The Relationship Between Physical Fitness and Stress-Related Disorders

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ABSTRACT

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Recent studies have suggested that the physically fit may be less anxious, and recover more quickly from the physiological effects of emotional stress, than the unfit. The present correlational study attempted to determine whether these differences would be reflected in a lower incidence, severity and frequency of stress-related disorders among the physically fit as compared to those beginning training. Members of Group Fit had been actively involved in an organized fitness program for at least two years. Group Beginner consisted of matched individuals just beginning fitness classes. Fitness level was assessed by post step test pulse recovery time. A self-report questionnaire was administered to determine the number, severity and frequency of stress-related disorders. Treating physicians were contacted, whenever possible, for confirmation of the diagnosis. Group Beginner reported a higher incidence of disorders than Group Fit. Differences in allergy, cardiac rhythm disorders and eczema were statistically significant. All other differences were in the predicted direction. Severity ratings of headache and low back pain and frequency rating of low back pain were significantly greater for Group Beginner. Severity of premenstrual headache, depression and emotionality was also significantly greater for Group Beginner. The findings suggest exercise as a prophylactic agent for stress-related disorders.

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The concept of mind-body relationships has been of interest to scientists for centuries. Despite this early attention, the precise nature of this interdependence remains unclear.

Many studies have explored the contribution of psychological factors to disease etiology. The term "psychosomatic" indicates a relationship between psychological process and bodily function. In general, this relationship is considered to be one in which an "unhealthy" mind creates an "unhealthy" body. The word "psychosomatic" is said to have been first used in reference to insomnia by Heinworth in 1818 (Margetts, 1958). In the strictest sense, a disorder is considered to be psychosomatic in so far as the psychogenic component is thought to be the most important etiological factor (Lachman, 1972; Groen, 1964). This does not deny the possible existence of predisposing biological factors (Lachman, 1972). Although there is as yet insufficient evidence of a causal relationship in some disorders, emotional factors appear to markedly influence onset and course (Groen, 1964). Psychosomatic research has suggested that physical changes result from prolonged arousal of psychological states. It seems logical to assume the reverse: that psychological changes result from continued physical states (Hammett, 1967). The influence of biological processes on psychological ones has been called somatopsychic (Lachman, 1972).

In general, psychosomatic research has concentrated on the damaging effects of a "sick" mind on the body. A somewhat opposite consideration, the beneficial effect of a healthy (fit) body on the mind, is now gaining some attention (Heinzelman, 1975; Morgan & Costill, 1972).

The Physiological Effects of Aerobic Fitness. Exercise is a stressor and training involves the adaptation of the body to this stress (Skinner, 1975). Aerobic fitness refers to a state of cardiorespiratory effeciency which is a product of the frequency, duration and intensity of exercise. Skinner (1975) suggests a frequency of two to four times per week, for 20 to 30 mintues per session at an intensity of 60% to 75% of maximal capacity. Endurance exercises such as running, cycling, and swimming, for which muscles require large quantities of oxygen, are most effective. Aerobic (with oxygen) metabolic reactions provide the energy needed for muscles contractions without producing an oxygen debt (Astrand & Rodahl, 1977).

The physiological changes that result from regular fitness training are well documented (Astrand & Rodahl, 1977; Cureton, 1969; Cooper, 1968). Improvements in the respiratory, cardiovascular, metabolic and muscular systems have been noted. Reports of pulmonary function changes which accompany conditioning programs suggest that the lungs increase in their capacity to process more air with

less effort (Bachman & Hovarth, 1967; deVries, 1974). Long term effects of training on the heart include increased stroke volume which is manifested in a lower resting heart rate. As training progresses, the heart rate for a given work load decreases and recovery to resting rate is accelerated (deVries, 1974). The effect of chronic exercise on resting blood pressure has not been clearly established (Scheuer & Tipton, 1977). Some studies have shown a reduction in resting blood pressure following training (Frick, Konttmen & Saraja, 1963) or lower levels in more active subjects (Montoye, Metzner, Keller, Johnson & Epstein, 1972). Improvement in the functioning of the gastrointestinal system, as a result of fitness training has been noted (Cureton, 1969; Cooper, 1968). Aerobic training produces an increase in lipid metabolism and a decrease in total body fat (deVries, 1974). One of the most visible effects of aerobic exercise is an increase in the muscle tone of the entire body (Cooper, 1968).

The most accurate method of measuring aerobic power, maximal oxygen uptake while working to exhaustion, involves a complex procedure and assessment, requires rather sophisticated equipment, and is physically taxing to undergo (Astrand & Rodahl, 1977). Tests of fitness performed at submaximal levels are available. The simplest and most extensively used method of testing cardiovascular efficiency is to record heart rate during or after

exercise (step test, treadmill, bicycle ergometer). Shepherd (1966) found the step test to be the method of choice for the prediction of aerobic capacity on grounds of reliability and convenience. This test is particularly well suited to testing large numbers of subjects in the field. The equipment is inexpensive and portable. In addition, subjects show little anxiety or learning (Shepherd, Benade, Davies, Prampero, Hedman, Merriman, Myhre & Simmons, 1968). The task is simple, merely requiring repetition of an up-down stepping motion, at a prescribed rate for a relatively short time period.

Findings from several studies have suggested that physical activity may be related to a lower incidence of coronary heart disease (Taylor, Klepetar, Keys, Parlen, Blackburn & Puchner, 1962; Fox & Haskell, 1968) however, few have measured physical activity in terms of aerobic power. Cureton (1969) has reported on the chronic complaints of adult men in the Young Men's Christian Association (Y.M.C.A.) fitness programs. Men in regular training report fewer ailments on checklists than men in general. Cureton suggests that the causes of these ailments (digestive upsets, diabetic tendency, constipation, headaches, fat, fatigue, hemorrhoids, heart thumping, chest pain, abdominal pain, sinusitis, swollen joints) are lack of movement, and stress.

Psychosomatic Research. Psychosomatic research is an area of many theoretical and methodological problems. The concept of psychogenesis itself is a complex one. Evidence that psychological stimuli are significant in evoking disease processes, come from a number of sources (Graham, 1972): 1) life history data, provided by the patient, indicating temporal correlations between stressful situations and the onset or exacerbation of disease, 2) experiments in which psychological stimuli (words, pictures) of presumed etiological significance, are presented to the patient while physiological changes are observed, 3) observations of patients during or following exposure to disturbing real-life stimuli either experimentally manipulated or naturally occurring, 4) epidemiological data concerned with correlations between major stressful events (e.g. war) and differences in the incidence of various diseases, 5) predictive studies of the course of a disease process given the psychological changes in the patients' life.

Psychological stimuli may provoke a variety of internal conditions. If the generated response is sufficiently intense and prolonged, a relatively permanent physiological change may occur (Lachman, 1972). The mechanism by which psychological stimuli may produce these physical changes is as yet unknown. Groen (1964) has discussed two levels of suspected involvement of psychological factors in the development of illness. He describes those functional disturbances which produce morphological changes

in various organs and which are believed to develop in response to emotional stress (e.g. ulcer, asthma, ulcerative colitis). At another level, he places those diseases for which psychogenic factors are thought to be actively, though not exclusively, involved (e.g. essential hypertension, migraine, allergy, eczema, urticaria). It is noteworthy, with regard to allergic disorders, that several reports have described allergic reactions without apparent physical cause (Wittkower, 1953; Rees, 1956; Block, Jennings, Harvey & Simpson, 1964; Feingold, Singer, Freeman & Deskins, 1966). The question of the degree of involvement of psychological stimuli in all of these disorders remains unanswered.

Physical symptoms of anxiety neurosis have often been studied in much the same manner as psychosomatic disorders themselves. Headache has undoubtedly received the most attention (Martin, 1972; Dalessio, 1972) although insomnia (Kales, Caldwell, Preston, Healey & Kales, 1976), low back pain (Williams, 1977; Jacobs, 1973), nervous dyspepsia (digestive upset) (Alvarez, 1943; Wolff & Wolff, 1943) and cardiac rhythm disorders (tachycardia and arrythmia) (Duncan, Stevenson & Ripley, 1950) have not been neglected. Psychological concomitants of the premenstrual syndrome have also been reported (Warnes & Hill, 1974; Coppen & Kessel, 1963; Paulson, 1961).

Various theories concerning the development of psychosomatic pathology have arisen. Among these are symptom-symbol formulations,

stimulus-response specificity theories and those which conform to either an individual-response specificity (constitutional vulnerability, personality profile theories, nuclear conflict theory) or learning model. The symptom-symbol theories, derived from early psychoanalytic conceptualizations, propose that physical symptoms are symbolic representations of emotional arousal that is not overtly expressed (Garma, 1950). These formulations do not lend themselves easily to external validation and do not seem to be widely accepted currently (Lachman, 1972).

Next to the question of etiology, that of specificity has been given most attention in the psychosomatic literature. Stimulus-response specificity theories suggest the existence of a predictable relationship, in different persons between disorders and stimulus situations, similar to those in infectious diseases (Lachman, 1972). A major criticism of this theory lies in the fact that very few dependable differences in physiological reactions have been observed for different stimuli (Lachman, 1972). Knowledge of psychological stimuli, without information about the individuals' response history is almost useless in predicting what illnesses a person will develop (Graham, 1972).

