Happiness and physical health: Associations with cardiovascular disease risk factors

Mutluluk ve beden sağlığı: Kalp damar hastalığı risk faktörleriyle olan ilişkiler

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Abstract

Evidence suggests that being significantly unhappy is associated with negative cardiac outcomes and that positive affect is beneficial to health. The aim of this study was to examine the relationships between happiness and the individual risk factors for cardiovascular disease (CVD) in otherwise healthy working adults. Participants were recruited from one workplace in Auckland, New Zealand and completed a CVD risk assessment and demographic, nutrition and physical activity, and Authentic Happiness Inventory (AHI) questionnaires. One-way ANOVAs were performed to identify whether any significant differences existed in AHI scores by demographic and health variables. Bivariable linear regression was used to investigate the relationship between potential predictor variables and AHI classification (low or high). Variables associated with AHI classification at $p < 0.20$ were then examined simultaneously in multivariable logistic regression. After elimination of all non-significant factors in the multivariable logistic regression, only smoking status remained negatively associated with AHI score ($p = 0.016$). Despite the fact that many smokers report that smoking makes them happy, smoking was negatively associated with happiness in this sample. This finding may be implemented in smoking cessation and CVD interventions and health promotion initiatives.

Keywords: Positive psychology, public health, smoking, health behaviours

Özet

Bulgulara göre, çok mutsuz olmak olumsuz kardiyak sonuçlara neden olurken olumlu duygunun sağlık açısından birçok faydası bulunmaktadır. Bu çalışmanın amacı mutluluk ile başka bir hastalığı bulunmayan çalışan yetişkinlerin kalp damar hastalığı (KDH) bireysel risk faktörleri arasındaki ilişkiyi incelemektir. Katılımcılar Yeni Zelanda'nın Auckland şehrindeki bir iş yerinden seçilmiş ve KDH risk değerlendirme, demografik bilgi, beslenme alışkanlıkları ve fiziksel aktivite anketlerini ve Otantik Mutluluk Envanterini (OME) doldurmuşlardır. ÖME puanlarında demografik değişkenlere ve sağlık değişkenlerine göre anlamlı bir farklılığın olup olmadığını belirlemek için tek yönlü ANOVA işlemleri gerçekleştirilmiştir. Çift değişkenli lineer regresyon potansiyel yordayıcı değişkenleriyle ÖME kategorileri (düşük veya yüksek) arasındaki ilişkiyi incelemek için kullanılmıştır. OME kategorileri ile $p < 0.20$ değerinde ilişkili bulunan değişkenler eş zamanlı olarak çok değişkenli lojistik regresyon ile incelenmiştir. Çok değişkenli lojistik regresyondaki anlamsız faktörlerin hepsi çıkarıldıktan sonra sadece sigara içme durumu OME puanları ile olumsuz ilişkiye sahip olma durumunu korumuştur ($p = 0.016$). Her ne kadar sigara kullanan pek çok kişi sigara içmenin kendilerini mutlu ettiğini belirtse de, sigara içmenin bu örneklemde mutlulukla olumsuz ilişkisi olduğu tespit edilmiştir. Bu bulgulardan sigara bırakma çalışmalarında, KDH müdahalelerinde ve sağlığın geliştirilmesine yönelik girişimlerde faydalanılabilir.

Anahtar Kelimeler: Pozitif psikoloji, halk sağlığı, sigara içme, sağlık davranışları

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Introduction

Cardiovascular diseases (CVD) are responsible for nearly one-third of deaths internationally (World Health Organization, 2013), and are predicted to be the leading cause of death worldwide by 2030 (World Health Organization, 2008). Comprising diseases of the heart and blood vessels, CVDs include cerebrovascular disease, coronary heart disease, and peripheral arterial disease. Modifiable risk factors for CVDs include smoking, physical inactivity, unhealthy diet, obesity, raised lipids, and high blood pressure. In particular, there is now a wealth of evidence to show the benefits of physical activity in reducing CVD risk both directly and via reduced obesity and improved lipid and blood pressure profiles (Brach, Simonsick, Kritchevsky, Yaffe, & Newman, 2004; Paffenbarger, Hyde, Wing, & Hsieh, 1986; Warburton, Nicol, & Bredin, 2006; Wessel et al., 2004). A clear relationship also exists between physical activity and mental health and emotional well-being (Biddle & Mutrie, 2001; Fox, 1999; Hamer, Stamatakis, & Steptoe, 2008; Stephens, 1988).

