The Health and Wellbeing of Staff Members at a Tertiary Institution in New Zealand

by Sonja Dreyer, Universal College of Learning, Palmerston North, New Zealand; Lukas I. Dreyer, Massey University Manawatu, Palmerston North, New Zealand; Dean M. Rankin, Universal College of Learning, Palmerston North, New Zealand

Abstract

The purpose of this study was to determine the physical, psychological and biochemical health status of staff members at a higher educational institution (Institute of Technology). Relative large numbers of subjects were identified with hypertension (18.5%), stress symptoms (32.1%), job stress (36%) and emotional exhaustion (11.4%). Thirty percent presented with more than three risk factors, 49% with one or two risk factors while only 21% were risk free. Cardiovascular fitness showed positive associations with body fat, body weight, stress, emotional exhaustion and fasting blood glucose levels. Psychological health correlated significantly ($p \leq 0.05$) with measures of coronary risk, health status, body composition and cardiovascular fitness. Staff assistance programs focusing on exercise, weight management and job stress could potentially have a positive impact on overall health of staff at tertiary institutions.

Key words: Happiness and quality of life

Various researchers from across the globe reflect in scientific publications on the continuous and disquieting increase in levels of occupational stress experienced by staff at higher educational institutions (Dua, 1994; Gillespie, Walsh, Winefields, Dua & Souch, 2001; Houston, Meyer & Paewai, 2006; Tytherleigh, Webb, Cooper & Ricketts, 2005). Stress might arise from job environmental factors, like overload, time constraints, lack of promotion, changing job roles and/or from individual interpretation (cognitive assessment) of the situation. There is general agreement that chronic job related stress can impact negatively on psycho-emotional well-being, physical health, as well as on lifestyle and exercise habits (Lovalla & Gerin, 2003; Nicholson, Fuhrer & Marmot, 2005; Rosengren et al., 2004). The impact of occupational stress on the physical and psychological health of staff at higher educational institutions is as yet not fully explored. This is surprising as the higher educational sector has commonly been regarded as a working environment that has become increasingly more stressful and psychologically demanding due to multiple triggers for stress-related illnesses (Kinman, 2001; Winefield & Jarret, 2001). In a national survey of British working conditions, university lecturers reported the lowest levels of self-reported psychological health compared to 19 other occupational groups (Millward-Brown, 1996). In a comprehensive study by Tytherleigh et al. (2005) examining occupational stress in higher education institutions, it was concluded that universities no longer provide the low stress working environment they once did.

Research conducted at a number of academic institutions (United Kingdom, United States of America, Australia, Netherlands, New Zealand and South Africa) identified several key stressors commonly associated with stress among faculty staff. Overload, time constraints, lack of promotion opportunities, inadequate recognition, salary, changing job role, inadequate management and/or participation in management, inadequate resources and funding, and student interactions were listed as the majors stressors in most of these studies (Barkhuizen & Rothman, 2008; Taris, Scheurs & Van Iersel-Van Silfhout, 2001; Tytherleigh et al., 2005; Winefield & Jarrett, 2001; Winter & Sarros, 2002). Research by Barkhuizen and Rothman (2008) indicate that the academic environment is still largely a male dominated occupation and express the opinion that female academics might therefore experience more stressors and strains than male academics. Reasons for this may include the lack of role models, less socialization from women of their own rank, gender stereotypes and role conflict as they endeavor to balance roles at work and home. Longer working hours resulting from trying to balance work and family responsibilities might make female academics more susceptible to psychological health and well-being problems (Barkhuizen & Rothman, 2008).

Health is traditionally determined by assessing coronary artery disease (CAD) risk and includes measures such as: a) family history, b) body weight, c) smoking status, d) total cholesterol (TC), e) total cholesterol/high density lipoprotein-ratio (TC/HDL-ratio), f) resting blood pressure, g) diabetes, h) gout (which is defined as elevated uric acid levels associated with pain attacks in selected joints like the big toe) and i) perceived levels of stress. Exercise capacity and elevated blood pressure responses during sub-maximal exercise testing have also been identified as potent predictors of long-term health (Ashley & Myers, 2003). In addition certain psycho-emotional constructs (e.g. depression, anxiety) have emerged lately as significant predictors of long-term health (Carney, 1998; Lovallo & Gerin, 2003; Nicholson et al. 2005; Rosengren et al., 2004).

Psychological stress is regarded as a secondary risk factor for coronary artery disease (CAD) (American College of Sports Medicine, 2010) but limited information is available regarding the association, or clustering, of psycho-emotional constructs with coronary risk and overall health status of staff at higher educational institutions. Higher education seems to equate with healthier lifestyles (Ogden, 2004). Kobasa, Maddi, and Courington (1981) introduced the concept of the hardy personality, or individuals that seem to flourish on stress, in essence, indicating that an individual's appraisal of the situation (stressor) could impact on the potential health consequences of a stressor like job environment. It is therefore quite possible that this type of population (highly educated individuals working at educational institutions) are better able to manage stress, or that higher probable levels of participation in physical exercise in this type of population would negate potentially positive relationships between psychological distress and markers of morphological, biochemical and physiological health.