The general principle of individual response specificity refers to the tendency of a given individual to respond similarly to a variety of stimuli (Graham, 1972; Lachman, 1972). The weak-link or constitutional vulnerability theory maintains than an individual

has a weak or otherwise predisposed organ or system in which illnesses develop. A differential susceptibility to the development of peptic ulcer has been noted in various rat strains (Sines, 1961; Tharp & Jackson, 1974). In humans it is more difficult to ascertain the strength or vulnerability of a particular organ relative to other bodily structures.

Attempts to correlate "personality-types" and specific diseases is another example of an individual response specificity formulation. Personality-profile theories maintain that particular sets of personality characteristics are related to the development of particular psychosomatic disorders (Dunbar, 1943). A great deal of investigation has followed this line of reasoning. Although "personality-profile" studies of various illnesses continue to appear in the literature, further empirical observation has led many workers to question the validity of this conceptual model (Mendelson, Hirch & Webber, 1956; Morkoff & Parson, 1967; Selby & Lance, 1960). In addition, the onset of a disorder is not always easy to determine. In retrospective studies it is also difficult to be certain that the personality antedates the disprder and has not developed as a response to it.

In the nuclear conflict theory, proposed by Franz Alexander (1950), a psychosomatic disorder was believed to stem from a central emotional conflict which could develop in individuals with different personalities. It is not the presence of psychological factors

but rather their configuration within the individual which is specific to each illness. The empirical basis for this thesis is still largely interpretations offered by psychoanalysts of their patients discourse (Graham, 1972). A major criticism of this reaction-pattern theory lies in the similarity and overlaps in physiological activitiy of a wide variety of emotions (Lachman, 1972). The fact that more than one psychosomatic disorder may occur in the same individual cast some doubt on specificity theories in general. Buck and Hobbs (1959) found that individuals who suffer from gastrointestinal disorders show a likelihood greater than chance of being treated for allergy or cardiovascular disorders within a five year period.

The role of conditioning and learning in psychosomatic medicine has caused much speculation (Lachman, 1972; Guze, Matarazzo & Saslow, 1953). Theories of organ-response learning hold that as a consequence of earlier associations between stimulation and response of an organ, particularly if that response is rewarded, new stressful situations will begin to arouse the same response. Apparently asthma is the only disorder that has undergone serious investigation in terms of a conditioning model (Dekker, Pelser & Groen, 1957; Ratner, 1953). To date, the role of learning in psychosomatic disorders has not been satisfactorily investigated (Graham, 1972).

Psychosomatic research has been plagued with problems. In

addition to the above mentioned conceptual and methodological difficulties, samples have often been contaminated. Subjects who are selected from a psychiatric population, often represent only a very select segment of sufferers in general (Feingold et al, 1966). The reliability of retrospective analysis of stressful life situations, based on patients' reports, is also uncertain. The use of psychological assessment procedures must be evaluated carefully, considering the known validity of the instruments. Despite these methodological problems, the quantity of studies and clinical reports suggesting psychological involvement in a certain class of disorders is impressive.

The Influence of Physical Fitness on Psychological Variables. Interest in physical-psychological relationships is not recent, yet there is relatively little knowledge of this specific interaction. It is generally assumed that there exist psychological correlates of physical fitness (Hammett, 1967). There are claims that the fit are generally more relaxed and more easily tolerate life stresses (Cooper, 1968). However, there are surprisingly few controlled studies to substantiate these claims.

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personality measures (Brunner, 1968; Tillman, 1964). The research in this area has been deservedly criticized (Rushall, 1973; Hammett, 1967; Cattell, 1960). Generalization from the results of studies using intact samples, such as team members, has been questioned (Ruskall, 1973). Studies of athletic champions may yield more information on achievement than on physical fitness (Hammett, 1967). Selection of assessment tools in this research area have often been inappropriate, since many were not intended for use in evaluating differences in members of the normal population. Ruskall (1973) has also criticized this research for failing to formulate testable hypotheses and to generate practical information for those in the fields of athletics and physical education. To date no definitive conclusions can be drawn from studies on the relationship between physical fitness and personality traits.

Measures of mood, such as anxiety and depression, may be less static than traits and therefore more likely to change with exercise. Morgan and Costill (1972) found that marathon runners did not differ significantly from the normal population on measures of extraversion, depression and neuroticism, however, they did score significantly lower on the I.P.A.T. Anxiety Battery (less anxious). Folkins (1976) found that adult males, who had been randomly assigned to an exercise program, showed significant decreases in anxiety and depression which were not observed in

controls. There were no signrficant changes in other psychological variables. Morgan, Roberts, Brand and Feinerman (1970) found no significant decrease in depression scores in a group of adult men after a six week exercise program. However, a significant reduction was observed in the scores of initially depressed subjects. Studies examining the changes in those participating in fitness programs have generally reported significant improvements in psychological measures (Folkins, Lynch & Gardner, 1972; Ismail & Trachtman, 1973). In order to counteract the influence of self-selection, Heinzelman (1975) experimentally manipulated physical fitness by randomly assigning subjects either to an exercise program or an inactive control group. After 18 months, program participants were found to report significantly more positive effects, including less feelings of tension, than did those in the control group.

In an attempt to more objectively measure differences in individuals at various fitness levels, Keller (Note 1) used autonomic indices to measure reactivity on contrived laboratory tasks designed to induce emotional stress. Lability in galvanic skin response and finger temperature provided the index of emotional arousal. The measure of aerobic fitness was pulse rate recovery time following a 2-minute step test. Quicker recovery from the autonomic changes created by the tasks suggested that the physically fit cope with emotional stress better than those who

are less fit. In addition, the reactions of those who were beginning training showed changes as fitness levels improved. A later study (Keller, Note 2) in which fitness levels were experimentally manipulated, has produced similar results.

Autonomic indices have recently attracted some attention as a measure of psychological health. Johansson (1976) and Skevington (1977) have shown that the more accurate measure of emotional well-being is not the magnitude of an autonomic response but rather the speed with which it recovers to baseline. If recovery of autonomic responses is a measure of psychological well-being, and if aerobic training can induce rapid recovery, then the physically fit should be less vulnerable to stress-related disorders than the unfit.

Exercise and Stress-Related Disorders. Physical fitness training has been employed in the treatment of several disorders. Reports on the use of physical training in cardiac rehabilitation suggest that fitness may reduce the occurence or severity of coronary heart disease (Hellerstein, 1968; Gottheiner, 1968). Murphy, Bennett, Hagen and Russell (1972) have reported on the use of physical fitness training as an integral part of a twelve week treatment program for alcoholics. The physical and psychological benefits of a general fitness program for asthmatic children have often been reported (Strick, 1969; Millman, Grundon, Kasch, Wilkerson & Headley, 1965; Scherr & Frankel, 1958). It has been shown that

chronic asthmatics are capable of improving their level of physical fitness (Strick, 1969). As outlined earlier, exercise increases cardiovascular and neuromuscular efficiency so that the same effort requires less oxygen and reduced cardiac output. McElhenney and Petersen (1963) have reported a 30% decrease in severity and frequency of asthma attacks following training. Investigators have reported improvement in psychological adjustment of asthmatics, as evidenced by changes in classroom behaviour.

The therapeutic effect of exercise on essential hypertension has not been conclusively established (Scheuer & Tipton, 1977). Johnson and Grover (1967) found training had no effect on the blood pressure of four hypertensive men following a 10 week exercise program. Choquette and Ferguson (1973) compared resting blood pressure in hypertensives and normotensives during a six month conditioning program. At the conclusion of training both groups exhibited a significant reduction in resting systolic and diastolic blood pressure. Reduction was significantly greater for hypertensives than for normotensives. In a study of essential hypertensives and normotensives following a six month exercise program, Boyer and Kasch (1970) have reported similar findings. The length of time in a conditioning program may be a critical factor.

Although reports on the therapeutic effect of aerobic training

on insomnia are lacking, the effect of exercise deprivation on sleep patterns has been studied. In a study by Baekeland and Lasky (1966) college athletes reported increased restlessness with exercise deprivation. Wakefulness and first R.E.M. period latencies were increased, while time in R.E.M. sleep was decreased In the earliest objective work relating exercise and relief from muscular tension (Jacobson, 1936), college athletes were found to relax muscles more quickly than controls. DeVries and Adams (1972) have reported on the significantly greater tranquilizing effect of 15 minutes of walking type exercises (heart rate of 100 beats) as compared to meprobramate (a tranquilizer of the carbomate family).

Cooper (1968) has made the subjective observation that airmen who exercised regularly had a lower incidence of ulcers than those who were more sedentary. Frenkl (1971) also reported a lower incidence of peptic ulcer in sportsmen, under regular training, than in persons of the same age groups abstaining from physical activity. Several researchers have reported on the antiulcerogenic effect of chronic exercise in rats (Tharp & Jackson, 1974; Frenkl, 1971; Frenkl, Csalay, Csákváry, Jákó, Juhász & Richter, 1969). Although research in this area is very meagre, early findings on the application of physical fitness training to the treatment of stress-related disorders have been promising.