It is possible that these aspects of positive psychology are also linked with reduced CVD risk, however to date exploration of this relationship has remained limited to broad investigations of associations with CVD presence or events. For example, Giltay, Gelejnse, Zitman, Hoekstra and Schouten (2004) reported that having high optimism was associated with a significantly lower odds ratio (0.23) for CVD death. Similarly a positive correlation was found between high levels of optimism and increased protection against cardiovascular events (Kubzansky, Sparrow, Vokonas, & Kawachi, 2001). Kubzansky and Thurston (2007) found a strong positive relationship between emotional vitality and lack of CVD. More recently, Richman, Kubzansky, Masello, Ackerson and Bauer (2009) found that mental vitality was associated with reduced odds of cardiovascular outcomes.

Overall, evidence suggests that a relationship exists between happiness and CVD outcomes (Wulsin & Singal, 2003), however there is limited information on relationships between specific CVD risk factors and happiness. By gaining a more detailed understanding of relationships between happiness and health behaviours and outcomes, researchers and practitioners can identify factors for intervention and promotion of positive health. The aim of this study was to examine the relationships between happiness and the individual risk factors for CVD in otherwise healthy working adults. For the purposes of the current study, the definition of physical health was delimited to key risk factors for CVD (sex, age, systolic blood pressure (SBP), smoking status, total cholesterol, high density lipoprotein (HDL) cholesterol, and diabetes status).

Methods

Participants and procedures

A convenience sample of participants was recruited from one workplace based in Auckland, New Zealand. The workplace was a 'blue collar' workplace, with the primary business of producing biscuits and confectionery. The organization was undertaking a workplace intervention promoting and supporting healthy lifestyles. The data presented here are from the baseline assessment of this intervention study; results of the intervention are yet to be published. All employees from the workplace were invited to participate. To be eligible participants were required to be aged 20 years or older and either part time or full time employees of the workplace. A team of health professionals and researchers visited the workplace and each participant underwent a CVD risk assessment and answered three questionnaires: The AHI, a physical activity and nutrition patterns questionnaire, and a demographic survey. Data were collected between 03 May and 14 May 2010. Informed consent was gained from all participants and ethical approval was granted by the host institution ethics committee.

Measures

Self Report Measures

The Authentic Happiness Inventory (AHI) was used as a measure of overall happiness (Seligman, Steen, Park, & Peterson, 2005). Compared with earlier measures of happiness (Fordyce, 1988; Lyubomirsky & Lepper, 1999), the AHI offers a tool to measure current state happiness with the ability to capture changes in happiness, rather than being a global or general trait measure of happiness. Consequently, for the purposes of the current study, happiness is defined as encompassing positive emotion, engagement, and meaning, in keeping with Seligman's original authentic happiness theory (Seligman et al., 2005), and as assessed by the AHI. The AHI comprises 24 questions to which there is a group of 5 statements as possible answers. Participants are asked to tick the one statement in each group which best describes the way they have been feeling in the past week, including the day of completing the questionnaire. Scores are coded on a scale of 1 to 5, with 5 indicating greater happiness levels (e.g., 1 = my life does not have any purpose or meaning, 5 = I have a very clear idea about the purpose or meaning of my life; 1 = I am pessimistic about the future, 5 = I feel extraordinarily optimistic about the future). No items are reverse scored. Participant's scores are summed and averaged to provide an overall happiness score. We have previously established the convergent validity ($r = 0.76$, $p < 0.005$ with the Satisfaction With Life Scale; $r = 0.82$, $p < 0.005$ with the Positive and Negative Affect Scale – positive), test-retest reliability (ICC = 0.92, $p < 0.001$), and internal consistency (Chronbach alpha coefficient of 0.92 for the overall happiness score) of the AHI in this sample (Shepherd, Oliver, & Schofield, in press).