The aims of this study were:

1) To report the coronary risk and psycho-emotional health, physical work capacity and morphological profiles of staff members at a higher educational institution.
2) To determine if female staff members exhibit more psychological distress and whether that correlates with inferior or lesser levels of morphological, physiological and biochemical health.
3) To study the contribution of various psychological constructs to the variance of coronary risk and health status of staff members at a higher educational institution.
4) To determine whether the level of cardiovascular fitness influences (negate or strengthen) the relationships between selected measurements of psychological, morphological, biochemical and physiological health.

Method

Subjects

The subjects (n=81 randomly sampled out of 150 volunteers for the study) were either teaching (44.3% - n=35) or administrative (56.7% - n= 46) staff members at a higher educational teaching institution in New Zealand. This institution currently employs a total of 350 staff members. A total of 14.8% (n=12) of the 81 staff members participating in this study were in either academic or administrative managerial positions, the remainder (n=69) were in general administrative positions and/or lecturing staff. Eighty (80.2%- n=65) percent of the group were females and 19.8% (n=16) were males. This study reports baseline data of an exercise/ lifestyle intervention study and subject numbers were dictated by amount required to obtain statistical power with intervention.

Health Status Questionnaires

All subjects completed two health-screening questionnaires after providing informed consent. Symptomatology of illness was measured through the Seriousness of Illness Rating Scale (IRS) (Wyler, Masuda & Holmes, 1967), a self-reported checklist of 126 commonly recognized physical and mental symptoms and diseases. In the development of this instrument by the Department of Psychiatry at the Washington University School of Medicine, a general severity weighting for each disorder was obtained by asking a large sample of physicians, interns, residents, and lay persons to rate each of them as to their relative seriousness. The ratings reflected prognosis, duration, threat to life, degree of disability, and degree of discomfort. A highly significant mean rank-order correlation (r=0.947) was found between the medical and the lay samples, and a system of weightings was accordingly constructed by essentially placing a list of 126 diseases in a hierarchical rank order from 1 to 126, with number 1 being the least troublesome or serious, and number 126 the one with the largest impact on health and well-being. This seriousness of illness rating scale has served as a frequent tool in stress and illness studies (Kobasa et al., 1981; Schroeder & Costa, 1984) and still reflects most of the common health problems that could potentially force people to use medication or visit a general practitioner. Modern diseases like fibromyalgia and chronic fatigue syndrome are not on the list but are covered by diseases/problems/ symptoms like tiredness, anxiety, nervousness, depression and a whole range of infectious problems. The questionnaire was used in this study to complement other measures of health in order to gain a concrete overall impression of general health.

Coronary risk was assessed using a Coronary risk index reflecting the 14 most common or typical risk factors for CAD. Fourteen risk factors namely a) age, b) family history, c) body weight, d) exercise, e) tobacco smoking, f) total cholesterol, g) systolic blood pressure (SBP), h) diastolic blood pressure (DBP), i) gender, j) perceived stress, k) cardiovascular disease symptoms, l) personal history of cardiovascular disease, m) diabetes mellitus and n) gout are included in this index utilising a Likert scale format based on levels of risk (Bjurstrom & Alexiou, 1978). For example, females younger than 45, would get a gender risk score of 1, those older than 45 would get a risk score of 2, while a male would get a risk score of 4, a bald male a score of 5 and a short bald stocky male a score of 7. The category score for each of the 14 risk factors are summed to get an overall risk score for each individual and the highest probable score that an individual can get with this Coronary risk index is 114 and the lowest possible score is 5.

Psychological Health

Psychological health was assessed by means of reliable questionnaires, validated by their respective designers, through the process of using random controlled samples and by correlating results with various other accepted and validated questionnaires measuring similar or opposite psychological constructs. The Perceived Stress Scale (PSS), (Cohen, Kamarck, & Mermelstein, 1983) was included as a measure of general life stress. The PSS measures the degree to which the subject perceives situations in her/his life as stressful. The PSS consists of 14 items referring to the general frequency of feelings or thoughts about stress during the past month. Items are rated on a 5 - point scale from "never" to "very often". The items are quite general in nature in order to assess a global level of perceived stress. Internal reliability has been shown to range from .84 to .86 across a variety of populations (Cohen et al., 1983). Emotional exhaustion was measured by the Psychological Burnout questionnaire (Pines, Aronson & Kafry, 1981) and Happiness, Well-being and Quality of Life by the Affectometer 2 (Kammann & Flett, 1983). Job Stress was determined by a questionnaire designed by Dua (1994), which specifically measures job stress in the academic environment.

Biochemical Measures

Fasting venous blood samples were taken in the week after which fitness testing was conducted. Total cholesterol (TC), Low density lipoprotein-cholesterol (LDL-C), High density lipoprotein-cholesterol (HDL-C), triglycerides, glucose and the total cholesterol/HDL-ratio (TC/HDL-ratio) were assessed using a registered biochemistry laboratory.