The Present Study. Whether physical fitness training can in some way protect the body from the damaging effects of psychological factors is as yet unknown. The present study is concerned with the relationship between the length of time spent in aerobic training and the incidence, severity and frequency of stress-related disorders. Subjects were assigned to one of two groups depending on their training history. By comparing long term trainees with beginners, it was hoped that any confound due merely to interest in fitness would be minimized. The number of years spent in aerobic training was considered to be most directly related to possible changes in the disorders. Performance on the fitness task would be expected to improve relatively quickly (Keller, Note 1). Whether this improvement would be immediately reflected in differences in stress-related disorders is questionable.

Group Fit were those who had trained regularly (minimum of twice weekly) for at least two years. Group Beginner were those who had been training from one to six months. Since the rate of attrition is relatively high in the first month, sampling from this group was avoided.

On the basis of those studies which show an effect of exercise on anxiety level (Morgan & Costill, 1972; Folkins, 1976; Heinzelman, 1975) and those which suggest more rapid recovery from autonomic arousal in the fit (Keller, Note 1, Note 2), it was expected that

the incidence of stress-related disorders would be less in Group Fit than in Group Beginner. In addition, length of time in training was expected to decrease severity and frequency of reported disorders.

Method

Subjects. Two groups of 90 subjects each were tested. In order to control for the possible effects of sex, educational level and occupational status on either fitness level or the incidence of stress-related disorders, the groups were matched on these variables. Group Fit contained 33 males and 57 females, between the ages of 18 and 79 (mean age of 35.6), who had been actively involved in an organized fitness program for at least two years (mean duration was 7.9 years). As part of the screening process, only those whose pulse recovery rate was less than 3 minutes, after a 2-minute step test, were considered for this group (mean of 1.65 minutes). Six volunteers failed to meet this criterion. Group Beginner consisted of 31 men and 59 women, between the ages of 18 and 61 (mean age of 31.3), who had been enrolled in an organized fitness program for from one to six months (mean duration of 3.2 months) and who had not previously engaged in any regular fitness training. Only those whose weight fell within the normal range for their height were considered. Subjects were recruited from Y.M.C.A. fitness classes (four branches) and from the University Athletic Department. All subjects were unpaid volunteers.

Material and Apparatus. Blood pressure was measured with a Hartz Standard syphygmomanometer, model 1010. Pulse rate was

monitored by a Whittaker Pulse Watch, model 420, equiped with a photocell electrode in a finger clasp. A single wooden step, 41 cm (16.1 in.) in height, was used for the fitness testing.

Procedure. Testing was conducted throughout the day and evening in spacious offices provided by the local Y.M.C.A. branches and by the University. Some of the subjects were tested at the Y.M.C.A. either before a class or at least 20 minutes after exercising. Others were contacted by phone and given appointments to be tested at the University. Each subject was assessed individually, by the author, in one session of approximately 30 minutes duration. After a brief explanation of the study, blood pressure readings were taken while the subject remained seated. The electrode of a Pulse Watch was then attached to the middle finger of the right hand. Resting pulse rate was recorded as the subject stood before the step. The step test procedure was then demonstrated for the subject and he was given the signal to begin. This task involved ascending and descending from a single step, in a four step movement. First, the subject placed one foot on the step and brought up the other foot, stood up straight and then brought down the leading foot; finally returning to the original position. The pace was regulated by a metronome set at 116 beats per minute. Pulse rate was recorded one minute into the test, at completion and at one minute intervals during the post test recovery period

until pulse rate returned to baseline (maximum eight minutes). The subject sat quietly during the recovery period. Only resting pulse rate and recovery time were included in the data analysis.

Each subject was then given a three page self-report questionnaire. Those subjects who had been given the questionnaire by an assistant, while waiting for fitness testing, were now asked to complete it. Questions related to the extent and history of the subjects' participation in physical activities, his smoking habits, and the numbers of stress-related disorders from which he suffered. The complete questionnaire has been reproduced in Appendix A. A supplementary questionnaire (Appendix B) was provided for each disorder for the purpose of collecting information on the frequency, severity and history of the illnesses. Subjects were given one supplementary questionnaire for each disorder reported. Frequency questions, with the exception of those on headache, were open ended and later transformed to a 0 to 5-point scale. Headache was rated on a 1 to 7-point scale ranging from "Daily" to "Less than five times per year". Severity was measured on a 7-point semantic differential ranging from "Very mild" to "Very severe". Subjects reporting hypertension were not asked to rate severity or frequency of this disorder. Information on history included age of onset, time of last attack (if no longer active) and number of work days missed.

Only those disorders for which there is considered to be a strong psychological component and which have been given considerable attention in the psychosomatic literature were included in the questionnaire (e.g. asthma, allergy, hayfever, low back pain (without a known physical basis), ulcerative colitis, migraine, peptic ulcer, cardiac rhythm disorders (cardiac arrythmia and tachycardia), insomnia, digestive upset, essential hypertension, hives, and eczema). Subjects reporting asthma or hayfever were instructed not to include these disorders a second time in the allergy category. Due to its high incidence, hayfever was included as a separate disorder to differentiate it from the other allergies. In addition, reports of hives and eczema were included in their own categories only if there was no known allergen, otherwise they were counted as allergies. If a subject reported asthma, allergy, hayfever, cardiac rhythm disorders, essential hypertension, migraine, hives or eczema, without having seen a physician, the disorder was not included in the final tabulation. Those reports of insomnia, digestive upset, and low back pain, for which the subject had not consulted a physician, were included. Since the incidence of headache is high in the general population, all subjects were asked to rate the frequency and severity of their headaches. All females were given an additional questionnaire on premenstrual symptoms on which they were asked to rate the severity of each

on a 5-point scale from "Not at All" to "Very Much" (Appendix C).

Subjects reporting stress-related ilnesses were asked to sign a medical release form (Appendix D). Treating physicians were contacted by letter (Appendix E) and a follow-up phone call for confirmation of the diagnosis and assessment of the severity (7-point semantic differential) of each disorder.

Measure of Physical Fitness. Fitness levels were assessed by pulse recovery rate (to baseline) following the 2-minute step test. The step test emerged from earlier experiments with long standing members of advanced fitness classes, beginners and non-members (Keller, Note 1). The task was found in this previous work to adequately differentiate the trained from the untrained. Post test pulse rate recovery times for trained subjects were around one minute. Recovery time for the untrained group was greater than 5 minutes and the beginners were initially greater than 5 minutes but decreased to between 3 and 4 minutes over a 12 week training period. In addition, the task was of sufficiently short duration so that subjects at all levels of fitness were able to complete it. Preliminary testing in this study revealed a history of inconsistent or infrequent (less than twice weekly) attendance, at fitness classes, in those "Fit" subjects who required more than 3 minutes to recover to baseline. Since the time in fitness training for Group Beginner varied from one to six months, some overlap with Group Fit was expected in pulse rate recovery time.

Results

Appendix F contains individual subjects' data on age, sex, educational level, years in fitness training, number of fitness activities, blood pressure (systolic and diastolic), resting pulse rate, pulse recovery rate and stress-related disorders. A summary of the general characteristics of the two groups is given in Table 1. The mean number of years in training for Group Fit was 7.9; for Group Beginner, .3 years. A significant difference in age was found between the two groups ($\bar{X}_F = 35.6$, $\bar{X}_B = 31.3$, $t(178) = 2.78$, $p < .01$). Age was not significantly correlated with the incidence of reported disorders (r (178) = +.17). There was no significant difference between the two groups in sex, educational level or in the proportion of smokers.

Table 2 outlines the physiological data collected from each group. Differences between both resting pulse ($\bar{X}_F = 71.4$, $\bar{X}_B = 78.5$, t (178) = 6.27, $p < .001$) and pulse recovery rate ($\bar{X}_F = 1.7$, $\bar{X}_B = 3.8$, t (178) = 9.77, $p < .001$) were highly significant. Group Fit had lower resting pulse and more rapid recovery rates. Systolic blood pressure was found to be significantly lower for Group Fit than for Group Beginner ($\bar{X}_F = 118.1$, $\bar{X}_B = 121.8$, t (178) = 3.75, $p < .05$); however, there was no significant difference in diastolic blood pressure ($\bar{X}_F = 75.1$, $\bar{X}_B = 75.3$, t (178) = 0.14, $p < .45$). A total of 59 disorders

Table 1

Descriptive Data of Group Fit and Group Beginner

Descriptive Data	Group Fit	Group Beginner
Sex		
male	33	31
female	57	59
Age		
mean years	35.6	31.3
range	18 - 79	18 - 61
Education		
mean years	13.7	13.4
Occupation (No.)		
housewife	19	22
office worker	20	16
manager	14	13
student	10	10
sales	9	8
teacher	5	7
technician	5	7
professional	4	2
artist/musician	2	1
waiter/waitress	1	1
unemployed	1	3

Table 1 (Cont'd)

Descriptive Data of Group Fit and Group Beginner

Descriptive Data	Group Fit	Group Beginner
Time devoted to fitness		
Mean years in training	7.9	.3
Mean days per week	4.1	2.8
Fitness Activities[1]		
Mean no. participated in regularly	2.2	1.5
Sports		
No involvement proportion of sample	.55	.67
Involvement mean number of sports played regularly	1.58	1.43
Smoking		
Proportion of group	.23	.29
Mean number of cigarettes daily for smokers	10	15.3

[1] cycling, swimming, jogging, running, cross-country skiing

Table 2

Physiological Data of Group Fit and Group Beginner

Group	Physiological Measures			
	Resting Pulse	Blood Pressure Diastolic	Blood Pressure Systolic	Pulse Recovery Time (in minutes)[1]
Fit	71.36***	75.05	118.08*	1.65***
Beginner	78.45***	75.28	121.80*	3.80***

[1] after 2-minute step test

* $p < .05$

*** $p < .001$

were reported by Group Fit; 121 by Group Beginner. Although there was a difference in the incidence of disorders between the groups, analysis of only the disorders confirmed by physicians yielded no statistically significant findings.

