

## Some Measurements of Fitness in Older Female Employees of a Toronto Department Store

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**W**OMEN 40 years of age and over form a substantial and increasing part of the total labour force in most nations. Little scientific interest, however, has been shown in the fitness of this segment of the population. A review of cardiorespiratory performance<sup>1</sup> noted only two papers on older women,<sup>2,3</sup> each dealing with rather small numbers of subjects. Of two further recent reports, one considered the results for five men and three women jointly,<sup>4</sup> while the other described findings on a larger group of subjects during very mild exercise.<sup>5</sup> Other investigators have described the strength<sup>6</sup> and the state of nutrition<sup>7-9</sup> of older women, but there has as yet been no broadly based study of fitness for this age group. Accordingly, we have carried out a detailed study of 62 women ranging in age from 41 to 69 years, all drawn from a distinct occupational group—the employees of a large department store.

### METHODS

#### *Subjects and Experimental Plan*

The subjects were volunteers who responded to an advertisement of the proposed fitness tests in the staff bulletin of a large Toronto department store. Tests were carried out in the medical department of the store. Subjects attended on two occasions. At the first visit, a thorough medical examination was completed, blood and urine specimens were obtained, and subcutaneous fat was measured. At the second visit, tests of grip strength and ventilatory capacity were made, and a progressive step test was performed. Detailed questionnaires and personality inventories were completed between the two visits.

#### *Questionnaires*

The first questionnaire was a 48-item inventory relating to such details as the social and medical background of the subjects, their income, diet, activity, attitude to sport, and personal habits (Shephard, unpublished). Personality was assessed

by the Maudsley inventory,<sup>10</sup> which yields scores for extroversion/introversion (E) and neuroticism (N).

#### *Medical Examination*

The systolic and diastolic blood pressures were measured by a standard sphygmomanometric technique, with the subjects in the supine position. The hemoglobin level was estimated by the internationally agreed cyanomethemoglobin method,<sup>11</sup> using reference preparations distributed by the Dominion Bureau of Standards. The urine was tested for the presence of reducing sugars and protein using a Combistix strip. The standing height and body weight were measured with the subjects nude. Skin-fold thickness was determined at eight standard sites (chin, anterior axillary fold, triceps, subscapular, waist, abdomen, suprailiac and knee), using Lange calipers exerting a force of 10 g. Posture, obesity and muscularity were rated subjectively on a five-point scale.

#### *Second Attendance*

The grip strength of the dominant hand was measured by means of a Smedley hand dynamometer; the best of two attempts was recorded. The one-second forced expiratory volume (FEV<sub>1.0</sub>) and the forced vital capacity (FVC) were determined using a Stead-Wells spirometer. The best of three measurements was recorded in each case.

The progressive step test in general followed the procedure previously described for male subjects.<sup>12</sup> A flight of two 9-inch steps was climbed at a progressively increasing rate (eight ascents per minute for 2 minutes, 12 ascents per minute for 3 minutes, 16 ascents per minute for 3 minutes, and 20 ascents per minute for 3 minutes). As a concession to age and some instability at the knees, a padded handrail was provided for the present subjects. The electrocardiogram was monitored by parasternal leads before, during, and for 5 minutes after the exercise test. Expired gas was collected by a low resistance box-valve and meteorological balloon during the final minute at each intensity of exercise. These samples were analyzed for oxygen and carbon dioxide concentrations, using paramagnetic and infrared gas analyzers respectively. The maximum oxygen intake was predicted, using the oxygen scale of the Astrand-Ryhmung nomogram.<sup>13</sup> Indications for cessation of exercise before completion of the test schedule were (i) exhaustion of the subject, (ii) marked depression of the ST segment of the electrocardiogram (>.1 mV) and (iii) frequent ventricular extrasystoles (more than two in 10 seconds).