Physiological Variables

The physiological variables included height, weight, body composition, resting heart rate (RHR), and resting blood pressure (RBP). Body composition was obtained using the six skinfold procedure according to the guidelines of the International Society for the Advancement of Kinanthropometry (2001). Resting blood pressure was taken after subjects had been lying for 5 minutes in the supine position in a quiet room, and was repeated three times.

The lowest reading was recorded in cases where the three measures were within a 4 mmHg range. In cases where differences of larger than 4 mmHg were found the lower of the two measures that were within 4 mmHg from each other were used. Resting heart rate (RHR) was measured after the blood pressure readings, for a full minute with a stethoscope, and compared with the heart rate obtained with a polar heart rate monitor. This was repeated (if it didn't match 100%) by checking the polar monitor and recounting heart rate for a full minute until a 100% match was obtained. All measurements on every subject were completed by the same person. Pulse Pressure (SBP-DBP) and Mean Arterial Pressure [DBP+ (PP/3)] were mathematically calculated using systolic (SBP) and diastolic blood pressure (DBP).

Functional Capacity

Baseline physiological assessments of aerobic fitness were made using the YMCA cycle ergometer sub maximal test protocol (ACSM, 2010). The testing protocol was comprised of a 3-minute warm-up at 25 Watts followed by 3-minute stages with increments in power output, depending on the subject's heart rate and blood pressure exercise response. The aim was that each individual reached at least 70% of his/her age predicted maximum heart rate but blood pressure responses were used to determine symptom maximums on occasions where blood pressure responded poorly (systolic raising above 230 mmHg or diastolic increasing by more than 10 mmHg) during the exercise test. Heart rate was recorded every minute of each stage manually and with a heart rate monitor, while exercise blood pressure was manually recorded during the last minute of each stage. Karvonen's formula (ACSM, 2010) was used to determine 80% of maximum heart rate (220 - age - RHR x training percentage + RHR). The ACSM's (2010) guidelines were used for early termination of the test. The ACSM (2010) metabolic and multistage equations were utilized to calculate each individual's relative predicted VO_{2max}.

Procedure

Following ethics approval (Central Regional Ethics Committee, New Zealand) the project was advertised using the institutions website. A request was made for volunteers to join a health promotion and fitness training program run by the Department of Exercise and Sport Science. A total of 81 staff members out of 150 volunteers (from a possible cohort of 350 employees) were randomly selected for the study. The data in this study represent baseline data (prior to any lifestyle interventions). Although the population are a self-selected group it does provide valuable information regarding the health status of staff at a higher educational institution and on the interrelationships between baseline physiological, biochemical, cardiovascular, morphological and psychological variables. Staff were scheduled for one-hour appointments to perform the fitness test and complete the questionnaires starting on the first day of the week. The fitness testing was completed within 5 days (two stations testing nine people per day). Blood tests were taken between 07h00 and 09h00 on two consecutive week days (Tuesday and Wednesday) the week after the fitness test was conducted, utilising a roster system.

An independent t-test was used to assess for statistical differences between the two genders (male and female) with regard to the morphological, physiological, biochemical and psychological variables measured. Statistical analyses were also performed using correlations, stepwise multiple regression analysis and simple (one-way) analysis of variance (ANOVA). The Newman-Keuls post hoc test was used to determine intergroup differences. For the purpose of the ANOVA the respondents (male and females separately) were placed in fitness groups based on the VO_{2max} group distribution. Those with VO_{2max} scores above the 70th percentile of the respective gender group distribution curves were placed in the highly fit groups and those below the 30th percentile in the low fitness groups. The rest were classified as moderately fit. The exact VO_{2max} fitness grouping cut-off values for males and females can be found in Table 3 where the results of an ANOVA are reported.

Results

Independent T-test Comparing Gender Groups Regarding Morphological, Physiological, Biochemical and Psychological Profiles

Descriptive data (means and standard deviations) for male and female respondents are reported in Table 1.

Table 1. *Independent T-test Comparing Descriptive Data Of Male and Female Respondents*

	Males (n=25)		Females (n=56)		
Variables	Mean	SD	Mean	SD	P<
Age in years	40.4	6.01	42.9	10.9	N.S.
Heart rate in rest (RHR)	67.5	11.4	73.2	12.3	N.S.
Systolic blood Pressure (SBP)	131.5	11.6	126.3	10.9	N.S.
Diastolic blood pressure (DBP)	78.9	9.37	78.7	8.92	N.S.
Pulse pressure (PP)	52.6	13.3	47.7	9.36	N.S.
Mean arterial pressure (MAP)	96.5	7.98	94.6	8.56	N.S.
Percentage body fat	13.5	3.53	24.1	7.53	0.0001
Height in cm	178.2	6.21	164.8	6.48	0.0001
Body weight in kg (BW)	88.5	15.9	72.4	14.7	0.0001
Body mass index (BMI)	27.8	3.79	26.7	4.99	N.S.
Waist-to-hip ratio (WHR)	0.89	0.06	0.78	0.07	0.0001
VO_{2max} in ml.kg.min-1	35.5	6.8	28.8	7.04	0.0001
Physical work capacity$_{170}$ (PWC_{170})	2.43	0.56	1.94	0.59	0.0001
Physical activity index (PAI)	59.9	46.2	56.8	40.9	N.S.
Coronary risk index (CRI)	25.3	5.99	23.6	7.29	N.S.
Illness rating scale (IRS)	231.7	174.0	221.4	133.5	N.S.
Stress symptoms (SS)	11.9	8.68	13.2	7.62	N.S.
Job stress (JobS)	1.62	0.25	1.54	0.29	N.S.
Emotional exhaustion (EMB)	3.15	0.77	2.91	0.77	N.S.
Happiness and Quality of life	17.3	12.1	22.6	11.7	N.S.
Total cholesterol (TC)	5.42	0.89	4.95	0.98	0.05
Fasting glucose (GLU)	4.82	0.89	4.58	0.73	N.S.
Triglycerides (Trig)	1.57	0.81	1.09	0.44	0.001
HDL-cholesterol	1.44	0.36	1.75	0.43	0.01
LDL-cholesterol	3.26	0.79	2.69	0.82	0.01
TC/HDL-ratio	3.98	1.19	2.93	0.70	0.0001