There was no significant difference in the proportion of subjects in each group reporting disorders for which they did not consult a physician. Nor was there any significant difference in the proportion of physician confirmations received for each group. Contact was established with 51% of the treating physicians; in only one case was the diagnosis provided by the subject found to be inaccurate. Self-ratings and physician ratings of severity were not significantly different from each other for either group, although in both groups there was a tendency for subjects to rate the severity slightly higher than physicians.

A comparison of the total number of disorders reported by each subject, both confirmed and unconfirmed, revealed a significantly different distribution ($\chi^2(5) = 16.57$, $p < .01$) within Group Fit and Group Beginner (Table 3). The proportion of subjects in each group reporting one or more disorders was significantly greater for Group Beginner ($P_B = .69$, $P_F = .43$, $z = 3.53$, $p < .001$). Figure 1 displays the proportion of both groups reporting each disorder and the proportion for which a physician's confirmation was obtained. The incidence of eczema (self-report) in Group Beginner was significantly greater than in Group Fit ($\chi^2(1) = 6.19$, $p < .02$).

Table 3

Number of Fits and Beginners per Number of Disorders Reported

	Number of Disorders Reported					
	0	1	2	3	4	5
Fits	51	24	10	5	0	0
Beginners	28	26	19	13	2	2

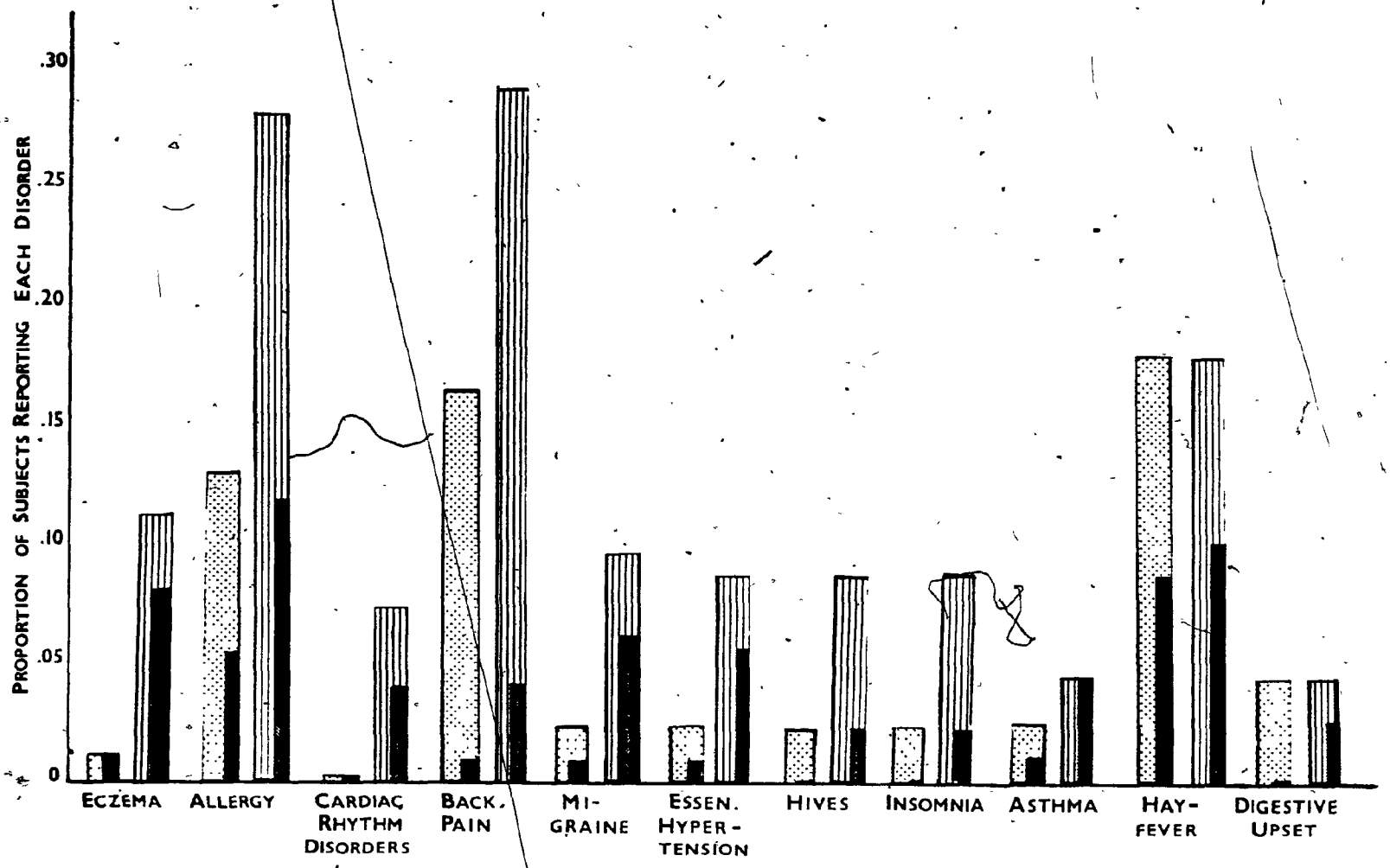

Figure 1. The proportion of subjects in Group Fit ⬚ and Group Beginner ▥ reporting each disorder and the proportion of physician confirmations ■ .

Similarly the incidence of allergies ($\chi^2(1) = 4.03$, $p < .05$) and cardiac rhythm disorders ($\chi^2 = 4.30$, $p < .05$) was significantly higher in Group Beginner. The reported incidence of each disorder, with the exception of hayfever and digestive upset, was greater for Group Beginner than for Group Fit. No significant differences were found between the two groups in the incidence of the remaining disorders. There were no reported cases of ulcerative colitis, and ulcers were reported by only one member of Group Beginner.

Table 4 displays an intercorrelational matrix of the incidences of the disorders. Significant correlations were found between allergy and hayfever ($\phi(178) = .41$, $p < .01$), allergy and asthma ($\phi(178) = .21$, $p < .05$), allergy and eczema ($\phi(178) = .27$, $p < .01$), insomnia and low back pain ($\phi(178) = .27$, $p < .01$), insomnia and cardiac disorders ($\phi(178) = .38$, $p < .01$) and cardiac rhythm disorders and migraine ($\phi(178) = .23$, $p < .05$).

There was a significant difference between the two groups in the proportion of reported disorders which were no longer active ($P_F = .30$, $P_B = .13$, $z = 3.4$, $p < .001$). Although Group Fit showed a greater proportion of inactive disorders, there was no significant correlation ($r(18) = -.20$) between years in fitness training and years without the illness for that group.

Mann-Whitney U tests (with normal curve approximation), showed premenstrual headache ($z = 1.99$, $p < .05$) and depression ($z = 2.29$, $p < .02$) to be significantly more severe in the females of Group Beginner. Group Beginner also reported a significantly greater

Table 4

Intercorrelational Matrix of Incidences of Disorders

	Migraine	Asthma	Hayfever	Allergy	Low Back Pain	Insomnia	Digestive Upset	Ess. Hypertension	Cardiac Rhythm Dis.	Hives
Asthma	.04									
Hayfever	-.10	.16								
Allergy	.05	.21*	.41**							
Low Back Pain	-.18	-.03	.03	.10						
Insomnia	.06	-.05	.02	.01	.29**					
Digestive Upset	-.05	.04	.07	-.05	-.02	.07				
Ess. Hypertension	-.06	.10	-.02	.01	-.05	-.05	-.05			
Cardiac Rhythm Dis.	.23*	-.03	-.08	-.02	.05	.38**	.07	.10		
Hives	-.06	-.04	.12	.01	-.01	.06	.01	.06	-.04	
Eczema	-.06	-.05	.16	.27**	.02	-.06	-.05	.16	-.18	.16

* $p < .05$

** $p < .01$

tendency to "Cry Easily" as a premenstrual symptom ($z = 1.97$, $p < .05$). No significant differences were found in the severity of the remaining measured premenstrual symptoms (nervous tension, fatigue, tender breasts, irritability, low back pain, lethargy, swelling, and acne).

There was a significant, although small, negative correlation between years in a fitness program and the number of reported disorders ($r(178) = -.26$, $p < .05$). No significant correlation emerged between the number of years in fitness training and the severity of any disorder as rated by the subjects.

