform several 2-minute stages of gradually increasing intensity. Briefly, starting from a work intensity (power) of 25 W, the power is increased in a stepwise manner every 2 minutes by 25 W until the patient's heart rate (HR) reaches a value corresponding to 65% of his or her HR reserve ($HR_{65\%}$) or more, according to Karvonen's formula, in which resting HR is assumed to be 80 beats/min for all patients. Indeed, while the resting HR should theoretically be easy to measure, it may vary considerably between and within subjects and especially in patients

with chronic pain who are habitually more anxious during the period immediately preceding an exertion test and often use medication affecting resting HR (tricyclic antidepressants, β-adrenergic antagonists, etc.). Together, these factors make resting HR measurements unreliable. As a consequence, if the $PWC_{65\%}$/kg is used as an index to monitor improvement in CRE, the variability of any measured resting HR may lead to an error in the estimation of the improvement made by the patients. To avoid this potential problem, a fixed resting HR value of 80 beats/min was selected to be used for the calculation of the $PWC_{65\%}$/kg for all subjects in this study. This value was chosen because it was the average resting HR previously obtained from a large number of patients (>50) with chronic pain whose resting HR was measured at the end of a 2-minute period spent sitting quietly (unpublished results). Although 80 beats/min seems to correspond to the average resting HR of such patients, it is obvious that this approximation may lead to a considerable margin of error in the estimation of the resting HR in some subjects. Most patients achieve three or four stages, and some may achieve more depending on their level of fitness.

During the test, the HR of the patient is monitored by a HR meter (Polar, Kempele, Finland). The HR corresponding to the steady state at the end of each stage is recorded as well as the corresponding powers (25, 50, 75, 100 Watts, etc.).

Calculation of the fitness index ($PWC_{65\%}$/kg)

The power or work capacity at $HR_{65\%}$, $PWC_{65\%}$, is obtained by interpolation of the power (watts) for $HR_{65\%}$ on the HR-versus-power linear relation calculated from the data collected during the test. The fitness index ($W_{65\%}$/kg) is finally obtained by normalizing $PWC_{65\%}$ for body weight (kilograms) of the subject and is expressed in watts per kilogram (Fig. 1). This index may be considered as the power, expressed in watts per kilogram of body weight, that the subject would generate on a cycle ergometer if he or she exercised in a steady state at a relative work intensity corresponding to 65% of his or her HR reserve. The $PWC_{65\%}$/kg is thus the equivalent of several well-known indexes such as the PWC_{170}, PWC_{150}, and PWC_{160} previously used by investigators to evaluate the CRE of patients with chronic pain,[2,10,12,13] except that the $PWC_{65\%}$/kg is calculated for the same relative work intensity (corresponding to 65% of the HR reserve of the subject according to age) instead of the same absolute value of HR (150, 160, 170 beats/min, etc.). This methodology is preferable in groups including subjects with a wide range of ages.[4,11]

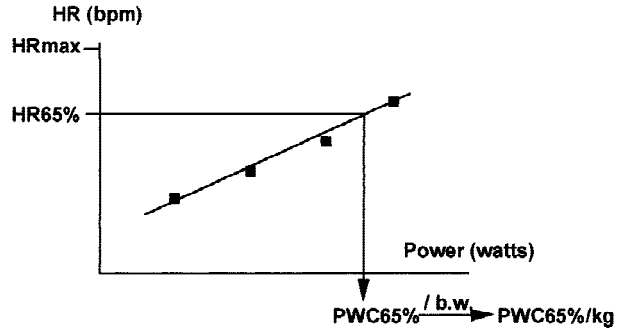

FIG 1. The cardiorespiratory index ($PWC_{65\%}$/kg) is based on the linear relation of heart rate (HR in beats/min) versus intensity of exercise (power in watts) on a cycle ergometer. The HR values are measured at the end of each of the four stages of the cycle ergometer test. $PWC_{65\%}$ is computed by interpolation (i.e., the power corresponding to a HR of 65% of the HR reserve [$HR_{65\%}$]). Finally, the cardiorespiratory endurance index ($PWC_{65\%}$/kg) is obtained by normalization for body weight (b.w. in kilograms).