Note: N.S. = Not statistically significant;
Statistical significance at $p<0.05$

Not surprisingly, statistically significant ($p\leq0.05$) differences were found between the gender groups with regard to percentage

body fat, height, body weight, waist-to-hip ratio, VO_{2max}, Physical work capacity$_{170}$[1], total cholesterol, Triglycerides (Trig), HDL-cholesterol, LDL-cholesterol and the TC/HDL-ratio.

Males and females both had mean BMI scores in the overweight category (BMI – 25.0-29.9) and Waist-to-Hip circumference ratio scores that could be classified as moderately high for the age group 40-49 according to the ASCM (2010). The mean percentage body fat values for both males and females were however within acceptable ranges (males 13% and females 24% body fat). Percentage body fat correlated significantly with body weight (r=0.75), BMI (r=0.76) and WHR (r=0.93).

The VO_{2max} (ml.kg.min^{-1}) scores of both groups indicated low levels of cardiorespiratory fitness according to normative data provided for the age groups 40-49 by the ACSM (2010). Females presented with borderline LDL-cholesterol levels (>2.60 mmol.l^{-1}) while males had elevated mean total cholesterol (>5.2 mmol.l^{-1}) and LDL-cholesterol (>2.60 mmol.l^{-1}) levels. Mean HDL-cholesterol level were lower for males and females than the optimal or desired level of 1.6 mmol.l^{-1} (ACSM, 2010).

No significant (p>0.05) differences were found between the two gender groups using the independent t-test, regarding their general physical and psychological health profiles. Males had an average emotional health score that can be classed as moderate burnout (Pines et al. 1981) while the females had a mean Happiness and Quality of life score that could be regarded as low according to normative information provided by Kammann and Flett (1983). The mean job stress scores can be regarded as medium (1.51-2.00) for both gender groups according to normative information provided by Dua (1994).

Staff at Risk Based on Classification Cut-offs

The percentage respondents with abnormal physical, biochemical and psychological profiles are presented in Table 2. Total cholesterol's cut-off to indicate high risk was set at >6.3 mmol.l^{-1}, HDL-cholesterol at <0.9 mmol.l^{-1}, LDL-cholesterol at >4.2 mmol.l^{-1} and triglycerides at >2.3 mmol.l^{-1} (ACSM, 2010).

Elevated total cholesterol (>6.3 mmol.l^{-1}) was prevalent in 8.64% (n=7) of the overall group, while 6.2% (n=5) presented with elevated triglyceride levels (>2.3 mmol.l^{-1}), and 18.52% (n=15) and 16.05% (n=13) with abnormal resting systolic and diastolic blood pressure values respectively (see Table 2). Nearly forty percent (39.5% or n= 32) of the respondents also had a functional capacity lower than 8 METS.

As indicated (Table 2), 48% (n=38) were categorised as unhappy and 36% (n=29) reported elevated levels of job stress. Further analysis indicate that only 21% (n=17) of the overall group were risk free, while 19% (n=15) exhibited two, and 30% (n=24) three or more physical, biochemical, morphological or psychological markers of risk. This indicates that a relatively large percentage of staff members at this tertiary institution, which volunteered for this study, may be at risk for CAD and/or exhibit psychological profiles that could compromise both general health and work performance.

Results of the ANOVA

Results of a simple (one-way) analysis of variance in which respondents were grouped into three (3) VO_{2max} groups and compared regarding morphological, biochemical, physiological and psychological markers of health and well-being are presented in Table 3.