Figure 2 displays the medians and inter-quartile ranges of subjects' severity ratings for each disorder. Severity of low back pain was rated significantly greater by Group Beginner than by Group Fit (Mann Whitney U -, $z = 3.13$, $p < .01$). The frequency of attacks of low back pain was also rated significantly greater by Group Beginner ($z = 2.78$, $p < .01$). Severity of headache was similarly rated as greater by Group Beginner ($z = 2.46$, $p < .02$). The number of medical examinations per year was significantly greater for the hypertensives of the Group Beginner than for those of Group Fit ($\bar{X}_F = 1.3$, $\bar{X}_B = 3.9$, $t(7) = 4.15$, $p < .01$). The age of onset of essential hypertension was significantly older for the hypertensive of Group Fit than those of the Group Beginner ($n_F = 2$, $n_B = 7$, $\bar{X}_F = 44$, $\bar{X}_B = 29$, $t(7) = 3.13$, $p < .05$). One member of Group Fit reported missing a total of 2 days from work in the past year due to low back pain.

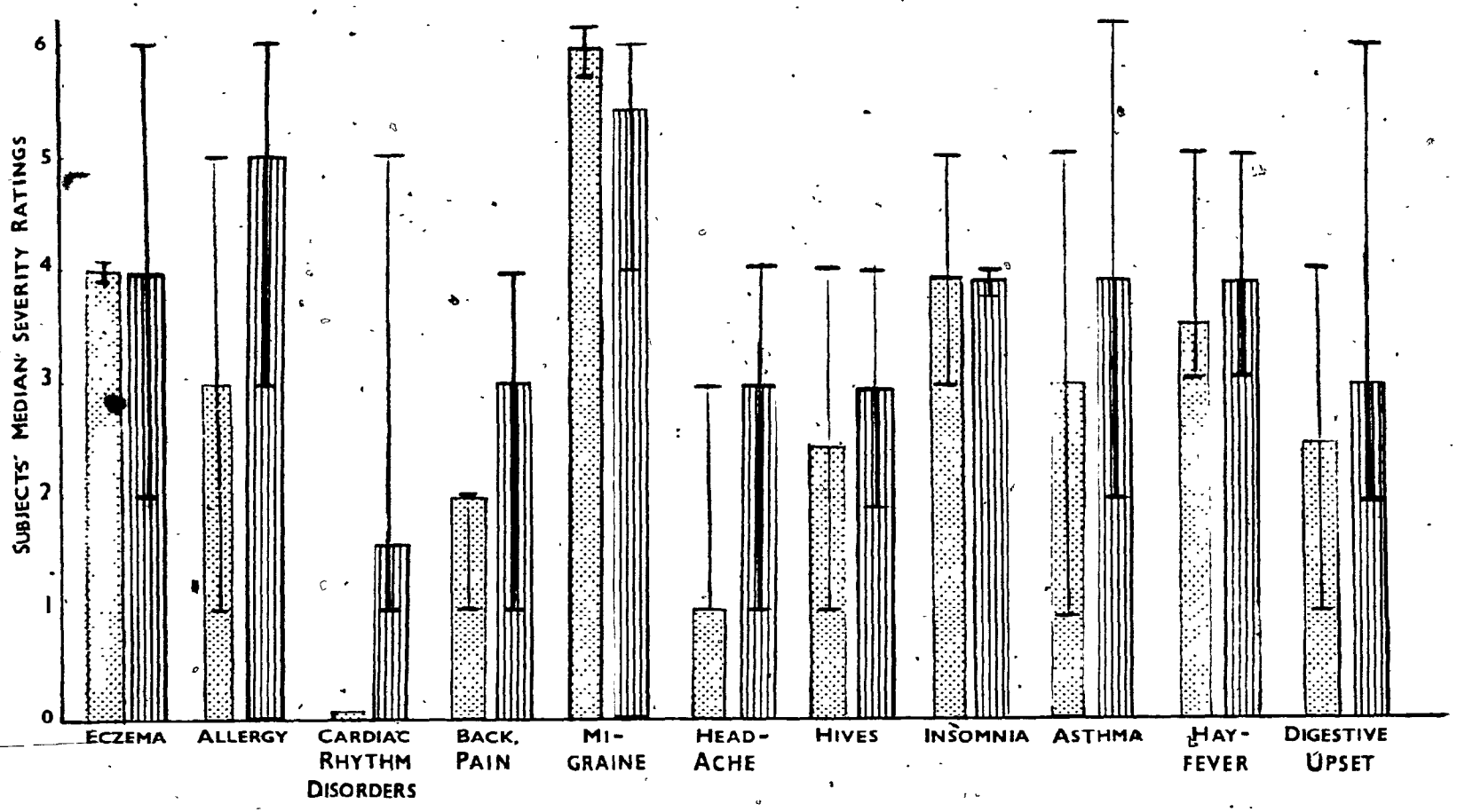

Figure 2. Median severity ratings (and interquartile ranges) of disorders reported by Group Fit ▨ and Group Beginner ▥.

Six members of Group Beginner missed a total of 28 days. One asthmatic missed 10 days, one subject with insomnia missed 10 days and four migraine sufferers missed a total of 8 days. Severity and frequency ratings of the remaining disorders did not differ significantly between the two groups.

Discussion

The results of the present study generally support the initial hypothesis that the incidence of stress-related disorders would be less in Group Fit than in Group Beginner. A clear relationship, however, between the length of time in training and either severity or frequency of reported disorders was not observed.

Although the difference in incidence emerged only when the data was expanded to also include disorders for which a physicians confirmation could not be obtained, the self-report data appear to be reliable for both groups. Only one subject reported an inaccurate diagnosis. There was no significant difference in the proportion of confirmations for the two groups; nor was there a significant difference between physician and subject severity ratings for either group. The differences that did emerge for each group were in the same direction.

The difference in the incidence of stress-related disorders between the groups was significant for three disorders, eczema, allergy and cardiac rhythm disorders. All other differences, however, were in the predicted direction. Due to the relatively low incidence of many of these disorders, a larger sample might yield more statistically significant findings. The incidence of hayfever and digestive upset was identical for the two groups.

Hayfever is considered to be the classical allergy because of the predictable relationship between allergens and reaction. If one can assume that the contribution of psychological factors are minimal, then it is not surprising, given the original hypothesis, that exercise would have little if any effect. On the other hand, a strong psychological component has been suggested in digestive upset and yet no difference emerged between the two groups in its incidence. The reported incidence for each group, however, was only 4%; much lower than would be expected in the general population (Cureton, 1969). If we assume that exercise was responsible for the low incidence of digestive upset in both groups, then it follows that the onset of its action, in this particular disorder, is very early. Alternately, exercise may have had no effect. It seems reasonable to assume, given the different levels of psychological involvement in each disorder, that exercise will have a differential effect on each. This study does not adequately address this issue. A larger sample and the inclusion of a no-exercise control group would be necessary changes.

The significant intercorrelations between the incidences of the disorders, although for the most part relatively small, must be considered when evaluating the findings of this study. The incidence of both allergy and eczema was significantly

different between the two groups and therefore the extent of their significant intercorrelation should be noted. It is noteworthy that the incidence of hayfever, although also correlated with allergy, was identical for the two groups.

The findings of deVries and Adams (1965) and Jacobson (1936) suggest the positive effect of exercise on muscle relaxation. The difference in subjects' severity ratings was found to be significant for backache and headache, both being related to increased muscle tension. The positive effects of exercise on anxiety and depression have often been reported (Morgan & Costill, 1962; Folkins, 1976). Severity of premenstrual headache, depression and emotionality (cry easily) was rated higher by Group Beginner. Although the difference between groups in blood pressure severity ratings was not statistically significant, a greater severity for Group Beginner may be inferred from the greater frequency of visits to their physicians for blood pressure readings. The age of onset of hypertension of this group is somewhat younger than would generally be expected. With these exceptions no other significant differences in severity ratings were found between the two groups. The therapeutic effect of exercise on stress-related disorders remains to be demonstrated.

Although the two groups were not matched for age, Group Fit being slightly older, there was no correlation between age and the incidence of disorders. Differences in resting pulse and

recovery rate suggest a group difference in levels of physical fitness. Difference in mean systolic blood pressure, although only 3 points, may be clinically significant. Cornfield (1962) has calculated that, at a starting blood pressure of 110 mm Hg, a 1% decrease in systolic blood pressure represents a 4.6% decreased risk of coronary heart disease. Percentage changes in blood pressure were associated with larger percentage changes in risk when starting from low rather than from high pressures.

While there are no clear explanations, one may speculate as to the mechanism by which physical fitness may influence the development of stress-related disorders. Psychosomatic ailments develop when the psychological reactions to stress are sustained for a long period of time (Selye, 1974). If exercise has some value in reducing the effects of stress it may be due to its part in stabilizing the autonomic nervous system and its partner, the endocrine system (Cogan, Note 3). This is suggested by the effect of training on the recovery of autonomic indices (Keller, Note 1, Note 2; Evan, Cox, & Jamieson, Note 4). Michael (1957) proposes that regular exercise affects the adrenal glands and autonomic nervous system so as to improve the adaptive mechanisms of the body to resist emotional stress. One may only speculate as to how this may occur. According to Selye (1954) the adrenal cortex is a major organ of homeostasis. The pituitary gland,

by discharging adrenocorticotrophic hormone when local stress exists, induces the adrenals to produce anti-inflammatory corticoids. Selye (1976) proposed that exercise, as a general stressor, may minimize the damaging effects of other stressors on the body. He suggests that when stress is disporportionately great on one organ or system, deviation (activating the whole body to better distribute the stress) may be beneficial. Alternate stress-on, stress-off periods may help the body to achieve general resistance. Selye believes that conditioning, by the moderate stress of an exercise program, sets up a "cross-resistance" to other forms of stress.