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TABLE I.—DATA OBTAINED ON 62 EMPLOYEES OF TORONTO DEPARTMENT STORE. MEAN AND S.D. OF SUBJECTS, GROUPED ACCORDING TO AGE AND PRESENCE OR ABSENCE OF CONDITIONS LIKELY TO AFFECT "FITNESS"

Age (years)	Height (cm.)	Weight (kg.)	Excess over "ideal" weight <sup>14</sup> (kg.)	Average skin-fold thickness (mm.)	Systemic blood pressures mm.Hg	Hemoglobin g./100 ml.	Grip strength (kg.)	Forced vital capacity (FVC) litres BTPS*	Percent predicted VC <sup>15</sup>	FEV <sub>1.0</sub> ** litres BTPS	FEV <sub>1.0</sub> FVC %	Resting pulse rate per min.	Predicted maximum oxygen intake	
													Litres STPD/min.†	ml. STPD/kg. min.
40 to 49 Healthy (n = 18).	161.6±5.7	63.8± 9.8	8.2± 8.7	20.8± 7.1	127±12/76± 9	14.1±1.2	31.2±5.7	3.16±0.42	112.3±11.7	2.61±0.46	82.6± 9.4	75.9± 9.4	1.78±0.38	28.2±5.1
	Abnormal (n = 4)...	160.8±8.7	58.2±18.6	2.2±19.7	17.1±11.4	128±28/75±13	15.5±1.5	28.3±8.3	2.84±0.44	99.8±17.9	2.47±0.51	87.1± 9.7	82.2±17.1	1.62±0.49
50 to 59 Healthy (n = 15).	160.0±6.6	59.5± 8.7	4.9± 7.0	20.9± 5.8	130±15/75±10	13.5±1.1	28.3±5.6	2.98±0.52	113.1±17.8	2.40±0.43	82.8± 8.1	70.9± 8.2	1.76±0.51	29.6±7.0
	Abnormal (n = 11)...	159.6±4.0	58.5± 5.8	4.5± 6.3	21.2± 7.0	140±21/77±11	14.3±0.9	28.7±4.4	2.81±0.39	103.8±16.2	2.14±0.38	76.1± 7.5	73.8± 6.3	1.49±0.24
60 to 69 Healthy (n = 11).	157.3±7.4	61.2±11.2	7.1±10.6	22.5± 7.9	137±18/79± 8	14.5±0.8	27.5±4.5	2.55±0.55	104.5±20.8	1.93±0.30	75.8±11.4	73.2± 8.4	1.41±0.32	22.9±4.8
	Abnormal (n = 3)...	155.7	62.8	11.8	31.4	157 /92	13.5	21.4	2.22	87.0	1.84	82.9	75.0	1.89

\*BTPS—at body temperature and pressure, saturated with water vapour.  
\*\*FEV<sub>1.0</sub>—forced expiratory volume, measured over 1.0 second.  
†STPD—standard conditions of temperature and pressure.

## RESULTS

### General Health

Of the 62 women in the study, 33 had no current medical abnormality. Eight others had chronic medical conditions such as peptic ulcer that seemed unlikely to influence fitness greatly. A further four complained of "nervous tension"; none of these four had a high resting pulse rate (range: 63-74 per minute) or marked elevation of systemic blood pressure (range: 130/80 to 145/90 mm. Hg) when tested. All 12 of these abnormal subjects have been included with the normal subjects in subsequent analysis. The remaining 17 subjects had physical conditions likely to affect cardiorespiratory performance (hypertension, rheumatic carditis, anemia, thyroidectomy, bronchitis, healed tuberculosis, retropulsion of a cervical intervertebral disc); these are treated separately as an "abnormal" group.

The diastolic pressure was > 90 mm. Hg in only three of the 62 subjects. In the first of these three cases (pressures 150/100 mm. Hg) the patient had no symptoms, there were no other abnormal signs, the urine was free of protein, and the systolic reading was relatively low; she was thus not excluded from the normal subjects. The second (pressures 170/95 mm. Hg) had a long history of hypertension, and was receiving hypotensive drugs, while the third (pressures 180/105 mm. Hg) had a history of thyroidectomy, and a urinary protein > 30 mg. per 100 ml.: these are both classed with the abnormal group. Five subjects had a urinary protein ≥ 30 mg. per 100 ml., and a trace of protein was found in the urine of a further 13. This seems mainly an orthostatic phenomenon, related to prolonged standing on the shop floor; 11 of the 18 instances

of albuminuria occurred in the 19 women who stood all day. Clinical significance was attached to the finding in only one patient, in whom it was associated with a long history of hypertension, as has been noted previously.

### Nutrition

The majority of both normal and abnormal subjects had a weight that was 5 to 10 kg. above the "ideal"<sup>14</sup> proposed for a person of average build and comparable height (Table I). Seventeen had a substantial degree of obesity (weight more than 10 kg. above the ideal figure), and in five the weight was between 20 and 30 kg. above the ideal. In general, these excess weights were reflected in the subjective ratings of obesity (20 subjects being classed as obese, and four as very obese), and in the skinfold readings (Tables I and II), 16 subjects having an average skinfold thickness ≥ 25 mm., including 13 of the 17 with weights of 10 kg. or more above the ideal.