Table 2. *Percentage Of Respondents With Elevated CAD Risk And Abnormal Psychological Health Profiles*

Risk factors	Total group (n=81)	Males (n=25)	Females (n=56)
Resting systolic blood pressure (>140 mmHg)	18.52%	28%	14.30%
Resting diastolic blood pressure (>90 mmHg)	16.05%	16%	16.07%
Percentage body fat (Male >16% & F >26%)	27.85%	20%	37.50%
BMI (Obesity class I, II and III)	25.90%	26%	26.76%
Waist-Hip ratio (Male >0.94 & Female>0.82)	23.61%	24%	23.21%
Functional capacity (< 8.0 Mets)	39.51%	20%	35.71%
Physically inactive	34.57%	32%	35.70%
Total cholesterol (> 6.3 mmol.l-1)	8.64%	12%	8.93%
Triglycerides (> 2.3 mmol.l-1)	6.20%	12%	1.79%
Glucose (> 6.0 mmol.l-1)	4.94%	4.0%	5.35%
HDL-cholesterol (< 0.9 mmol.l-1)	1.24%	4.0%	0.0%
LDL-cholesterol (> 4.2 mmol.l-1)	6.17%	28%	1.79%
TC/HDL-ratio (> 4.6)	8.64%	24%	1.78%
Unhappy (Negative effect < 24)	48.12%	60%	42.85%
Emotional exhaustion (Burnout scores > 4.0)	11.37%	12%	10.71%
Stress symptoms (>15)	32.10%	20%	42.85%
Job stress (>1.67)	36.03%	40%	34.00%

As indicated in this table, cardiovascular fitness, or VO_{2max}, showed statistically significant (p≤0.05) relationships with a large number of the dependent variables, with the high fitness groups presenting with the healthier profiles. Highly fit females presented with statistically significant (p≤0.05) lower resting heart rate F(2,53)=4.73, body weight F(2,53)=10.68, job stress F(2,53)=4.04, fasting glucose F(2,53)=4.79 and higher HDL-cholesterol F(2,53)=2.14 values. Male respondents differed significantly (p≤0.05) regarding stress symptoms F(2,22)=1.57 and emotional exhaustion F(2,22)=0.64 and in both males and females, the highly fit groups presented with more favourable (p≤0.05) percentage body fat, physical activity and coronary risk profiles (see F-values in table 3).

These results are consistent with the scientific literature, namely that both males and females with higher levels of cardiovascular fitness present with healthier morphological, biochemical and physiological profiles. The statistically significant relationships that cardiovascular fitness shows with psychological constructs like job stress (females), emotional exhaustion and stress symptoms (males) are interesting (though not entirely unexpected or out of line with what is generally reported) and justified further statistical investigation to explore the relative contribution of psychological well-being to morphological, biochemical and overall physical health.

Correlations of Psychological Constructs with Other Risk Factors

The correlations of the four psychological variables with the traditional morphological, biochemical and physiological cardiovascular risk factors as well as with measures of health are reported in Table 4. Stress symptoms, emotional exhaustion and

Table 3. *Cardiovascular Fitness (VO_{2max}) And Morphological, Biochemical, Physiological And Psychological Well-being As Determined With a One-way ANOVA*

		VO_{2max} groups							
		Low Fitness (L)		Moderate Fitness (M)		High Fitness (H)		F-value	Newman Keuls
		F <23.74 (n=16)		F =23.75-30.75(n=23)		F >30.76(n=16)		(2, 53)	post hoc p≤0.05
		M <31.25(n=7)		M =31.25-40.09(n=11)		M >40.10(n=7)		(2, 22)	
Variable	Group	Mean	SD	Mean	SD	Mean	SD		
Age	F	46.4	12.2	38.4	10.1	45.7	8.9	3.66	N.S.
	M	41.6	5.2	39.2	5.6	40.8	7.6	0.32	N.S.
RHR	F	76.3	11.5	76.3	13.6	66.0	7.8	4.73*	H from L & M
	M	74.1	12.6	66.7	10.4	62.6	9.9	2.13	N.S.
SBP	F	130.6	9.7	125.7	11.9	123.2	9.8	2.04	N.S.
	M	135.4	10.1	133.0	12.6	126.3	10.7	1.35	N.S.
DBP	F	81.8	10.3	78.3	7.5	76.2	8.9	1.67	N.S.
	M	83.4	9.1	75.8	9.9	79.0	8.1	1.41	N.S.
Pulse Pressure	F	48.9	9.1	47.3	10.6	47.1	8.3	0.18	N.S.
	M	52.0	12.6	57.2	14.0	47.3	12.3	1.28	N.S.
Body Fat (%)	F	27.3	6.4	26.4	7.9	18.1	3.9	10.68*	H from L & M
	M	14.1	2.9	15.4	3.4	10.8	2.6	9.21*	H from L & M
Body Weight	F	77.8	16.0	76.0	15.2	62.4	5.3	8.90*	H from L & M
	M	91.7	11.8	93.3	20.8	79.9	8.4	1.90	N.S.
PAI	F	32.6	27.7	53.7	36.9	83.6	42.2	8.27*	H from L & M
	M	16.3	23.1	67.2	48.4	89.1	29.6	7.46*	L from M & H
CRI	F	28.3	7.4	22.8	6.9	20.4	5.7	5.93*	L from M & H
	M	29.1	2.5	27.0	5.8	19.9	4.8	8.16*	H from L & M
IRS	F	237.3	107.1	233.0	162.6	190.6	112.2	0.65	N.S.
	M	279.3	252.2	223.9	106.7	199.9	176.4	0.38	N.S.
Stress Symptoms	F	13.4	8.7	13.0	7.0	13.4	7.8	0.02	N.S.
	M	16.4	6.8	11.4	5.1	8.8	3.8	1.57*	H from L & M
Job Stress	F	1.40	0.21	1.55	0.28	1.64	0.35	3.04*	H from L
	M	1.60	0.35	1.56	0.20	1.69	0.23	0.53	N.S.
Emotional Exhaustion	F	3.02	.072	2.78	0.65	2.97	0.96	0.52	N.S.
	M	3.38	0.58	3.18	0.56	2.93	0.54	0.64*	H from L
Happiness	F	21.2	10.0	24.8	10.2	20.8	10.7	0.73	N.S.
	M	15.8	10.5	18.2	12.5	17.6	9.5	0.09	N.S.
TC	F	4.79	0.68	4.91	0.82	5.14	1.36	0.54	N.S.
	M	5.78	1.10	5.46	0.71	5.04	0.77	1.44	N.S.
Fasting Glucose	F	5.01	1.08	4.45	0.51	4.33	0.31	4.79*	L from M & H
	M	4.65	0.38	5.22	1.24	4.46	0.38	1.95	N.S.
Trig	F	1.90	0.38	1.12	0.36	1.08	0.59	0.05	N.S.
	M	1.64	0.78	1.65	1.09	1.42	0.42	0.19	N.S.
LDL-C	F	2.64	0.57	2.71	0.73	2.73	1.14	0.04	N.S.
	M	3.63	0.95	3.14	0.70	3.07	0.72	1.15	N.S.
HDL-C	F	1.65	0.38	1.69	0.34	1.93	0.35	2.14*	L from H
	M	1.34	0.32	1.40	0.48	1.56	0.13	1.03	N.S.
TC/HDL-Ratio	F	3.02	0.69	2.98	0.65	2.78	0.79	0.57	N.S.
	M	4.31	0.72	3.88	0.74	3.84	0.76	0.35	N.S.