The nature of the relationship between exercise and adrenal activity is not clear (deVries, 1974). There is some evidence that exercise alone, unless carried to exhaustion or performed under emotional arousal, does not produce a typical stress response (Chin & Evonuk, 1971; Steadman & Sharkey, 1969). In addition, Selye's use of the term stress may be too specific. It seems to depend on the similarity of response to different stimuli, a similarity apparently dependent on their common action on the pituitary-adrenal system. As yet there is no evidence that all psychogenic diseases have a special dependence on this mechanism (Graham, 1972).

The questions posed by this research may be better answered by a longitudinal study in which all fitness class members of a

Y.M.C.A. branch would be routinely tested. This procedure would overcome part of the self-selection problem and in addition would make it possible to study changes over time. Another possibility would be to randomly assign sufferers of a particular disorder to either an exercise or control group. This would be the most efficient method of determining the specific therapeutic effects of exercise.

Difficulties were encountered in this study, in contacting a sufficient number of personal physicians for confirmation of diagnoses. This problem may be bypassed by working in co-operation with a medical service. Uniformity of severity ratings may be achieved by one physician rating all disorders. Ratings could be based on medical results and subjects' responses on a questionnaire pertaining to their symptoms.

The present study provides some evidence of exercise as a prophylaxis for stress-related disorders. Although these disorders attack different body systems and manifest different reactions, the one feature all have in common is their resistance to treatment of any kind. There is no strong evidence from this study that exercise may be better than traditional treatment approaches. If early involvement in physical fitness training, however, can decrease the risk of stress-related disorders, then there is justification for its inclusion in the sphere of preventive medicine.

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Appendix A

Fitness Activity and Medical Status Questionnaire

The Psychology Department of Concordia University is currently studying the relationship between physical fitness and other physical and psychological factors. We would sincerely appreciate your cooperation in this effort.

We ask that you complete the following questionnaire as accurately as possible. All responses are completely confidential and will be used for research purposes only.

Name: _____

Telephone no.: _____

Age: _____

Marital Status: Single_____ Married_____ Divorced or Separated _____

Widowed _____

Occupation: _____

Last school grade reached: _____

Height: _____ Weight: _____

Appendix A (Cont'd)

1. Do you participate <u>regularly</u> in any fitness activity? YES NO

   If so, please indicate which activities and how often.

Activity	How Often
Jogging	
Fitness Classes	
Running	
Swimming	
Cycling	
Walking (briskly)	
Cross-country skiing	

2. When did you start the above activity(ies) on a <u>regular</u> basis?

   _____

3. Do you participate <u>regularly</u> in any other sport(s) YES NO

   If so, which one(s)? _____

   _____

4. Do you smoke? YES NO If so, how many cigarettes daily? ____

5. Do you frequently suffer from insomnia? YES NO

6. Do you frequently suffer from digestive upset (nausea, heartburn, indigestion)? YES NO

Appendix A (Cont'd)

7. How frequently do you have a headache? Daily _____

2-6 per week _____

Weekly _____

2-3 per month _____

Monthly _____

5-10 yearly _____

Less than that _____

8. How severe are your headaches?

Very mild _____._____._____._____._____._____._____. Very severe

1 2 3 4 5 6 7

Appendix A (Cont'd)

The following questions pertain to your medical status:

1. Do you currently have an ulcer? YES NO

1a. Have you had an ulcer in the past, which is now healed? YES NO

If so, when did you experience the last symptoms? _____

2. Do you suffer from migraine headaches? YES NO

2a. Did you have migraines in the past, but no longer? YES NO

If so, when did you have the last one? _____

3. Do you have asthma? YES NO

3a. Did you have asthma in the past, but no longer? YES NO

If so, when did you experience the last symptoms? _____

4. Do you suffer from ulcerative colitis? YES NO

4a. Did you suffer from ulcerative colitis in the past, but no longer? YES NO

If so, when did you experience the last symptoms? _____

5. Do you ever break out in hives (urticaria)? YES NO

5a. Have you suffered from hives in the past, but no longer? YES NO

If so, when did you experience the last symptoms? _____

Appendix A (Cont'd)

6. Do you sometimes have eczema? YES NO

6a. Have you suffered from eczema in the past, but no longer? YES NO

If so, when did you experience the last symptoms? _____

7. Do you suffer from hayfever? YES NO

7a. Have you had hayfever in the past, but no longer? YES NO

If so, when did you experience the last symptoms? _____

8. Are you allergic to any other substances? YES NO

8a. Did you have any allergies in the past, that you no longer have? YES NO

If so, when did you have the last symptoms? _____

9. Do you suffer from low back pain? YES NO

9a. Have you suffered from low back pain in the past, but no longer? YES NO

If so, when did you have the last backache?

_____

10. Have you been told by a physician that you suffer from a cardiac arrythmia (irregular heartbeat)? YES NO

10a. Have you suffered from a cardiac arrythmia in the past, but no longer? YES NO

If so, when did you experience the last symptom? _____

Appendix A (Cont'd)

11. Have you been told by a physician that you suffer from tachycardia (rapid heartbeat)? YES NO

11a. Have you suffered from tachycardia in the past, but no longer? YES NO

If so, when did you experience the last symptoms? _____

12. Do you suffer from essential hypertension (high blood pressure)? YES NO

12a. Have you suffered from essential hypertension in the past, but now have normal blood pressure? YES NO

If so, when was your blood pressure last elevated? _____

Appendix B

Supplementary Questionnaire for each Disorder

Regarding your ulcer:

1. Have you seen a physician for this problem? YES NO

   If so, please give his name _____

2. How often have you missed work or school in the last year because of your ulcer? _____

3. How often have you been hospitalized for your ulcer?

   _____

4. How frequently do you experience pain from your ulcer?

   _____

5. How frequently do you suffer from heartburn? _____

6. On the average, how severe is your discomfort?

   Very mild _____ . _____ . _____ . _____ . _____ . _____ . _____ . Very severe
   1 2 3 4 5 6 7

7. How long ago did you experience the first discomfort from your ulcer? _____

Appendix B (Cont'd)

Regarding your migraines:

1. Have you seen a physician for your migraines? YES NO

   If so, please give his name _____

2. How often have you missed school or work in the last year because of your migraines? _____

3. How many migraines do you have per year? _____

4. On the average, how long does each attack last? _____

5. On the average, how much and what type of medication do you take per attack? _____

6. On the average, how severe is the pain?

   Very mild _____.____.____.____.____.____.____. Very severe
   1 2 3 4 5 6 7

7. At what age did you get the first migraine? _____

Appendix B (Cont'd)

Regarding your asthma:

1. Have you seen a physician for your asthma? YES NO

   If so, please give his name _____

2. How often have you missed work or school in the last year because of your asthma? _____

3. How frequently do you have an asthma attack? _____

4. At what age did you first experience the symptoms of asthma?

   _____

5. How severe would you rate your asthma?

   Very mild _____._____._____._____._____._____._____ Very severe
   1 2 3 4 5 6 7

Appendix B (Cont'd)

Regarding your ulcerative colitis:

1. Have your seen a physician for this condition? YES NO

   If so, please give his name _____

2. How often have you missed school or work in the last year because of this condition? _____

3. How frequently have you been hospitalized for this condition?

   _____

4. Did you have surgery for this? YES NO

5. How frequently do you have a bowel movement? _____

6. How frequently do you suffer from fecal incontinence? ____

   _____

7. How severe would you rate your condition?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

8. At what age did you first experience the symptoms of ulcerative colitis? _____

Appendix B (Cont'd)

Regarding your hives (urticaria):

1. Have you seen a physician for this condition? YES NO

   If so, please give his name _____

2. How frequently do you break out in hives? _____

3. Please check all the parts of your body that have been affected.

   Face _____ Legs _____

   Hands _____ Arms _____

   Feet _____ Trunk _____

4. How severe would you rate your average case of hives?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

5. How old were you when you first experienced the symptoms of hives? _____

Appendix B (Cont'd)

Regarding your eczema:

1. Have you seen a physician for this condition? YES NO

   If so, please give his name _____

2. How frequently do you break out in eczema? _____

3. Please check all the parts of your body that have been affected.

   Face _____ Legs _____

   Hands _____ Arms _____

   Feet _____ Trunk _____

4. How severe would you rate your eczema?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

5. How old were you when you first experienced the symptoms of eczema?

Appendix B (Cont'd)

Regarding your hayfever:

1. Have you seen a physician for your hayfever? YES NO

   If so, please give his name _____

2. How often have you missed work or school in the last year because of your hayfever? _____ YES NO

3. During the hayfever season, how frequently do you suffer? _____

4. How much and what type of medicatton do you require during an attack of hayfever? _____

   _____

5. Which of the following symptoms are associated with your hayfever?

   Puffy eyes _____ Watery eyes _____ Sneezing _____

   Headache _____ Difficulty breathing _____ Itchy eyes or ears _____

6. How severe would you rate your hayfever?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

7. How old were you when you first experienced the symptoms of hayfever? _____

Appendix B (Cont'd)