Evaluation of physical activity

Numerous studies have been conducted to evaluate the accuracy (validity and reliability) of questionnaires as tools to assess the level of physical activity[14–16] and have found this technique to be satisfactory.[17,18] More objective and accurate methods such as respiratory chambers and double-labeled water methods are hardly applicable in routine clinical use or epidemiologic studies because of their cost and complexity and the fact that they may influence the subject's behavior. The use of such methods is therefore generally limited to validation studies of other activity assessment tools such as questionnaires.[14]

The choice of the questionnaire depends on several factors, including the population studied, the type of physical activity that should be assessed, the time available for the interview, and, possibly, interviewer skills. We chose two questionnaires that are generally presented as valid and reliable for population-based studies,[14–16] that could both be administered in less than 30 minutes and that covered all types of physical activity (occupation, leisure, sports, etc.). The Baecke self-administered[19] questionnaire and the Five-City Project questionnaire[20,21] satisfied these criteria and were thus used in this study after translation into French. For the Baecke questionnaire, the fact that normal data for European healthy subjects are available in the literature was also considered.

All patients were evaluated by the same well-trained observer.

The Baecke self-administered habitual physical activity questionnaire

The Baecke questionnaire includes 19 questions addressing the three main types of common physical activity (i.e., occupation, sports, and nonsports leisure activity). For each

question, the subject is asked to score his answer on a five-point Likert scale ranging from "never" to "always" or "very often." In addition, for the two most frequently reported sports, the subject is asked to report the number of months per year and hours per week of participation. Three indexes are calculated on the basis of the scores given by the subject: a Work index, a Sports index, and a Nonsports leisure index. The total Baecke score is obtained simply by summing these three indexes.

In the current study, the Baecke questionnaire was self-administered, but active help of the observer was provided when necessary. We used the following abbreviations: Boccup for Work index, Bsport for the Sports index, Bleisure for the Nonsports leisure index, and Btot for the total Baecke score.

The Five-City Project 7-day recall physical activity questionnaire

With the Five-City Project questionnaire, subjects are asked about their activities of the previous week after classifying them according to intensity (energy expenditure rate). Knowing that one MET is defined as the energy expenditure rate (work intensity) corresponding to sitting quietly and that it approximates the resting metabolic rate (approximately 1 kcal/kg/h),[20,22] the total amount of time (hours) spent during the previous week (workdays and weekend) in sleeping or resting (energy expenditure rate = 1 MET), and activity of light (1.5 MET), moderate (4 MET), hard (6 MET), and very hard (10 MET) intensity are recorded. These five amounts, expressed in hours per week, constitute the five Five-City Project physical activity subscores: Rest, Light, Mod, Hard, and Vhard. To allow recording and classification of some activities that were not present on the questionnaire's list of examples, we used the Compendium of Physical Activities from Ainsworth et al.[22]

The final total physical activity score (5-CPtot) is obtained by summing the five subscores multiplied by their corresponding intensity level (in METs) and dividing by 7 (7 d/wk). Thus, the 5-CPtot represents the average daily energy expenditure rate of the preceding week, expressed in kcal/d or, when normalized for body weight, expressed in kcal/d/kg. The 5-CPtot score expressed in kilocalories per day, which reflects the total daily energy expenditure of the subject, is directly related to the weight of the subject and thus tends to overestimate the actual physical activity in overweight subjects.[20] Hence, it may not be considered as an acceptable measure of energy expenditure in overweight populations, such as the patients in this study, who present with elevated body mass index values. Thus, to reflect the real physical activity of the subject, 5-CPtot needs to be normalized for body weight.

Statistical analysis

For all measured variables (CRE index, total physical activity scores, and corresponding subscores) mean values and SD were calculated.