Only four of the 62 had a weight 5 kg. below the ideal. In one, this was associated with "nervous tension", and in a second there was general debility following a serious neck injury and collapse of the lung. The other two with low weights were apparently healthy.

The hemoglobin level of most subjects was close to the average for adult females (Table I); only four had a hemoglobin concentration of less than 12.8 g. per 100 ml.

### Grip Strength

The grip strength is summarized in Table I. In general, results were not influenced greatly by the medical abnormalities noted in this sample. Six of the 62 subjects taking regular

TABLE II.—SKINFOLD THICKNESS (mm.) AT EIGHT STANDARD SITES; RESULTS ON 62 FEMALE EMPLOYEES OF DEPARTMENT STORE, AGED 41 TO 69 YEARS, CLASSIFIED BY AGE

Age (years)	Individual sites								Average
	Chin	Right sub-scapular	Right anterior axillary fold	Right of umbilicus	Suprapubic	Right triceps	Right knee	Right suprailiac	
40 to 49* (n = 22)....	11.2	19.1	18.0	23.5	28.0	14.3	22.5	22.4	19.9
50 to 59** (n = 27)...	13.1	17.9	17.4	26.9	30.3	16.0	24.1	22.9	21.1
60 to 69 (n = 13).....	13.4	21.4	22.3	32.1	33.8	15.3	25.9	31.1	24.4

\*Totals include one subject who was grossly underweight and had an average skinfold of 5.7 mm. following a neck injury and collapse of one lung.

\*\*Totals include one subject who was grossly underweight and had an average skinfold thickness of 14.8 mm. associated with "nervous tension".

gymnastics had a grip strength that was 2.4 kg. above the average for their age. Four of the 62 were participating in sports without gymnastics at an estimated energy expenditure  $\geq 100$  kcal. per day; of these, only one (who spent 12 hours skiing each winter week-end, and also enjoyed skating, curling and golf) had a grip strength that was above average.

The subjective ratings of muscularity and posture were mainly "average", and were thus not particularly helpful.

### Performance of Exercise

In general, the subjects found no great problem in performing the progressive step test, although a number remarked that they would have found it difficult without the help of a hand support. Twenty-nine of the 62 subjects completed all four rates of ascent, and a further 18 completed three rates of ascent. Fifteen were not able to withstand exercise for 8 minutes. Nineteen of the 62 subjects exceeded their theoretical maximum pulse rate,<sup>17</sup> and about half of

TABLE III.—COMPARISON OF LUNG CAPACITIES WITH PREDICTIONS BASED ON THE AUTHORS' MULTIPLE REGRESSION EQUATIONS<sup>16</sup> FOR HEALTHY OFFICE WORKERS IN TORONTO

Mean age (years)	Mean height (cm.)	FVC observed	VC predicted	FEV <sub>1.0</sub> observed	FEV <sub>1.0</sub> predicted	FEV <sub>1.0</sub> /FVC % observed	FEV <sub>1.0</sub> /FVC % predicted
44.4.....	161.6	3.16	3.21	2.61	2.57	82.6	81.8
53.2.....	160.0	2.98	3.05	2.40	2.35	80.6	79.5
62.4.....	157.3	2.55	(2.80)*	1.93	(2.09)*	75.8	(77.2)*

\*Sample size limited for predictions at this age.

### Lung Capacities

As anticipated, in general the FVC of the "normal" subjects exceeded the commonly accepted vital capacity standards.<sup>15</sup> It was marginally less (0.05-0.07 litre) than the vital capacity predicted from multiple regression equations<sup>16</sup> for office workers in Toronto (Table III). This discrepancy was thought to be due to the trapping of gas during the FVC maneuver since in the two younger decades the FEV<sub>1.0</sub> was equal to or greater than that of the previous sample of office workers; the validity of the comparison in the oldest decade was limited, since few of the previous population were in this age range.