Regarding your allergies:

1. Have you seen a physician for your allergies? YES NO

   If so, please give his name _____

2. Please list all the substances to which you are allergic and describe your reaction to each.

3. How frequently do you suffer from each of the above?

   _____

   _____

4. How severe would you rate your worst allergy?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

5. How old were you when you experienced your first allergic reaction? _____

Appendix B (Cont'd)

Regarding your low back pain:

1. Have you seen a physician for this condition? YES NO

   If so, please give his name _____

2. What was the diagnosis of your back pain? _____

   _____

3. How often have you missed school or work during the last year because of your back pain? _____

4. How frequently do you have a backache? _____

5. How severe would you rate your back pain?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

6. When did you first experience this back pain? _____

   _____

Appendix B (Cont'd)

Regarding your cardiac arrythmia or tachycardia:

1. What is the nature of your condition (diagnosis)? _____

   _____

2. Please give the name of the physician who diagnosed this condition. _____

3. How often have you missed work or school this year because of this condition? _____

4. How frequently do you suffer from this condition? _____

5. How severe would you rate this condition?

   Very mild _____._____._____._____._____._____._____. Very severe
   1 2 3 4 5 6 7

6. When was this condition first noticed by yourself or your physician? _____

Appendix B (Cont'd)

Regarding your essential hypertension (high blood pressure):

1. Please give the name of the physician who diagnosed essential hypertension. _____

2. How frequently do you see this physician for this condition? _____

3. When did you last have your blood pressure measured? _____

4. What was the reading at that time? _____

5. When was this condition first diagnosed? _____

6. Are you currently taking any medication for your hypertension?

   YES NO If so, what type and how frequently? _____

Appendix B (Cont'd)

Regarding your digestive upset:

1. Have you seen a physician for this condition? YES NO

   If so, please give his (her) name _____

2. Which of the following symptoms do you experience and how often?

Symptom	How Often
Indigestion _____	
Heartburn _____	
Nausea _____	
Stomach pain _____	

3. How frequently have you missed work (school) because of this condition? _____

4. How severe do you consider this condition to be in your case?

   Very mild _____._____._____._____._____._____._____. Very severe

   1 2 3 4 5 6 7

Appendix B (Cont'd)

Regarding your insomnia:

1. Have you seen a physician because of this problem? YES NO

   If so, please give his(her) name _____

2. How often have you missed work (school) because you did not sleep well the night before? _____

3. How frequently, on the average, do you have difficulty sleeping?

   Daily _____ 4-6 times per week _____ 1-3 times per week _____

   2-3 times per month _____ once monthly _____ less than that _____

4. How severe do you consider your insomnia?

   Very mild _____._____._____._____._____._____._____. Very severe

   1 2 3 4 5 6 7

Appendix C

Premenstrual Syndrome Questionnaire

Regarding your menstrual cycle:

Please indicate (check) to what extent you experience each of the following in the week prior to your period.

	Not At All	A Little	Some	Much	Very Much
1. Nervous Tension					
2. Fatigue					
3. Low Back Pain					
4. Swelling					
5. Headaches					
6. Depression					
7. Tender Breasts					
8. Irritability					
9. Lethargy (low energy)					
10. Cry easily					
11. Acne, pimples					

Appendix D

Authorization to Release Information

I, _____ authorize and request

Dr. _____ to relay the following information,

regarding _____, to Concordia University,

Department of Psychology, for research purposes.

_____ _____

signature date

_____ _____

signature date

.....

Confirmation of above diagnosis YES NO

(alternate diagnosis, if applicable _____)

Relative to other such cases, how would you rate the severity of this case?

Very mild _____._____._____._____._____._____. Very severe

1 2 3 4 5 6

Appendix E

Letter to Treating Physicians

Dear Dr.

We are currently involved in a study at Concordia University, under the direction of Dr. P. Seraganian, investigating the relationship between level of physical fitness and various disorders. Your patient is one of our subjects and has consented to our inquiry regarding his medical status. You will find his (her) signed authorization for release of information, enclosed with two questions to which we request your response.

Someone from our office will contact you shortly regarding your assessment of this case. May we suggest that you leave your response to our questions with your secretary, so that we might receive the information from her directly.

We sincerely appreciate your help in this aspect of our research and thank you in advance for your co-operation.

Yours sincerely

Appendix F

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
A.B.	F	43	9	4	3	62	94	70	1'48"	
H.G.	F	43	16	4	2	84	118	80	1'52"	
D.J.	F	40	18	3	1	64	110	80	2'	
J.M.	F	47	18	5	2	66	112	75	1'25"	allergy, hayfever
C.H.	F	23	16	8	4	88	132	85	2'10"	
J.N.	F	34	13	10	2	74	112	70	45"	hives, hayfever
I.H.	F	43	10	10	2	78	118	74	1'43"	
R.C.	F	39	11	14	2	68	120	72	1'10"	
A.M.N.	F	20	13	10	1	68	110	80	57"	hayfever
B.N.	M	44	11	10	2	88	140	70	1'43"	
G.E.	M	46	13	8	3	92	130	50	1'57"	
D.P.	M	71	12	30	3	88	122	80	1'48"	

Appendix F (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
D.A.N.	M	40	-	7	2	76	116	64	1'47"	
J.M.[1]	M	35	-	18	2	60	96	62	1'47"	
W.V.	M	26	14	3	2	110	150	82	2'18"	
P.F.	F	31	12	2	2	68	112	74	1'55"	
A.N.	M	23	15	6	1	78	122	65	1'25"	hayfever
B.N.[1]	M	34	15	3	1	70	112	70	1'15"	
J.P.	F	40	14	2	1	74	116	78	58"	hives
T.O.	F	30	12	2	1	76	110	60	50"	allergy
J.A.	F	24	13	12	4	68	110	65	2'23"	
M.L.R.	F	24	16	14	3	78	118	74	1'20"	
S.B.	F	21	15	7	2	58	112	54	33"	
S.R.	F	25	13	4	1	78	110	58	55"	

Appendix E (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
J.T.	F	34	12	3	1	80	130	80	61"	
D.D.	M	23	15	2	1	60	116	75	40"	back pain
S.L.	M	39	16	3	1	82	124	72	2'52"	
J.L.D.	M	50	15	4	1	76	122	60	1'04"	
I.M.	M	37	12	5	1	78	112	75	2'15"	
R.R.	M	60	14	10	3	82	132	65	47"	
N.H.	F	49	12	7	2	72	120	68	1'40"	all.,hay.,back
B.C.	F	32	16	3	2	68	104	65	2'05"	
M.B.	F	43	14	3	2	84	128	78	2'48"	back pain
J.H.	F	25	11	2	2	68	118	84	1'07"	back pain
M.B.	F	41	11	6	2	72	112	80	2'12"	
B.D.	F	32	17	10	2	62	102	64	55"	all.,migraine

Appendix F (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
B.M.	F	31	17	9	1	74	118	70	2'12"	back pain
D.H.	F	33	11	2	2	80	112	78	1'34"	hay.,digestive upset
C.M.	F	26	15	3	1	70	118	74	52"	back.,insomnia
C.P.	F	28	11	3	2	70	100	74	1'35"	
L.S.	F	28	13	2	3	64	102	80	1'12"	hayfever
H.L.	F	36	16	2	2	70	118	70	2'21"	
J.W.	F	57	11	2	2	70	104	72	1'36"	
P.C.	F	51	11	2	1	84	138	80	58"	back.,insom.,dig.
S.A.	F	28	12	3	2	68	118	76	2'48"	all.,asthma
R.T.	M	31	16	15	2	72	128	72	47"	all.,back
H.I.	M	47	-	8	2	80	128	75	1'33"	
J.F.	M	51	16	5	1	100	140	80	1'47"	back.,ess. hypertension

Appendix F (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
D.B.W.	M	39	12	6	1	90	130	80	2'25"	
T.H.	M	19	13	6	1	80	120	72	1'53"	
E.Z.	F	27	16	3	3	52	104	68	1'57"	
B.M.C.	F	41	11	2	3	82	122	82	1'49"	back pain
L.C.	F	27	20	12	3	74	118	78	1'24"	migraine
F.d.N.	F	43	18	15	2	72	114	76	1'28"	all.,hay.,back
D.D.[1]	F	26	14	3	2	78	108	80	2'23"	asth.,all.,hay.
M.R.R.	F	35	20	3	2	72	110	78	57"	hay.,all.,dig.
E.F.	F	24	18	2,5	1	78	110	80	2'43"	
S.C.	F	33	11	4	2	72	112	79	1'58"	back pain
C.T.	F	25	11	2	3	78	120	70	1'18"	digestive upset
E.G.	F	33	13	5	2	74	110	75	1'23"	eczema

Appendix F (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
R.L.	M	51	11	16	1	82	122	60	1'28"	
C.C.	M	36	15	3	2	80	138	70	1'54"	
N.M.K.	M	47	14	10	2	86	128	70	58"	hayfever
N.M.	M	38	15	3	1	78	126	62	2'54"	allergy
J.G.	F	34	17	20	3	62	102	68	42"	
A.E.	F	79	4	26	2	88	138	80	2'28"	
N.B.	F	21	13	10	3	68	116	72	1'07"	hay.,all.
P.R.	F	36	14	4	1	70	110	93	2'43"	back pain
G.B.	F	41	17	3	3	76	120	78	1'23"	
L.C.	F	56	-	15	2	72	122	68	2'28"	back pain
D.M.	F	34	16	5	2	82	132	75	48"	all.,back
R.J.D.	M	30	17	5	2	80	122	68	1'12"	