To evaluate the effects of gender difference on CRE and physical activity, an ANOVA with gender as the independent factor was conducted on CRE indexes and on all physical activity scores and subscores. If there was a difference in the total physical activity scores according to gender, contrast analysis (Scheffé F test) was conducted on the physical activity subscores to evaluate which type of activity contributed most to the difference.

To compare the mean CRE indexes obtained in this study to those of other studies, Student *t* tests were used based on the available data (mean, SD, and number of subjects).

The Spearman ρ correlation coefficient was calculated to evaluate the strength of the relation between fitness ($PWC_{65\%}$/kg) and physical activity (respectively Btot and 5-CPtot) and between both questionnaires scores.

RESULTS

With a mean weight of 84 ± 18.0 kg and 67 ± 13.3 kg and mean height of 1.74 ± 0.05 m and 1.64 ± 0.07 m for men and women, respectively, the patients with chronic pain in this study, especially the men, may be considered as moderately overweight. Indeed, according to Jaequier,[23] the mean body mass index of 27.7 kg/m^2 obtained in male patients is consistent with grade 1 obesity. With a body mass index value of 24.9 kg/m^2, women are at the upper limit of the desirable range.

CRE of patients with chronic pain

The mean and SD of the fitness index ($PWC_{65\%}$/kg) obtained in patients, as well as in 34 healthy control subjects,[5] are presented in Table 1.

Previously reported control values of $PWC_{65\%}$/kg[5] were significantly higher in men than women (F = 16.99; p = 0.0001), which is consistent with the

TABLE 1. *Fitness as measured by the $PWC_{65\%}$/kg in patients with chronic pain and healthy subjects*

Cardiorespiratory endurance index $PWC_{65\%}$/kg (watts/kg)	Chronic pain patients (mean ± SD)	Healthy subjects* (mean ± SD)
Males	1.59 ± 0.48† n = 19	2.42 ± 0.68‡ n = 17
Females	1.38 ± 0.38† n = 34	1.66 ± 0.46‡ n = 17

*From Nielens & Plaghki, 1994.
†p = 0.09.
‡p = 0.0001.

well-known fact that, in the healthy population, such CRE indices are higher in men.[24] In the patients in this study, the physiologic gender difference in $PWC_{65\%}$/kg was not present ($F = 2.99$; $p = 0.09$) because of a greater reduction in $PWC_{65\%}$/kg, which reached 34% in men and only 17% in women, in comparison with values for healthy subjects included in Table 1.

Physical activity level as assessed by the Baecke Questionnaire

Total physical activity scores and subscore indexes obtained with the Baecke questionnaire in patients with chronic pain are presented in Table 2. The Baecke total physical activity score (Btot) was significantly higher in female than in male patients ($F = 4.1$; $p = 0.049$). This was confirmed by a repeated-measures ANOVA on the three subscores with gender as the independent factor.

Contrast analysis with the Scheffé post hoc test (Table 2, last column) showed that the occupation subscore (Boccup) probably contributed the most to this difference. Indeed, in the group of male patients, only 20% (4 of 20) were still at their job at the moment of physical activity evaluation as compared with 34% (12 of 35) of the female patients.

Physical activity level as assessed by the Five-City Project Questionnaire

Total physical activity scores (mean ± SD) obtained with the Five-City Project questionnaire (5-CPtot) in male and female patients are presented in Table 3, where they are expressed in kilocalories per day and kilocalories per day per kilogram. In the last column of this table, mean differences in 5-CPtot scores of men as compared with women and significance levels are also presented.

When the 5-CPtot score was expressed in kilocalories per day, the mean total physical activity level of male patients was significantly higher than that of women ($F = 10.6$; $p = 0.002$). However, if the 5-CPtot score was expressed in kilocalories per day per kilogram (i.e., normalized for body weight), the absolute total physical activity level of male and female patients was not significantly different ($F = 0.07$; $p = 0.797$). There were no significant differences between male and female patients in the different categories of physical activity as reflected by all Five-City Project subscores. The patients in this study did not report any very hard, and only very few hard, physical activities.

