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Young Canadian adults: They may be fit, but are they healthy?

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Abstract

Background: Established relationships exist between health-related fitness and cardiovascular disease (CVD) in older adults; yet, this relationship in young adults (18-30 yr) is less clear. Current medical practices do not actively use blood lipid testing to screen for CVD in young adults; however, non-optimal lipids in young adults have been associated with coronary atherosclerosis later in life. *Purpose*: To explore the relationship between health-related fitness and CVD risk biomarkers in young male and female Canadian adults. *Methods*: Fasting levels of high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), total cholesterol, triglycerides, and high sensitivity C-reactive protein (Hs-CRP) were obtained and compared (n = 67) to the following health-related fitness measures; body mass index, waist circumference, Rockport Walk Test, YMCA Modified Sit and Reach Test, right angle push-ups, partial curl-ups, and wall-sit. The Healthy Physical Activity Participation Questionnaire, PAR-Q, and Fantastic Lifestyle Checklist questionnaires were used to measure lifestyle behaviours. *Results*: In men, relationships were found between triglycerides and body mass index ($r(27) = 0.408$, $p = 0.031$), waist circumference ($r(27) = 0.541$, $p = 0.003$), and the Rockport Walk Test ($r(27)= -0.500$, $p = 0.007$). In women, relationships were found between TC/HDL-C and WC ($r(36) = 0.563$, $p = 0.000$), BMI ($r(36) = 0.580$, $p = 0.000$), Rockport Walk Test ($r(36)= -0.496$, $p = 0.002$), push-ups ($r(37) = -0.323$, $p = 0.045$), and partial curl-ups ($r(37) = -0.359$, $p = 0.025$). *Conclusions*: Findings revealed significant relationships of weak to moderate strength between many health-related fitness components and biological CVD risk factors. Although appearing healthy based on the fitness tests and engaged in healthy lifestyle practices based on self-reported questionnaires, the presence of elevated biological CVD risk factors among young Canadian adults is concerning and merits further investigation. **Health & Fitness Journal of Canada 2012;5(4):3-14.**

Keywords: Health-related fitness, CVD risk, young adults, blood lipid, Hs-CRP

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Introduction

Recent data from the Canadian Community Health Survey (Statistics Canada, 2009) suggests that 49.5 % of Canadians are physically inactive during leisure time, and the cardiovascular disease (CVD) risk associated with physical inactivity is equal to that of hypertension, high blood cholesterol, and/or cigarette smoking (Stewart, 2005). Due to the variation in type, duration, intensity, and frequency of physical activity, many consider it to be a behaviour that can be difficult to measure reliably (Shephard, 2003). However, physical activity directly influences health-related fitness, a condition that is much simpler and more reliable to measure. Health-related fitness consists of five components; cardiorespiratory fitness, muscular strength, muscular endurance, flexibility, and body composition (Caspersen et al., 1985). Many studies have linked declining health-related fitness to CVD risk in older adults (Blair et al., 1995; Katzmarzyk and Craig, 2002; Katzmarzyk et al., 2006; Yamamoto et al., 2009). However, the relationship between health-related fitness and CVD risk in young adults (18 to 30 yr) remains unclear.

There is a substantial case to be made for early identification of individuals at medium to high-risk for CVD as currently, CVD is one of the leading causes of mortality in Canada, and is estimated to cost 22 billion dollars annually in direct and indirect healthcare and lost productivity costs (Statistics Canada, 2009). Current Canadian CVD screening strategies include blood lipid profiling, which involves testing for plasma levels of the following biomarkers; triglycerides, low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), total cholesterol (TC), and in some cases, high sensitivity C-reactive protein (Hs-CRP). All have been repeatedly linked to CVD (Genest et al., 2009). In Canada, blood lipid profiling is implemented mostly after 40 yr and some argue that current guidelines often identify medium to high-risk individuals after the clinical expression of symptoms, which is usually "too little, too late" (Steinberg et al., 2008). Recently, Pletcher et al. (2010) reported that cumulative exposure to non-optimal lipids in early adulthood were independently associated with coronary atherosclerosis two decades later, emphasizing the need to implement screening strategies that begin earlier in life.