Seventeen of the subjects were smoking a substantial number of cigarettes (more than 10 per day). The FVC of this group was close to average, but the FEV % was 5.3% less than in 31 non-smokers, and 7.9% lower than in eight occasional smokers.

the remainder would have exercised further, but were restrained because of the appearance of electrocardiogram abnormalities. Twenty-three of the subjects reached a plateau of oxygen consumption (increase < 0.15 litres per min.), and in a further 13, the final oxygen consumption exceeded the maximum as predicted by the Astrand nomogram (Table IV). The maximum

TABLE IV.—THIRTY-SIX SUBJECTS REACHING MAXIMUM OXYGEN INTAKE. THE MAXIMUM PULSE RATE, RESPIRATORY QUOTIENT, AND DISCREPANCY BETWEEN THE PREDICTED (ASTRAND NOMOGRAM) AND DIRECTLY MEASURED MAXIMUM OXYGEN INTAKE FOR THE THREE AGE GROUPS. MEAN  $\pm$  S.D.

Age (years)		Pulse	Respiratory quotient	$\Delta$ predicted maximum
40 to 50	Plateau subjects (n = 6)	175 $\pm$ 14	1.01 $\pm$ 0.10	+0.10 $\pm$ 0.17
	All maximums (n = 12)	173 $\pm$ 10	1.05 $\pm$ 0.09	-0.04 $\pm$ 0.30
50 to 60	Plateau subjects (n = 10)	180 $\pm$ 10	1.03 $\pm$ 0.12	+0.19 $\pm$ 0.16
	All maximums (n = 13)	163 $\pm$ 8	1.02 $\pm$ 0.11	+0.11 $\pm$ 0.20
60 to 70	Plateau subjects (n = 7)	153 $\pm$ 15	1.07 $\pm$ 0.15	+0.30 $\pm$ 0.36
	All maximums (n = 11)	157 $\pm$ 8	1.06 $\pm$ 0.15	+0.23 $\pm$ 0.30

pulse rates and respiratory quotients were similar in these two groups. In those subjects who reached a plateau, the predicted values in general exceeded the directly measured maxima; this reflects the tendency for oxygen consumption to increase beyond "plateau" as thus defined.

The predicted values for maximum oxygen intake are summarized in Table I. With one notable exception (the woman who was skiing for 12 hours each week-end; aerobic power 47.2 ml. per kg. per minute), the predicted maximum oxygen intakes were not above average either in those playing regular sport or in those taking gymnastics. This may reflect in part the relatively low aerobic cost of many sports and gymnastic feats, as currently performed by middle-aged women, and in part obesity (the six gymnasts had an average weight that was 4.9 kg. above ideal, and four women participating in regular sport had an average weight of 15.1 kg. more than the ideal). It is also possible that subjects may have exaggerated their participation in sports. There was no correlation of the subject's occupation (sales-girl, waitress or clerk) with aerobic power.

With one exception, the values found for the maximum oxygen intake of "normal" subjects were essentially in the sedentary range. Values for subjects with conditions judged likely to affect fitness were not significantly less.

#### *Electrocardiographic Abnormalities*

Substantial depression of the ST segment ( $> 1$  mv) occurred in nine of the 62 subjects during exercise. Seven of these nine had previously been classed as "unhealthy", including three patients with hypertension, and one with "dizzy spells". Seven others, all in the "healthy" group, showed gross junctional depression. Ventricular extrasystoles occurred at rest in two subjects; these extrasystoles disappeared with exercise. Six other subjects, with normal resting electrocardiograms, developed ventricular extrasystoles during exercise; one had a history of rheumatic carditis, but the other five were in the "healthy" group. Two of the subjects who showed ventricular extrasystoles were non-smokers, and only three of the eight were smoking more than 10 cigarettes per day. Occasionally, other abnormalities of rhythm were seen during or immediately after exercise, including nodal extrasystoles in one subject, and a partial sinoatrial block in one subject.

#### *Personality of Subjects*

In general, the E scores were not exceptional. However, 19 of the 45 healthy subjects had an

N score 1 SD or more above the average value for an unselected population,<sup>10</sup> and 10 of the 45 had an N score 2 SD or more above average. In the healthy subjects, extroverted neurotics ("psychopathic") were more common than introverted ("anxious"), whereas in the unhealthy subjects the reverse was true. The tendency to a neurotic personality does not seem to have caused any underestimation of aerobic power; indeed, seven of the 10 very neurotic patients (N score 2 SD  $>$  average) had a maximum oxygen intake that was above the average for their age group.