TABLE 2. *Baecke total physical activity score and subscores obtained in 55 patients with chronic pain*

Baecke scores and sub-scores	Males (n = 20, mean ± SD)	Females (n = 35, mean ± SD)	Mean difference & significance level
Btot	4.5 ± 1.5	5.5 ± 1.8	−0.99 $p = 0.049$
Boccup	0.5 ± 0.9	1.2 ± 1.7	−0.75 $p = 0.077$
Bsport	1.6 ± 0.4	1.6 ± 0.5	0.04 $p = 0.741$
Bleisure	2.4 ± 0.7	2.7 ± 0.6	−0.26 $p = 0.158$

TABLE 3. *Five-City Project total physical activity scores and subscores in chronic pain patients*

Five-City Project scores and sub-scores	Males (n = 20, mean ± SD)	Females (n = 35, mean ± SD)	Mean difference & significance level
5-CPtot (kcal/day)	2905 ± 739.5	2303 ± 609.7	602.4 $p = 0.002$
5-CPtot (kcal/day/kg)	34.4 ± 4.15	34.1 ± 3.77	0.28 $p = 0.797$
Rest (hours/week)	66.9 ± 21.35	65.4 ± 14.39	1.50 $p = 0.758$
Light (hours/week)	92.9 ± 21.02	94.8 ± 14.03	−1.94 $p = 0.684$
Mod (hours/week)	7.3 ± 6.21	7.7 ± 9.18	−0.39 $p = 0.868$
Hard (hours/week)	0.9 ± 3.80	0.1 ± 0.42	0.83 $p = 0.20$
Vhard (hours/week)	0	0	0

Correlation between physical activity scores and between fitness index and physical activity scores

There was a weak although significant correlation between the Btot and the 5-CPtot expressed in kilocalories per day per kilogram (Spearman $\rho = 0.32$; $p = 0.02$).

The correlations between the fitness index and both total physical activity scores were not significant (Spearman $\rho = -0.17$, $p = 0.22$ and $\rho = 0.23$, $p = 0.08$ for $PWC_{65\%}$/kg vs Btot and vs 5-CPtot expressed in kilocalories per day per kilogram, respectively).

DISCUSSION

Many investigators have observed a reduced physical capacity in patients with chronic pain. This condition is thought to be related to a reduced level of physical activity as a direct consequence of chronic pain. In two previous studies[4,5] involving a total of 98 patients with chronic pain, we observed that CRE, often considered as the most important component of fitness[8] and thus of functional capacity,[25] was altered more in male than female patients. We thus retrospectively hypothesized that

this phenomenon was probably a result of sociocultural factors, including job loss, which seems more systematic in men.[4] The current study, which included assessment of CRE as well as the level of physical activity in 55 patients, was conducted to test this hypothesis.

CRE in patients with chronic pain and influence of gender

It is a common clinical observation that patients with chronic pain seem generally unfit and physically inactive. Physical reconditioning is thus frequently proposed as part of the multidisciplinary treatment program.

In this study, the physiologic gender difference in CRE (Table 1) that characterizes healthy subjects[22,24] was absent as demonstrated by the lack of a significant difference between male and female $PWC_{65\%}$/kg. As compared with the $PWC_{65\%}$/kg values previously obtained in controls,[5] the male patients in this study presented with a very significant 34% reduction in $PWC_{65\%}$/kg (Student $t = 4.27$; $p < 0.01$). Although also significant (Student $t = 2.31$; $p \simeq 0.02$), the 17% reduction in $PWC_{65\%}$/kg found in women was less pronounced. Moreover, according to Gettman,[26] the fitness of the male patients could be described as "poor" (<1 SD from mean of the control group) and that of the women as "fair" (<0.5 SD from mean of control group). Finally, on the basis of the $PWC_{65\%}$/kg values (calculated $PWC_{65\%}$ and corresponding $HR_{65\%}$), the $\dot{V}O_2$max of the patients may be estimated roughly using the Astrand nomogram.[9,10,24] Using this method, $\dot{V}O_2$max may be estimated to be 32.9 ml/kg/min in male patients with chronic pain and 35.1 ml/kg/min in women. These values would place the male patients at approximately P20 and the females at approximately P75 according to the American College of Sports Medicine's normal values for $\dot{V}O_2$max.[24]