Demographic Information Form: Participants completed a brief demographic survey to identify sex, age, ethnicity and smoking status. Ethnicity was classified using Statistics New Zealand classifications (Statistics New Zealand, 2005). Smoking status was classified as non-smoking or smoking.

Physical activity and nutrition patterns: An omnibus questionnaire was used to assess health status and risk behaviors. The physical activity component comprised the New Zealand Physical Activity Questionnaire Short Form (NZPAQ-SF) (McLean & Tobias, 2004). The NZPAQ-SF is a modified version of the International Physical Activity Questionnaire Short Form (IPAQ-SF), a valid and reliable self-report instrument developed in 2003 (Craig et al., 2003). The NZPAQ-SF has been shown to be acceptable for measuring population level physical activity prevalence in the New Zealand population, however no psychometric properties have been reported (McLean & Tobias, 2004). Physical activity was assessed using the following item: "Thinking about all your activities over the last 7 days (including brisk walking), on how many days did you engage in at least 30 minutes of moderate activity that made you breathe a little harder than normal OR at least 15 minutes of vigorous activity that made you breathe a lot harder than normal?" Responses were categorized as sedentary (0 days), insufficiently active (1-4 days) and sufficiently active (5-7 days) in line with current New Zealand recommendations for physical activity (Hillary Commission). Sedentary behavior was assessed using the IPAQ-SF item "What do you estimate is the total time that you spend sitting during an average day?" Item responses were categorised into 0-2 hours, 3-4 hours, 5-6 hours or more than 6 hours." The nutrition component was drawn from the 2006/07 New Zealand Health Survey that relate to dietary behaviours (Ministry of Health, 2006), for which test-retest reliability had been previously established (Parnell, Wilson, & Russell, 2001). For the purposes of the current study, one item was examined, being: "Last week, on how many days did you have something to eat for breakfast?"

Physical Measures

Body Mass Index: Height was measured by stadiometer and weight was obtained using calibrated digital scales (Seca, Hamburg, Germany). Body Mass Index (BMI) was then calculated as weight in kilograms / height in meters^2. BMI data was categorised into normal, overweight and obese using WHO BMI thresholds (World Health Organization, 2004) and also taking into account differing ethnicity based BMI thresholds for Māori, Pacific Island and Indian Asian adults (Rush, Freitas, & Plank, 2009).

Waist circumference: Waist circumference was taken midway between the inferior margin of the last rib and the crest of the ilium in a horizontal zone and was measured to the nearest 0.1 cm. Sex-specific thresholds were used to define waist circumference as low/normal or high (> 80 cm for women; > 94 cm for men) as per WHO international classifications (World Health Organization, 2000).

Cholesterol: Using the Cholestech LDX, a blood sample enabled testing of total cholesterol, HDL and LDL cholesterol levels. For this study total cholesterol, HDL and LDL cholesterol levels were examined as separate variables. Thresholds used to classify high total cholesterol, HDL, and LDL were 5.0 mmol/L, 1.0 mmol/L, and 3.0 mmol/L, respectively.

The accuracy and precision of the Cholesterol LDX is highly comparable (between 2% and 6%) to a lipid profile obtained in clinical diagnostic laboratories (Alere, 2011).

Blood Pressure: After at least 5 minutes of sitting, blood pressure was measured in the right arm using a digital sphygmomanometer (Omron IA2, Vernon, USA). If a reading of systolic BP $\geq$ 140mmHg and/or diastolic $\geq$ 90mmHg was found, the procedure was repeated at the end of the physical assessment and the second measure was used. For this study systolic and diastolic blood pressure were examined as separate variables. They were categorised as low/normal being <143mmHg systolic and <89mmHg diastolic and high being >144mmHg systolic and >90mmHg diastolic in line with current international guidelines (World Health Organization, 1999).

CVD Risk : Overall CVD risk was calculated using the PREDICT workplace tool (Enigma, 2009). This tool uses the New Zealand Guidelines for CVD-Diabetes (New Zealand Guidelines Group, 2003) and the Framingham equation (Anderson, Odell, Wilson, & Kannel, 1991) to calculate an index of the risk for developing CVD. Variables included in the equation are sex, age, SBP (mmHg), smoking status (smoking or non-smoking), total cholesterol, HDL cholesterol and diabetes status (type 1 or 2 or no diabetes) For this study the CVD risk factor score was categorised into low (0-10) or medium/high (>10).