Note: F=female; N.S.=not statistically significant; M=male; L=low fitness; M=moderate fitness; H=high fitness; *=p≤0.05

the Affectometer2 (happiness and quality of life) had a significant negative correlation ($p \leq 0.05$) with the coronary risk index and the illness rating scale.

Table 4. *Correlation Of The Four (4) Psychological Measures With Markers Of Morphological, Biochemical And Physiological Health*

	Psychological variables			
Health variables	Job stress	Stress symptoms	Emotional exhaustion	Happiness quality of life
Age in years	-0.05	-0.03	0.09	-0.01
Heart rate in rest (RHR)	0.10	0.15	0.16	-0.13
Systolic blood Pressure (SBP)	0.04	0.02	0.18	-0.16
Diastolic blood pressure (DBP)	0.08	0.06	0.14	-0.07
Pulse pressure (PP)	0.11	0.03	0.07	-0.10
Mean arterial pressure (MAP)	0.04	0.06	0.18	-0.12
Percentage body fat	0.19	0.05	0.05	-0.12
Body weight in kg (BW)	0.02	0.04	0.14	-0.12
Body mass index (BMI)	-0.08	-0.05	0.10	-0.08
Waist-to-hip ratio (WHR)	-0.09	-0.03	0.20	-0.25*
VO_{2max} in ml.kg.min-1	-0.31*	-0.17	-0.10	0.12
Physical work capacity$_{170}$	-0.30*	-0.16	-0.07	0.12
Physical activity index (PAI)	-0.19	-0.12	-0.15	0.09
Coronary risk index (CRI)	0.17	0.29*	0.42*	-0.26*
Illness rating scale (IRS)	0.10	0.54*	0.42*	-0.32*
Total cholesterol (TC)	0.14	0.16	0.13	-0.04
Fasting glucose (GLU)	-0.06	-0.05	0.13	-0.16
Triglycerides (Trig)	0.14	0.15	0.01	-0.02
HDL-cholesterol	-0.06	-0.07	-0.10	0.17
LDL-cholesterol	0.09	0.09	0.09	-0.03
TC/HDL-ratio	0.09	0.08	0.12	-0.11

Note: *= $p \leq 0.05$

Results of the Stepwise Multiple Regression Analysis

In order to obtain more specific information on the relative importance of the psychological variables with regard to overall health, the contribution of all morphological, biochemical and physiological risk factors and the four psychological variables to the variance of the coronary risk index and the illness rating scale was studied using a stepwise multiple regression analysis. The results of this analysis are reported in Table 5.

A total of 22 factors, including the four psychological measures (emotional exhaustion, job stress, stress symptoms and happiness and quality of life), were used in this stepwise multiple regression analysis (Table 5).

Ten of the 22 variables were listed as contributors (the contribution of the rest of the variables were very low and as such are not listed), and their combined contribution to the variance of the two health status measures (coronary risk index and the illness rating scale) was 61.4%. Body mass index (24.9%), emotional burnout (15.6%), glucose (6.3%), physical activity (4.8%) and the TC/HDL ratio (2.3%) were the only statistically significant ($p \leq 0.05$) contributors. All four of the psychological measures contributed to the variance of overall health. Emotional exhaustion was, however, the only psychological variables which contributed statistically significantly ($p \leq 0.05$) to the variance of the two health status measures.