These observations, along with the findings of other investigators who have also used CRE submaximal testing protocols,[27] are in agreement with those of two previous studies conducted in the same Chronic Pain Unit.[4,5] Hence, the fact that CRE seems to be affected more in male patients with chronic pain than in female patients may have been overlooked in most studies. In fact, many studies[28–30] used maximal exercise testing protocols to evaluate CRE, which may not be satisfactory in patients with chronic pain since such testing protocols, as previously discussed, tend to be symptom-limited and may thus not be valid in such patients. Moreover, many studies including CRE evaluations also focused primarily on physical reconditioning. Hence, the results of such studies are generally presented for men and women as one group,[1,2,27,28,31] which renders recognition of any gender effect on CRE in patients with chronic pain impossible.

Nevertheless, the hypothetical greater impact of chronic pain in male patients in terms of physical deconditioning that we have observed in our Chronic Pain Unit (in 153 patients, 68 men and 85 women, from three separate studies) should be confirmed using other CRE evaluation procedures because no general agreement exists about the most accurate (valid and reliable) CRE evaluation method in patients with chronic pain.[3,30] Similar CRE evaluations in other countries could also be conducted to define the possible role of sociocultural factors governing the onset of physical deconditioning in such patients.

Physical activity assessment by questionnaire in patients with chronic pain

Much has been written on the issue of the validity and reliability of questionnaires. In particular, it must be stressed that most commonly used questionnaires have not been validated in patients with chronic pain.[32] Hence the question of the validity and reliability of such methods remains unanswered in that context. Although the choice of questionnaires made in this study agrees with the general recommendations applicable to patients with chronic pain,[32] it is obvious that any results obtained from the assessment of the level of physical activity by questionnaire in patients with chronic pain must be interpreted with caution.

In this study, the level of physical activity was assessed by two different questionnaires that are complementary: the Baecke and the Five-City Project questionnaires. The Baecke questionnaire may be considered as semiquantitative. Indeed, while it objectively evaluates the level of physical activity related to participation in sports using the Durnin and Passmore sports classification,[22] physical activity related to occupation and leisure time is more subjectively self-evaluated on a five-point Likert scale leading to physical activity indexes expressed in ordinal units without reference to any physiologic variable. On the other hand, the Five-City Project questionnaire, by recording the subjects' physical activity categories, intensities, and duration, may be considered as a quantitative and more objective method because it directly leads to an energy expenditure rate estimation preferably expressed in kilocalories per day per kilogram. Although the Five City Project thus seems more objective and the Baecke more subjective, the latter is still cited in a recent review[32] as a questionnaire that may be used in patients with chronic pain.

Although weak, the statistically significant positive correlation found between both questionnaire scores

(Spearman $\rho = 0.32$; $p = 0.02$) may be considered as an argument supporting their validity.

For future studies addressing the assessment of the level of physical activity in patients, direct measurement methods such as more recent models of multidirectional accelerometers, or activity recordings with a daily activity diary as used by Follick et al.[33] in patients with chronic pain, should probably be preferred. The use of a questionnaire more specifically oriented toward more sedentary subjects, such as the Modified Baecke Questionnaire,[34] could also be considered.

Physical activity level in patients with chronic pain

When the physical activity of patients is assessed with the Baecke questionnaire, patients of both genders seem to present with a very significant reduction in total physical activity level as compared with data for healthy subjects available from the literature.[16,19,35] Depending on the normal values in the studies referred to, the relative reduction in the total Baecke physical activity score ranged from 45 to 41% in male patients and from 35 to 27% in female patients, with respective Z scores ranging from −2.5 to −2.1 in men and from −1.7 to −1.3 in women.