Appendix F (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
N.B.	M	55	12	4	3	78	122	66	2'42"	
K.F.	F	35	15	2	3	62	98	65	3'00"	
M.C.	M	37	14	3	3	80	120	65	1'02"	
R.M.[1]	M	38	14	5	1	80	120	72	2'44"	hayfever
N.D.	F	21	11	6	2	68	112	65	54"	
M.G.	F	30	15	3	1	80	112	80	1'19"	
I.M.[1]	F	45	11	5	1	86	140	70	2'29"	
J.B.	M	46	11	15	2	80	110	60	1'44"	
J.B.[1]	M	51	11	26	1	92	138	70	2'58"	hypertension
O.W.	F	23	13	2	1	64	112	60	1'42"	
O.G.	F	28	12	3	1	55	108	70	2'15"	
K.R.	M	23	16	5	1	78	118	61	55"	hayfever

Appendix F (Cont'd)

Individual Subjects' Data

Group Fit

Subject	Sex	Age	Educ.	Yrs. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
P.C.[1]	M	22	13	3	1	78	120	62	2'02"	
P.D.	M	21	15	5	1	72	116	58	56"	allergy
G.S.	M	24	15	5	4	68	120	60	45"	
I.S.	M	25	14	3	2	78	122	65	65"	hayfever
C.D.	M	23	14	6	1	68	122	65	1'04"	
A.B.[1]	F	23	13	10	3	72	118	68	2'07"	hayfever

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subject	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
L.L.	F	39	13	6	2	70	108	72	4'45"	migraine
A.T.	M	44	12	4	1	74	120	65	1'20"	
G.T.	M	30	17	5	1	70	120	70	1'22"	
J.L.	M	34	14	6	2	64	104	68	4'50"	hayfever
D.W.	M	21	13	1	1	76	126	68	1'25"	allergy
M.S.	M	24	13	4	1	68	110	75	2'17"	back pain
D.S.	F	22	11	6	3	74	114	70	1'10"	
J.M.C.	F	25	11	6	1	70	110	70	57"	back pain
A.P.	F	29	15	2	1	78	122	66	6'26"	cardiac,all.,back.,mig.
J.S.	M	46	9	4	1	96	156	105	5'08"	hypt.,cardiac
C.M.H.	F	28	16	2	3	92	142	76	8"	all.,hypt.
W.H.	M	22	14	4	1	62	118	85	4'28"	hay.,all.,ecz.
N.M.	M	20	13	1	1	76	120	70	1'30"	

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subject	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
K.F.A.	M	27	13	3	1	98	160	70	6'46"	hypertension
S.S.	M	21	13	1	1	78	124	70	5'41"	
F.A.	M	21	12	1	1	75	122	60	2'23"	
L.C.	F	34	14	3	-	62	108	80	3'11"	hives
T.S.A.	F	30	12	4	1	74	118	70	4'23"	allergy
B.J.S.	F	42	11	4	1	68	104	60	4'44"	mig.,cardiac
D.B.	F	21	12	5	1	75	120	80	8"	ulcer.,hives
A.B.	M	35	14	1	1	72	118	70	2'35"	
A.R.	F	27	16	4	1	80	122	70	2'03"	back pain
E.P.	F	31	12	5	2	78	128	90	5'03"	hay.,all.,back.,insom.,hives
C.C.	F	26	17	5	1	70	118	80	2'55"	hay.,all.,ecz.
L.V.	F	31	16	5	2	70	110	68	1'40"	
M.C.	F	31	14	6	1	62	102	78	1'20"	

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subject	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
N.D.	F	46	13	5	1	70	110	90	2'29"	allergy
H.H.	F	31	16	5	1	80	130	80	1'37"	ecz.,all.
J.W.	F	27	14	6	1	68	122	80	1'34"	
M.M.	F	57	11	1	2	66	126	75	3'18"	all.,ecz.
R.D.D.	M	25	11	5	1	78	128	78	3'18"	
B.M.M.	M	35	11	1	2	82	138	74	5'24"	back pain
P.S.	M	28	16	4	2	72	122	78	2'15"	allergy
J.L.[1]	F	30	12	1	2	78	138	80	4'31"	hayfever
D.B.	F	25	13	1	1	72	110	80	4'10"	
E.N.	F	19	12	1	1	80	138	80	8"	
K.A.	F	33	15	4	2	78	122	82	3'53"	
M.R.M.	F	32	13	1	1	80	128	104	3'57"	insom.,dig.,cardiac
L.A.M.	F	26	12	1	2	72	110	85	2'54"	

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subject	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
K.D.	F	31	-	1	1	64	108	80	1'56"	
J.B.[2]	F	29	11	3	1	72	112	100	4'29"	back.,dig.,cardiac
N.B.	F	29	11	5	1	70	110	84	3'42"	all.,back
C.M.	F	21	16	4	2	58	104	76	8"	hayfever
S.M.	F	26	11	4	2	70	110	80	8"	
H.H.[1]	F	36	12	4	2	76	128	85	3'59"	asth.,back
N.F.	F	32	11	1	1	90	142	82	3'20"	back.,hypt.,ecz.
J.B.[3]	F	27	11	4	1	76	114	80	3'48"	
D.M.K.	F	31	12	6	1	78	122	86	3'24"	
M.R.	F	29	16	4	1	66	116	80	2'46"	back pain
M.A.R.	F	20	12	4	1	68	106	78	4'33"	asth.,hay.,all:,ecz.
D.B.M.	M	61	16	5	1	84	138	70	2'38"	back pain
J.G.	M	47	13	3	1	92	158	74	2'12"	hypertension

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subject	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
G.R.	F	56	16	1	1	62	100	70	-	ecz.,hives
T.R.	F	18	13	1	2	70	114	84	3'08"	
S.S.	F	27	11	1	1	76	112	85	3'48"	back pain
M.K.	F	41	11	3	1	80	128	80	3'57"	back.,dig.
P.C.[2]	F	31	11	1	1	76	118	86	4'08"	all.,mig.
E.S.	F	18	11	2	2	80	126	85	2'28"	
B.G.T.	F	25	12	6	1	64	108	70	2'	
J.K.	F	19	12	6	1	70	108	85	2'24"	migraine
L.K.	F	30	11	1	1	76	122	80	2'07"	
T.M.	F	21	11	2	1	76	118	85	5'04"	
C.D.	M	26	11	3	1	90	162	72	2'56"	migraine
M.de.N	M	38	12	6	1	74	128	72	2'28"	back pain
P.O.	M	29	17	3	1	108	164	78	8"	hay.,all.,hypt.,hives.,ecz.
G.G.	M	32	16	1	1	74	118	80	6'27"	

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subect	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
S.K.	M	37	18	1	1	74	120	80	3'16"	hay.,dig.,back
R.D.	M	33	18	1	2	82	126	80	2'59"	hives
D.S.[1]	M	29	18	1	2	84	150	87	5'43"	hay.,all.
E.V.	M	34	8	3	1	76	124	82	2'12"	asth.,hay.,all.
W.H.P.	M	47	18	2	1	82	132	70	2'26"	
G.V.	M	24	16	3	2	96	150	78	3'27"	all.,hives
J.R.C.	M	50	13	5	3	76	118	80	1'54"	
N.C.L.	M	38	16	6	1	78	120	85	2'53"	hayfever
E.F.	M	45	13	1	1	82	132	88	4'42"	
J.Y.	F	30	16	6	1	62	110	80	4'18"	hay.,all.,back
D.A.	F	29	16	6	1	72	110	78	8"	hay.,all.,back
L.R.	F	34	12	6	1	68	110	84	2"	all.,hay.,back
B.M.	F	47	14	3	3	76	122	86	3'26"	insomnia,cardiac
S.B.[1]	F	25	13	2	1	70	112	80	2'58"	migraine

Appendix F (Cont'd)

Individual Subjects' Data

Group Beginner

Subject	Sex	Age	Educ.	Mo. in Fitness	No. of Fitness Activities	Blood Pressure Diast.	Blood Pressure Syst.	Resting Pulse	Pulse Recovery Time	Stress-Related Disorders
L.S.	F	24	14	6	3	90	140	72	1'07"	asth.,hypt.
T.M.	F	36	14	6	1	70	120	80	3'	back.,insom.,mig.
B.F.	F	33	16	3	1	64	108	82	5'47"	back.,insom.
R.R.	F	33	16	5	1	68	110	78	5'	eczema
N.A.	F	32	16	1	1	76	122	78	5'32"	back pain
M.P.	F	28	18	4	2	78	122	70	3"18"	back.,insom.
M.B.	F	25	13	1	2	76	118	82	2'	all.,back
R.S.	F	30	12	4	3	78	108	82	3'12"	insom.,all.,back
G.S.	F	35	12	1	2	72	118	75	8"	hay.,all.,ecz.
P.C.[3]	M	36	12	3	1	76	120	85	4'28"	all.,back

1, 2, 3 repeated initials