Statistical Analyses

Descriptive statistics were calculated to determine the mean and standard deviation of the AHI sum by differing individual demographic and health variables. Pearson correlations were calculated between the AHI sum and each demographic and health variable. One-way analyses of variance (ANOVAs) were performed to identify whether any significant differences existed in AHI scores by demographic and health variables. Bivariable linear regression was used to investigate the relationship between potential predictor variables and AHI classification (low or high). Variables associated with AHI classification at $p < 0.20$ were then examined simultaneously in multivariable logistic regression (Sun, Shook, & Kay, 1996). Non-significant factors ($p > 0.05$) were then removed from the multivariable regression in a stepwise fashion until all remaining variable/s in the multivariable model were

significant ($p < 0.05$) (Sun et al., 1996). All data analyses were conducted using SPSS 17.0 software and confidence intervals were set at 95%.

Results

Of the 222 participants in the Brief Interventions sample, 27 participants did not complete the three questionnaires or the cardiovascular risk assessment, leaving a final sample of 195 participants (60% male). Of the full sample the mean age of participants was 39.8 years (SD 9.71) with a range of 20-63 years old. The mean AHI sum score was 79.46 (SD 11.76) with a range of 48-115. Full demographic information for participants included in analyses is provided in Table 1. A majority were non-smokers (76.6%), and 41.0% were classified as obese.

Pearson correlations performed on all individual demographic and health variables showed no meaningful relationships between variables. Table 1 shows the ANOVA results for all variables where a $p < 0.05$ was found. Post hoc testing was performed for ethnicity using the Tukey HSD test to identify significant differences between specific ethnic groups. Results showed Māori and Asian Indians were statistically significantly different in terms of happiness ($p = 0.022$) with Asian/Indians reporting a higher level of happiness (mean (SD) AHI score of 79.59 (11.61) compared with 75.77 (11.53)), albeit the magnitude of this difference was small (Eta = 0.050) (Cohen, 1977). Eta values for total cholesterol and LDL cholesterol also indicated small effects, at 0.040 and 0.027, respectively (Cohen, 1977). Post hoc analyses showed that with α=0.05, and 2-4 groups per variable, we had between 83-93% power to detect a medium effect (0.25) between groups (Cohen, 1977).

Table 1: *Descriptive information for demographic and health variables, along with ANOVA results for associations with AHI score (n = 195)*

Variable	AHI Sum *n* (%)	Mean (*SD*)	*F*-statistic	*p*-value
Sex			0.831	0.363
Male	78 (40)	80.40 (11.28)		
Female	117 (60)	78.82 (12.07)		
Age range			0.373	0.773
< 30	38 (19.5)	77.92 (11.64)		
31-40	64 (32.8)	79.53 (13.52)		
41-50	67 (34.4)	80.42 (10.32)		
> 50	26 (13.3)	79.04 (11.77)		
Ethnicity			3.335	0.021
European/NZ	60 (31.7)	79.00 (11.95)		
Māori	26 (13.8)	75.77 (11.53)		
Pacific Island	58 (30.7)	78.57 (11.83)		
Indian/Asian	45 (23.8)	79.59 (11.61)		
BMI range			2.423	0.091
Normal	42 (22.1)	76.02 (12.76)		
Overweight	72 (36.9)	80.71 (10.59)		
Obese	80 (41.0)	80.18 (12.00)		
Smoking status			3.517	0.062
Non-smoker	144 (76.6)	80.27 (10.88)		