When the 5-CPtot obtained with the Five-City Project questionnaire was expressed in kilocalories per day, the total level of physical activity was not significantly different to that of healthy subjects.[20] However, as discussed above, patients with chronic pain present with a relative excess of body weight, and the 5-CPtot should thus be expressed in kilocalories per day per kilogram to reliably reflect physical activity in overweight subjects. However, 5-CPtot values normalized for body weight are seldom available from the literature. Hence, on the basis of data obtained by Sallis et al.[20] in 993 male and 1,111 healthy female subjects, we recalculated the mean 5-CPtot in kilocalories per day per kilogram in 911 men and 1,000 women, after exclusion of their 65- to 74-years-of-age category to age match their subjects with the patients of this study. We obtained mean 5-CPtots of 41 and 36 kcal/d/kg, respectively, in healthy men and women. SDs for these values are unfortunately unavailable from recalculations but may be estimated to be close to 6.5 kcal/d/kg. As compared with the data obtained in the male and female patients of this study (Table 3), these control values are, respectively, 16% and 5% higher; male patients are very significantly less active (Student $t = 4.52$; $p < 0.001$), whereas the reduction in the total level of physical activity in female patients is not significant (Student $t = 1.72$; $p \approx 0.09$).

When analyzing the time spent by patients with chronic pain in this study according to the different intensity categories of physical activity and comparing with age-matched controls,[20] patients spent more time in bed or resting and significantly less time doing light activities. In fact, patients spent approximately the same amount of time resting that they lost in light activities. They also spent approximately the same amount of time doing moderate intensity activities, which, in general, consist of mandatory household tasks such as shopping, sweeping, and mopping the floor. Finally, they demonstrated a major reduction in "hard" and "very hard" categories of physical activity, which generally consist of sports or heavy occupational work.

The total Baecke score was significantly lower in male than female patients, which is usually not the case in healthy subjects.[16,19,35] Moreover, analysis of the Baecke physical activity subscores (Table 2) revealed that the subscore reflecting occupation was the most affected, especially among males; most male patients had lost their job or had a sedentary occupation. These data obtained with the Baecke questionnaire thus corroborate the data obtained with the Five-City Project questionnaire.

Hence, our data show that the male patients included in this study are clearly less physically active than healthy subjects of the same age. Males with chronic pain behavior seem similar to the healthy elderly who are mostly retired and for whom less intense activities such as light household chores and gardening take a predominant place in daily life.[15,34]

These observations are in agreement with our hypothesis of a more pronounced effect of chronic pain on the level of physical activity and especially on occupational status in male than female patients. Although job loss is more common in men, the fact that women are kept more active at home by household tasks and child care probably contributes to keeping them at an activity level that may be considered as almost equivalent to that of healthy females in most cases.

Nevertheless, several factors, including patient inclusion criteria and social pressure related to gender, should be taken into account before drawing conclusions that could be extended to patients with chronic pain in general. For instance, men may be referred to the chronic pain unit for help later in the course of their condition (i.e., at a time when their pain already has a greater level of impact on their activity level). They may also be more inclined to emphasize how much they have lost in terms of physical activity and capacity because of social pressures.

Finally, many investigators have studied the relation between fitness and activity level in healthy subjects[8,36,37] and have found a weak positive significant correlation between CRE indexes and the level of lei-

sure-time physical activity as measured by questionnaire. Other investigators have found no correlation between such variables[38] or between $\dot{V}O_2$max and total weight-bearing physical activity.[39] Bouchard et al.[40,41] have shown that among both main determinants of CRE, training (i.e., physical activity level) and heredity, the latter is the major determinant in sedentary people. Hence, it is not surprising to find a lack of correlation between activity level and fitness in patients who present with a reduced level of physical activity, as discussed above.