Table 5. *Contribution Of Risk Factors To The Variance Of Overall Coronary Risk And Health Status Of Staff Members At a Tertiary Institution*

Contributing variables	R	R^2	R^2-change	F-value
Body Mass Index (BMI)	0.499630	0.249631	0.249631	26.28*
Emotional exhaustion	0.636654	0.405328	0.155697	20.42*
Glucose	0.684506	0.468548	0.063221	9.159*
Physical activity Index	0.718741	0.516589	0.048040	7.553*
Happiness	0.734081	0.538875	0.022286	3.625
Job Stress	0.747183	0.558283	0.019409	3.251
TC/HDL-ratio	0.762848	0.581936	0.023653	4.130*
Stress symptoms	0.772049	0.596059	0.014123	2.517
Systolic blood pressure	0.779226	0.607194	0.01135	2.013
Resting Heart rate	0.783778	0.614308	0.007114	0.259

Note: *= $p \leq 0.05$

In order to determine if level of fitness would influence the contribution of the psychological variables to general health, their contribution to the two health status variables (Coronary risk index and illness rating scale) were studied in individuals grouped as low, moderate and highly fit.

As indicated in Table 6, emotional exhaustion was the primary contributor to the variance of the coronary risk index and illness rating scale in the stepwise multiple regression analysis performed on females. This was the case in all three of the fitness groups. The overall contribution of the psychological constructs to the variance of the health status (coronary risk index and illness rating scale) increased from 23.47% in the low fitness group to 54.32% in the moderate fitness group, but decreased to 24.04% in the high fitness group. In the moderately fit group, stress symptoms (18.1%) were also a statistically significant contributor ($p \leq 0.05$) to the variance of overall health.

Table 6. *Contribution Of Various Psychological Variables To The Variance Of Overall Coronary Risk And Health Status Of Females With Low, Moderate And High Levels Of Cardiovascular Fitness*

Fitness grouping	Contributing variables	R	R^2	R^2-change	F-value
Low fit (VO_{2max} <23.74)	Emotional exhaustion	0.4694	0.2123	0.2123	10.24*
	Happiness	0.4845	0.2347	0.0224	1.083
Moderate fit (VO_{2max} =23.74-30.75)	Emotional exhaustion	0.5648	0.3190	0.3190	14.52*
	Job Stress	0.7069	0.4998	0.1808	10.84*
	Stress symptoms	0.7370	0.5432	0.0434	2.756
High fit (VO_{2max} >30.75)	Emotional exhaustion	0.4570	0.2089	0.2603	9.769*
	Job Stress	0.4902	0.2404	0.0315	1.493

Note *= $p \leq 0.05$.

In males, job stress was the only statistically significant ($p \leq 0.05$) contributor, and only in those respondents classified as moderately

fit (Table 7). The psychological variables made no contribution to the variance of health in the low fitness group, while job stress and stress symptoms contributed 22.9% ($p>0.05$) to the variance of health as measured with the coronary risk index and the Illness rating scale, in the high fitness group.

Table 7. *Contribution Of Various Psychological Variables To The Variance Of Overall Coronary Risk And Health Status Of Males With Low, Moderate And High Levels Of Cardiovascular Fitness*

Fitness grouping	Contributing variables	R	R^2	R^2-change	F-value
Low fit (VO_{2max} <31.25)	No contribution				
Moderate fit (VO_{2max} =31.25-40.09)	Stress symptoms	0.4163	0.4163	0.1733	2.725
	Job Stress	0.7537	0.5860	0.3947	10.96*
	Emotional exhaustion	0.8213	0.6745	0.1065	3.599
High fit (VO_{2max} >40.09)	Job Stress	0.3618	0.1309	0.1309	2.259
	Stress symptoms	0.4791	0.2295	0.0986	1.792

Note *= $p \leq 0.05$.

Measures of psychological health seem to be as potent a marker/predictor of health in fit and in unfit individuals. The results of these analyses therefore indicate that the level of fitness does not seem to negate the contribution of psychological health to overall health, as measured with a coronary risk index and the illness rating scale.

Discussion

There is now overwhelming evidence in the scientific literature attesting to what many academics have believed for years: academia is a highly stressful occupation. The work environment has been implicated in various studies as a causal factor of impaired work performance, decrease in faculty productivity, increase in absenteeism, propensity to leave, and higher staff turnover (Kinman, 2001; Taris et al., 2001). The effect of a stressful work environment on health and well-being is also well established (Lovallo & Gerrin, 2003; Nicholson et al. 2005) but very few studies have investigated the impact (or relationship) of psychological health variables on markers of morphological, biochemical and physiological health in academia.