#### DISCUSSION

##### *Selection of Population*

The use of volunteers who have been subjected to no form of coercion, direct or indirect, is mandatory under the code of ethics drawn up by the World Medical Association.<sup>18</sup> It is inevitable that a sample obtained in this way will include a substantial number of subjects who either have some medical abnormality or are unduly concerned about their health. The physician thus has a dual role in the assessment of fitness—the protection of the patient during and after testing,<sup>19</sup> and the exclusion from the volunteer panel of those with conditions liable to diminish fitness.

There is some evidence that neurotic subjects, particularly extroverted neurotics ("psychopaths"), have an excessive ventilatory and cardiac response to unfamiliar exercise.<sup>17</sup> Perhaps because a 9-inch step is a familiar household item, no such tendency was found in the present results, and the relatively poor cardiorespiratory performance of the group cannot be explained on this basis. With the possible exception of an orthostatic proteinuria, the results also seem uninfluenced by the occupations represented, and the findings are probably typical for older females carrying out light indoor work and (in most instances) maintaining a home in a Canadian metropolitan environment.

##### *Nutrition*

The concept of an overnourished North American Society is sustained. The reference weights proposed by the Society of Actuaries<sup>14</sup> are somewhat arbitrary, but there can be no question that subjects who in some cases exceeded these standards by 20 to 30 kg. were obese.

No difficulty other than the time involved in removal of clothing was encountered while obtaining a full range of eight skinfold measurements from these women. The average value was very similar to that found by other workers in

upstate New York<sup>7</sup> and in Michigan.<sup>8</sup> The thickness of the triceps fold, however, was a little less than in a previous Canadian survey,<sup>9</sup> and substantially less than in two studies in the United States;<sup>7, 8</sup> rather misleading information regarding obesity might thus have been obtained if reliance had been placed on a single skinfold measurement.

#### *Regional Differences in Muscular and Cardiorespiratory Performance*

The grip strength compared favourably with that of 17-year-old girls in another part of Canada,<sup>20</sup> but was somewhat poorer than average figures for 250 Danish women attending night school (34.5 kg. at age 45, 30.9 kg. at age 55).<sup>6</sup>

The maximum oxygen intake, whether expressed in absolute terms or relative to body weight, was 10 to 12% poorer than published figures from Scandinavia.<sup>1</sup> Whereas the present figures are predictions based on sub-maximal effort, many of the Scandinavian measurements have been obtained during maximal effort. However, since the predictions tend to exceed the true maximums in the present series, the discrepancy cannot be attributed to this cause.

In a number of the medically healthy subjects tested, one of whom was under 50, the maximum oxygen intake was less than 1.20 litres per minute, and this implies that the individual concerned must operate at 50% or more of her aerobic power even while carrying out light household duties. Durnin and Passmore<sup>21</sup> set the cost of bed-making, vacuum cleaning, tidying a room, polishing a floor, window cleaning, and shopping with a light load at 3 to 4 kCal. per minute, with higher values for beating carpets, scrubbing floors and polishing furniture. A relative effort > 50% of aerobic power cannot be sustained for a normal eight-hour day without undue fatigue,<sup>2</sup> and subjects with such limited cardiorespiratory reserves should find immediate benefit from training programs increasing their aerobic power by no more than 10 to 20%.

The greater grip strength in subjects who take formal gymnastics than in those who merely play sports is perhaps not surprising. The general absence of influence of sport and of gymnastics on maximum oxygen intake, while disappointing, is also in line with the impression gained from time and motion studies of such pursuits (Pelzer, unpublished). A high proportion of the available time is commonly spent at very low levels of activity which are quite inadequate to produce cardiorespiratory training.

#### *Electrocardiographic Abnormalities*

The incidence of electrocardiographic abnormalities during exercise,<sup>22, 23</sup> although quite high, is lower than in male subjects over the age of 40 (Shephard: to be published). Since marked junctional depression normally progresses to frank depression of the ST segment with continuation of exercise, it should probably be included in the total of "arteriosclerotic" abnormalities. Extrasystoles appearing for the first time during exercise are also probably an adverse sign. On this basis, 22 subjects (14 with no abnormality of their resting electrocardiogram on medical examination) had an above average chance of a coronary episode. The majority of these patients would not have been detected by a routine medical examination, even if this had included a resting electrocardiogram.