CONCLUSIONS

The results of the current study on 55 patients with chronic pain are in agreement with data previously published on the subject: CRE seems to be reduced more by chronic pain in male than female patients. Data on the level of physical activity in patients obtained with two different physical activity questionnaires by the same interviewer showed that the male patients in this study were more sedentary than the female patients. However, several factors, including the selection criteria used in this study and social pressures that may vary with gender, should be taken into account before drawing any conclusions that can be extended to patients with chronic pain in general.

REFERENCES

1. Mayer TG, Gatchel RJ, Kishino N, et al. A prospective short-term study of chronic low back pain patients utilizing novel objective functional measurement. *Pain* 1986;25:53–68.
2. McQuade KJ, Turner JA, Buchner DM. Physical fitness and chronic low back pain: an analysis of the relationships among fitness, functional limitations and depression. *Clin Orthop* 1988; 233:198–204
3. Harding VR, de C Williams AC, Richardson PH, et al. The development of a battery of measures for assessing physical functioning of chronic pain patients. *Pain* 1994;58:367–75.
4. Nielens H, Plaghki L. Evaluation of physical adaptation to exercise of chronic pain patients by a step-test procedure. *Pain Clin* 1991; 4:21–8.
5. Nielens H, Plaghki L. Perception of pain and exertion during exercise on a cycle ergometer in chronic pain patients. *Clin J Pain* 1994;10:204–9.
6. Bortz W. The disuse syndrome. *West J Med* 1985;141:691–4.
7. Merskey H, Bogduk N. *Classification of chronic pain, definitions of chronic pain syndromes and definitions of pain terms*, 2nd ed. Seattle: IASP Press, 1994.
8. Lamb KL, Brodie DA. Leisure-time physical activity as an estimate of physical fitness: a validation study. *J Clin Epidemiol* 1991; 44:41–52.
9. Heyward VH. *Advanced fitness assessment & exercise prescription*, 3rd ed. Champaign: Human Kinetics, 1998.
10. Astrand PO, Rodahl K. *Textbook of work physiology, physiological bases of exercise*. New York: McGraw-Hill, 1977.
11. Gore CJ, Booth ML, Bauman A, Neville P. Utility of PWC75% as an estimate of aerobic power in epidemiologic and population-based studies. *Med Sci Sports Exerc* 1999;31:348–51.
12. McCain GA, Bell DA, Mai FM, Halliday PD. A controlled study of the effects of a supervised cardiovascular fitness training program on the manifestations of primary fibromyalgia. *Arthritis Rheum* 1988;31:1135–41.
13. Cady LD, Bischoff DP, O'Connel ER, et al. Strength and subsequent back injuries in firefighters. *J Occup Med* 1979;21:269–72.
14. Pereira MA, Fitzgerald SJ, Gregg EW, et al. A Collection of Physical Activity Questionnaire. *Med Sci Sports Exerc* 1997;29(Suppl): s5–9.
15. Montoye HJ, Kemper HCG, Saris WH, Washburn RA. *Measuring physical activity and energy expenditure.* Champaign: Human Kinetics, 1996.
16. Jacobs DR, Ainsworth BE, Hartman TJ, Leon AS. A simultaneous evaluation of 10 commonly used physical activity questionnaires. *Med Sci Sports Exerc* 1993;25:81–91.
17. Laporte RE, Montoye HJ, Caspersen CJ. Assessment of physical activity in epidemiologic research: problems and prospects. *Public Health Rep* 1985;100:131–46.
18. Montoye HJ, Taylor HL. Measurement of physical activity in population studies: a review. *Hum Biol* 1984;56:165–216.
19. Baecke J, Burema J, Frijters J. A short questionnaire for the measurement of habitual physical activity in epidemiologic studies. *Am J Clin Nutr* 1982;36:936–42.