Psychological health among academics is, generally speaking, relatively poor (Kinman, 2001). Academics in Gillespie et al.'s (2001) study reported feelings of anxiety, depression, burnout, anger, irritability and helplessness as a direct consequence of perceived work related stress. The link between psychological exhaustion/burnout, depression and suicidal tendencies has been well established and indications of an epidemiological study on the contribution of occupation and geography to suicide death in England and Wales conducted by Kelly, Charlton, and Jenkins (1995) are that academics are at 50 percent greater risk than the average worker to commit suicide as a direct consequence of work environment related distress. A survey carried out for the UK-based Association of University Teachers (AUT, 2003) found that 93% of its members (representing almost 160,000 academic staff) suffered from work-related stress and 62% from 'excessive' strain, while approximately 27% reported 'fairly seriously' considering a career change, 46% said their morale had worsened in the past two years, 72% were dissatisfied with pay and 86% felt their workload was too heavy (Smithers, 2003). The above-mentioned survey results are matched by other international studies (Barkhuizen & Rothman, 2008; Forlin, 2001; Gillespie et al., 2001; Kinman, 2001; Winefield et al., 2003; Winter & Sarros, 2002). Psychological stress now appears to be a feature of occupational life of university staff (Fisher, 1994) and working during evenings and weekends is commonplace (Kinman, 1998).

In this study 48% of the respondents were unhappy as measured by the Affectometer2 (Kammann & Flett, 1983). The Affectometer2 consists of 20 items concerning the subject's present life situation. Each item is rated on a 5 - point scale of agreement/disagreement regarding questions like "my life is on the right track, my future looks good, I like myself, I have energy to spare" and so forth. A lower score reflects a more negative orientation and less satisfaction with life. In terms of whether a person has, in general, a negative or positive orientation towards life, these questions are as applicable today as when the questionnaire was developed. People seem to be less happy today than after the second world war (Persaud, 1998) but it is debatable whether normative scores established by Kamannn and Flett, 26 years ago, and calibrated using the academic gravitated population of Dunedin (same country and same type of population used in this study) should be rejected based on the fact that the normative scores are 26 years old. The focus of the present study is more on the impact of psychological distress on other measures of health and according to this data about half of the staff participating in this project were in general fairly unhappy, while 32% exhibited a high amount of stress symptoms and 36% presented with job stress. The implication is that this study population provided enough participants with psychological distress to examine the relationships of the psychological constructs with other measures of health.

Our study suggests that relatively large numbers of staff at this tertiary institution may be at risk of cardiovascular disease, and that a relationship seems to exist between constructs of psychological health and markers of morphological, biochemical and physiological health. Firstly, regarding relative risk for cardiovascular disease, our results indicate that if optimal or desirable levels were to be considered, 40.7% of volunteering staff presented with total cholesterol values above the desirable level of <5.2 $mmol.l^{-1}$ and 19.8% of the overall group presented with triglyceride levels (>1.7 $mmol.l^{-1}$) that could be regarded as being high. In addition, 50.6% presented with abnormal HDL-cholesterol (<1.6 $mmol.l^{-1}$) and 61.7% with higher than desirable LDL-cholesterol (>2.6 $mmol.l^{-1}$) levels.

In a study by Meyers, Prakash, Froelicher, Partington and Atwood (2002) it was reported that in both healthy and cardiovascular disease subjects, the peak exercise capacity achieved was a stronger predictor of overall mortality than hypertension, smoking, diabetes, obesity, development of arrhythmias during exercise, or elevated total cholesterol level. The mortality risk from any cause in participants whose exercise capacity was less than 5 METS was roughly double that of subjects whose exercise capacity was more than 8 METS. In this study 39.51% of the respondents had a functional capacity lower than 8 METS and 2.47% had a functional

capacity lower than 5 METS.

Secondly, concerning the interrelationship between the physical, biochemical and psychological measures it is evident that the level of cardiovascular fitness does not negate or weaken the contribution of the psychological constructs to overall health.

Lastly, the psychological constructs correlated negatively with physical activity and VO_{2max}. For example job stress, stress symptoms and emotional burnout showed correlations of r = -0.31, r = -0.17 and r = -0.10 with VO_{2max} and correlations of r = -0.19, r = -012 and r = -0.15 with participation in physical activity. This indicates that psychological health can impact in an indirect manner on health through its negative effect on lifestyle and exercise habits. It seems therefore that the work environment impacts negatively on cardiovascular and overall health in both a direct and indirect manner. The results of this study support the need for intervention for these lecturers and administrators, especially in areas of stress management and mental health.

Conclusions

1. High percentages of staff presented with risk factors for CAD as well as with unfavourable psychological profiles.
2. Female staff members did not exhibit more psychological distress and/or worse levels of biochemical and overall health than their male counterparts. As can be expected females do present with lower levels of cardiovascular fitness and higher morphological measurements (percentage body fat and waist-to-hip ratio's). Normatively speaking, both the male and female BMI and waist-to-hip ratio averages in this study can be regarded as moderately high.
3. Reported emotional exhaustion seems to be a significant contributor to the variance of health in both males and females at this tertiary institution.
4. The level of cardiovascular fitness improves overall health status but does not negate the relationship of emotional exhaustion with health. The overall contribution of the psychological constructs to the variance of health status stayed the same or increased in male and female respondents classified as respectively low, moderately or highly fit.

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[1] The physical work capacity$_{170}$ is an expression of maximum exercise capacity in watts divided by body weight at 170 beats per minute. It is obtained by explorating HR responses during the three stages of the YMCA Cycle Ergometer test to 170 beats per minute ■