Smoker	44 (23.4)	76.45 (12.24)		
Waist Circumference			0.000	0.062
Low/normal	67 (34.4)	79.46 (10.88)		
High	128 (65.6)	79.45 (12.24)		
CVD risk factor score			0.055	0.815
Low	138 (87.0)	79.46 (11.71)		
Medium/high	39 (22.0)	79.74 (12.53)		
Sitting time			1.466	0.225
0-2 hours	38 (19.5)	82.29 (11.96)		
3-4 hours	73 (37.4)	77.51 (13.02)		
5-6 hours	34 (17.5)	79.50 (11.30)		
> 6 hours	50 (25.6)	80.12 (9.62)		
Breakfast			2.842	0.061
Never	11 (5.6)	71.82 (9.74)		
1-4 times/week	53 (27.3)	78.62 (13.09)		
5 + times/week	130 (67.1)	80.26 (11.02)		
Physical activity			1.609	0.203
Sedentary	96 (49.2)	78.14 (13.02)		
Insufficiently active	67 (34.4)	80.00 (10.36)		
Sufficiently active	32 (16.4)	82.28 (10.19)		
Total cholesterol			8.232	0.005
Normal	135 (69.2)	77.87 (12.06)		
High	60 (30.8)	83.02 (10.19)		
High density lipoprotein			0.039	0.844
Normal	107 (54.8)	79.61 (11.74)		
Low	88 (45.2)	79.27 (12.15)		
Low density lipoprotein			5.006	0.027
Normal	111 (62.4)	77.96 (11.22)		
High	67 (37.6)	81.97 (12.15)		
Systolic blood pressure			0.449	0.504
Low/normal	136 (70.1)	79.99 (11.26)		
High	58 (29.9)	78.76 (12.46)		
Diastolic blood pressure			0.030	0.863
Low/normal	118 (60.8)	79.73 (11.33)		
High	76 (39.2)	79.43 (12.06)		

Key: ANOVA = one way analysis of variance; AHI = Authentic Happiness Inventory; BMI = body mass index; CVD = cardiovascular disease; n = number; SD = standard deviation.

Because of the relative homogeneity in AHI scores, participants were classified into tertiles by AHI scores (low, medium, high), and only those in the highest and lowest tertiles included in further analyses (n = 130). Bivariable logistic regression was conducted on the six variables with p-values less than 0.20 from the ANOVA results in Table 1. Five of these variables retained p-values of less than 0.20 in bivariable logistic regression (Table 2) as follows: ethnicity (p = 0.105), smoking status (p = 0.016), breakfast (p = 0.129), total cholesterol (p = 0.024), LDL cholesterol (p = 0.103). Multivariable logistic regression was conducted on these five variables. LDL cholesterol was removed as the highest p-value (p = 0.723) and the multivariable logistic regression was repeated with remaining factors. This

process was repeated, with factors removed in the following order: ethnicity (p = 0.374), breakfast (p = 0.372) total cholesterol (p = 0.058). Smoking status was the only significant variable remaining (p = 0.016).

Table 2. *Bivariable logistic regression in tertiles (n = 130)*

Variable	*n*	Mean (*SD*)	Odds Ratio	(95% *CI*)	*p*-value
Ethnicity					
European/NZ	41	0.488 (0.506)	reference		0.105
Māori	18	0.333 (0.485)	0.525	(0.165, 1.667)	
Pacific Island	39	0.462 (0.505)	0.900	(0.374, 2.166)	
Indian/Asian	29	0.690 (0.470)	2.333	(0.861, 6.323)	
Smoking status					
Non-smoker	97	0.557 (0.499)	reference		0.016
Smoker	30	0.300 (0.466)	0.341	(0.142, 0.821)	
BMI range					
Normal	31	0.387 (0.495)	reference		0.268
Overweight	45	0.578 (0.499)	2.167	(0.850, 5.513)	
Obese	54	0.500 (0.505)	1.583	(0.645, 3.888)	
Breakfast					
Never	10	0.200 (0.422)	reference		0.129
1-4 times/week	6	0.460 (0.505)	3.400	(0.634, 18.224)	
5 + times/week	11	0.549 (0.501)	4.865	(0.973, 24.323)	
Total cholesterol					
Normal	90	0.433 (0.498)	reference		0.024
High	40	0.650 (0.483)	2.429	(1.122, 5.256)	
LDL cholesterol					
Normal	73	0.452 (0.501)	reference		0.103
High	48	0.604 (0.494)	1.850	(0.883, 3.876)	

Key: *CI* = Confidence Interval; *n* = number; *SD* = standard deviation; *p* = significance.