20. Sallis JF, Haskell W, Wood P, et al. Physical activity assessment methodology in the Five-city project. *Am J Epidemiol* 1985;121: 91–106.
21. Blair SN, Haskell WL, Ho P, et al. Assessment of habitual physical activity by a seven-day recall in a community survey and controlled experiments. *Am J Epidemiol* 1985;122:794–804.
22. Ainsworth BE, Haskell WL, Leon AS, et al. Compendium of physical activities: classification of energy costs of human activities. *Med Sci Sports Exerc* 1993;25:71–80.
23. Jaequier E. Energy, obesity and body weight standards. *Am J Clin Nutr* 1987;45:1035–47.
24. American College of Sports Medicine. *ACSM's guidelines for exercise testing and prescription*, 5th ed. Philadelphia: Williams & Wilkins, 1995.
25. Huang Y, Macera CA, Blair SN, et al. Physical fitness, physical activity, and functional limitation in adults aged 40 and older. *Med Sci Sports Exerc* 1998;30:1430–5.
26. Gettman LR. Fitness testing. In: American College of Sports Medicine, ed. *ACSM's resource manual for guidelines for exercise testing and prescription*, 2nd ed. Philadelphia: Lea & Febiger, 1993.
27. Brennan GP, Ruhling RO, Hood RS, et al. Physical characteristics of patients with herniated intervertebral lumbar discs. *Spine* 1987; 12:699–702.
28. Davis VP, Fillingim RB, Doleys DM, Davis MP. Assessment of aerobic power in chronic pain patients before and after a multidisciplinary treatment program. *Arch Phys Med Rehabil* 1992;73: 726–9.
29. Fisher NM, Pendergast DR. Effect of a muscle exercise program on exercise capacity in subjects with osteoarthritis. *Arch Phys Med Rehabil* 1994;75:792–7.
30. Wittink H. Physical fitness, function and physical therapy in patients with pain: clinical measures of aerobic fitness and performance in patients with chronic low back pain. In: Mitchell M, ed. *Pain 1999: an updated review. Refresher course syllabus.* Seattle: IASP Press, 1999:137–44.
31. Burckhardt CS, Clark SR, Padrick KP. Use of the Modified Balke Treadmill Protocol for determining the aerobic capacity of women with fibromyalgia. *Arthritis Care Res* 1989;2.4:165–7.
32. Protas EJ. Physical activity and low back pain. In: Mitchell M, ed. *Pain 1999: an updated review. Refresher course syllabus.* Seattle: IASP Press, 1999:145–51.
33. Follick MJ, Ahern DK, Laser-Wolston N. Evaluation of a daily activity diary for chronic pain patients. *Pain* 1984;19:373–82.
34. Voorrips L, Ravelli ACJ, Dongelmans PCA, et al. A physical activity questionnaire for the elderly. *Med Sci Sports Exerc* 1991; 23:974–9.
35. Philippaerts RM, Lefevre J. Reliability and validity of three physical activity questionnaires in flemish males. *Am J Epidemiol* 1998; 147:982–90.

36. Bouchard C, Tremblay A, Leblanc C, et al. A method to assess energy expenditure in children and adults. *Am J Clin Nutr* 1983; 37:461–7.
37. Godin J, Jobin J, Bouillon J. Assessment of leisure time exercise behavior by self-report: a concurrent validity study. *Can J Public Health* 1986;77:359–62.
38. Sallis JF, Patterson TL, Buono MJ, Nader PR. Relation of cardiovascular fitness and physical activity to cardiovascular disease risk factors in children and adults. *Am J Epidemiol* 1988;127:933–41.
39. Petrie RS, Sinaki M, Squires RW, Bergstralh EJ. Physical activity, but not aerobic capacity, correlates with back strength in healthy premenopausal women from 29 to 40 years of age. *Mayo Clinic Proc* 1993;68:738–42.
40. Bouchard C, Lortie G. Heredity and endurance performance. *Sports Med* 1984;1:38–64.
41. Bouchard C, Dionne FT, Simoneau JA, Boulay MR. Genetics of aerobic and anaerobic performances. In: Holloszy JO, ed. *Exerc Sport Sci Rev*. Baltimore: William & Wilkins, 1992:20–7.