The abnormal findings were reported to the store physician, who interpreted them to the individual women. The advice required by the patients is problematical. Theoretically, a large increase in cardiac work due to isometric or sustained isotonic exercise could lead to a relative coronary ischemia and the onset of a fatal ventricular fibrillation. The appearance of left ventricular extrasystoles is a sign that foci of increased myocardial irritability which could progress to fibrillation are developing during exercise. However, the number of fatal episodes where heavy and unaccustomed exercise is a precipitating factor is probably small, relative to the thromboses which develop during inactivity, and from the patient's point of view coronary ischemia of exercise progressing to fibrillation is unimportant unless the precipitating exercise has been required in the course of employment or during a fitness experiment. If a patient with an abnormal exercise electrocardiogram is cautioned against excessive exercise, he will probably avoid all activity, and this will certainly increase rather than decrease his chance of a coronary fatality.

**Summary** Comprehensive tests of "fitness" were completed on 62 older women employees of a Toronto department store. Their ages ranged from 41 to 69 years. Thirty-three had no medical abnormality, 12 had conditions not affecting fitness and 17 had conditions influencing strength, lung capacity, or cardiorespiratory performance. The importance of preliminary medical "screening" of a volunteer population is thus emphasized. Four were anemic and 18 had some protein in their urine; the latter was thought to be orthostatic in origin, resulting from prolonged standing on the shop floor. The majority were obese, some weights being 20 to 30 kg. above "ideal" values; skinfold readings were similar to those obtained in some recent surveys in

the United States. Grip strength (25 to 30 kg.) compared favourably with the performance of 17-year-old Edmonton schoolgirls, but was poorer than that of Danish housewives; it was apparently improved by gymnastics, but not by sport. The forced vital capacity and the one-second forced expiratory volume agreed closely with predictions, using the authors' regression equations. The one-second forced expiratory volume was substantially smaller in those who smoked. The maximum oxygen intake (28 ml. per kg. per minute at age 40 to 49; 25 ml. per kg. per minute at age 50 to 59; and 23 ml. per kg. per minute at age 60 to 69) was a little poorer than in Scandinavian series. As with most "volunteer" samples, the population included a substantial number of "neurotic" subjects; this tendency was evaluated by the Maudsley personality inventory, and was shown not to affect the reported values for aerobic power. Twenty-two of the 62 subjects showed electrocardiographic evidence of myocardial ischemia during vigorous exercise.

**Résumé** Les auteurs ont effectué des épreuves complètes de santé physique sur 62 employées, d'âge variant de 41 à 69 ans et travaillant dans un magasin à rayons de Toronto. Trente-trois d'entre elles ne présentaient pas d'anomalie médicale, 12 présentaient des pathologies qui n'affectaient pas leur aptitude physique et les 17 autres souffraient de pathologies qui influençaient leur force physique, leur capacité pulmonaire ou le fonctionnement de leur appareil cardio-respiratoire. On souligne ici l'importance de procéder à un dépistage médical préliminaire d'un groupe de volontaires parmi la population. Chez quatre, on a découvert de l'anémie et chez 18 une certaine quantité de protéine dans l'urine; on a cru voir une origine orthostatique dans cette dernière anomalie, les sujets étant souvent en station debout prolongée par suite de leurs fonctions. Il y avait une nette obésité chez certaines personnes, leur poids étant parfois de 20 à 30 kg au-delà du poids idéal; les résultats des lectures des plis cutanés étaient similaires aux chiffres de récentes études faites aux Etats-Unis. La force de préhension (25 à 30 kg) se comparait favorablement avec celle d'étudiantes de 17 ans de la région d'Edmonton, mais était inférieure à celle de ménagères danoises: cette force de préhension était apparemment améliorée par la gymnastique, mais non par le sport. La capacité vitale forcée et le volume expiratoire forcé ( $VEF_{1.0}$ ) étaient en étroite corrélation avec les prédictions, d'après les équations de régression des auteurs. Le  $VEF_{1.0}$  était notable-

ment plus faible chez les fumeurs. La capacité maximum en oxygène (28 ml/kg/min. aux âges de 40 à 49 ans, 25 ml/kg/min. aux âges de 50 à 59 ans et 23 ml/kg/min. aux âges de 60 à 69 ans) était un peu plus faible que celle constatée dans les études scandinaves. Dans ce groupe, tout comme dans les échantillons de "volontaires", on comptait un nombre important de sujets "neurotiques". Cette tendance a été évaluée par le bilan de personnalité de Maudsley. Elle n'affectait pas les valeurs classiques de la capacité aérobie. Des 62 sujets, 22 présentaient des signes électrocardiographiques d'une ischémie du myocarde pendant un exercice énergétique.

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