Discussion

The purpose of this study was to examine whether any relationships existed between happiness and the individual health behaviours and risk factors associated with CVD. The results showed smoking status and happiness were related in that non-smokers were slightly happier than smokers in this sample. Earlier research has also provided evidence to suggest a negative association between smoking and happiness. Dawkins, Acaster and Powell (2007) found that smokers had reduced positive affective responses to pleasurable film clips. In Hedonism and Happiness, Veenhoven (2003) investigated happiness and use of stimulants. This analysis revealed that non-smokers were as happy as moderate smokers while heavy smokers were somewhat less happy than moderate smokers or non-smokers. Overall unhappiness with life was related to being a smoker by Emmons, Wechsler, Dowall and Abrahan (1998) in their research with US college students.

Although small effects have generally been observed, these consistent results suggest that indeed, smoking and happiness are negatively associated. This may be due to an individual's knowledge that they are undertaking a behavior known to be detrimental to health, or their feelings of physical and

psychological addiction to smoking. The financial burden of smoking may also play a role in happiness levels.

Results from the ANOVA and the bivariable analyses showed ethnicity, BMI range, breakfast consumption, total cholesterol and LDL cholesterol were potentially related to happiness but after being considered in the multilevel model, they no longer remained significant. Previous research has shown mixed results when looking at individual variables in relation to happiness and it may well be that factors such as eating breakfast and having a healthy BMI, while desirable, have little effect on happiness when examined on their own. It is likely that a combination of health factors in addition to positive mental well-being may have an effect on happiness. A positive relationship between happiness and physical activity could have been anticipated given previous research linking physical activity and positive mental health, however this relationship was not found in the current study. It is possible this was due to the use of self-report measures for assessment of physical activity and happiness, which may have been limited by biases associated with recall, comprehension, and social desirability (Knauper & Turner, 2003; Mackay, Schofield, & Schluter, 2007).

The homogeneity found across the AHI data could also explain the lack of significant associations found. It is possible that a majority of people may have reported their happiness as being relatively high despite what they may have been feeling (2008). While major changes in certain areas of one's life such as personal or professional life affect happiness, some of the major impacts on happiness appear to come from small changes in mood. This kind of temporal mood can either positively or negatively increase happiness or life satisfaction scores. Even negative events that took place a long time ago can increase current reported happiness or life satisfaction. It could then be argued that global happiness reports are merely constructions drawn 'on the spot' from whatever information, mood and environment is available at the time (Schwarz & Strack, 1999). Chambers and Windschitl (2004) found that individuals routinely rated themselves higher than others on a variety of attributes in particular regarding life satisfaction. It is possible that an indirect measurement of happiness (by calculating the difference between personal happiness and perceptions of others' perceived happiness) may have provided more accurate results (Klar & Giladi, 1999).

It is also possible that the AHI did not provide an optimal assessment of subjective well-being for comparison with CVD risk factors. Indeed, Seligman, founder of the positive psychology movement now believes the concept of happiness has limitations and is currently researching five crucial elements of well-being within a concept called flourishing (translated from ancient Greek word eudaimonia meaning "well-being" or "flourishing") (Seligman, 2011). These five elements are positive emotion, engagement, relationships, meaning & accomplishment.

It is worth noting that this was a cross-sectional study conducted with a relatively small sample of working adults in New Zealand, so the results cannot be generalized to other populations and causality cannot be established from the results. It is possible that with a larger sample size, we would have been more likely to detect significant differences in AHI scores between groups. It is also worth noting that this study focused on otherwise healthy, working adults. It is probable that mediating and moderating relationships with happiness exist, for example with socioeconomic status, environmental conditions, and suboptimal health conditions. Consequently, had a broader population sample been recruited, it is likely that greater variance in AHI data and relationships with CVD risk factors may have been found.

Conclusion

Despite the fact that many smokers report that smoking makes them happy findings from the current study have illustrated a negative association between smoking and happiness. This is an important finding and is consistent with other literature on smoking and happiness, however the direction of causality is not yet known. Further research is needed to longitudinally investigate associations between happiness and health behaviors and outcomes (particularly smoking) in other populations. Quantification of happiness remains challenging, and further research may benefit from considering using a combination of measures of happiness and psychological well-being.

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