Young adults are a demographic to target for many reasons. First, lipid levels in this population are generally stable (Katzmarzyk et al., 2001). Second, as we age, CVD risk increases regardless of other factors, suggesting a proactive approach to CVD risk assessment is preferable if disease prevention is to be achieved (Roger et al., 2012; Stone et al., 1996). Finally, there are no known CVD screening strategies that specifically target young adults. As a potential CVD screening strategy, health-related fitness is an attractive option as it is non-invasive, low in cost, requires minimal equipment, and most importantly, unlike blood lipid profiling, assessment does not require the presence of CVD symptoms before consideration. The main purpose of this study was to explore the relationship between health-related fitness and biological CVD risk factors in young Canadian male and female adults.

Methods

Sixty-seven Kinesiology and Nursing students volunteered to participate in the study. All participants were non-smokers (18 to 30 yr) with no family history of heart disease. Following approval by the Lakehead University ethics board, and before inclusion in the study, participants were required to successfully complete a Physical Activity Readiness Questionnaire (PAR-Q) (Chisholm et al., 1975). Additionally, two self-report surveys were used to collect demographic information. The Fantastic Lifestyle Checklist (FLC) was used to gather information regarding lifestyle behaviours during the previous 30 days. The Healthy Physical Activity Participation Questionnaire (HPAPQ; Shephard and Bouchard, 1994) was used to measure health benefits associated with current levels of physical activity (as outlined by Gledhill and Jamnik, 2003). Testing was conducted in two stages: the first being health-related fitness assessment, the second being blood lipid analysis.

Health-Related Fitness Assessment

Health-related fitness assessment was supervised by individuals who had an Honours degree (or a higher designation) in Kinesiology. The supervisors had assistance from trained Kinesiology students who were utilized as assessors. Prior to testing, all assessors were provided with and required to review a written assessment protocol that outlined the assessment procedures. Health-related fitness assessment was modeled after the President's Adult Fitness

Challenge, which tests the five components of health-related fitness using the following measures, in the following order: (a) body composition measures (BMI and waist circumference); (b) cardiorespiratory fitness measure (Rockport Walk Test); (c) flexibility measure (YMCA Modified Sit and Reach Test); and (d) muscular strength and endurance measures (90^0 push-ups, partial curl-ups, wall-sits). Established procedures for each measure other than the wall-sits can be found at www.adultfitnesstest.org and are described in Table 1. It should be highlighted that these procedures are very similar to that employed in the Canadian Physical Activity and Lifestyle Approach developed by Gledhill and Jamnik (2003).

One additional measure, the wall-sit, was added to include a lower-body muscular strength and endurance measure. The protocol for the wall-sit test was similar to that used by McIntosh et al. (1998). Wall-sit validity and reliability data for young adults represent a gap in the literature. Recent research into health-related fitness in adolescents with a mean age 14.8 yr found test-retest reliability of the wall-sit test to be poor (Lubans et al., 2011). However, our lab has performed a similar study using a slightly older population of young adults (mean age 19.0 yr) and found test-retest reliability to be much higher ($r(74) = 0.82$, Cronbach's $\alpha = 0.895$; Thompson et al., 2010).

During administration of the test protocol, participants were allowed time between tests to recover (a maximum of 10 minutes), with overall assessment requiring approximately 50 to 60 minutes to complete. Time was measured using two digital stop watches. For the Rockport Walk Test, Polar Heart rate monitors (Polar FT2) were used to measure heart rate. Height was measured using a wall-mounted stadiometer (Landauer Height-measuring device, 2001), and weight was measured using a digital scale (MyWeigh MD-500).

Table 1: Health-related fitness measures.

Rockport Walk Test – 1 mile indoor walking test used to estimate maximal aerobic capacity, reported in $mL \cdot kg^{-1} \cdot min^{-1}$.
Modified Sit and Reach Test – Assesses trunk flexibility while in the seated position (cm).
90^0 Push-ups – Assesses upper body muscular strength and endurance, measured in maximum # of repetitions .
Partial Curl-ups – Assesses core muscular strength and endurance, measured in maximum # of repetitions in 60 s.
Wall Sit – Assesses lower body muscular strength and endurance, measured in maximum number of seconds able to maintain correct form.
Body Mass Index – Classifies body weight in adults, reported in $kg \cdot m^{-2}$
Waist Circumference – Measure of central adiposity, measured in cm.

Biological CVD Risk Analysis

Following fitness assessment, participants were provided with a blood lipid analysis referral form and asked to report to one of three LifeLabs™ collection centres in Thunder Bay, Ontario for blood collection. All blood specimens were drawn by LifeLabs™ (a company that is certified in all aspects of blood collection). Participants were instructed to wait at least 72 hours before undergoing blood lipid analysis, as increased physical activity can skew biological CVD risk factor analysis results. Also, prior to blood analysis, participants were instructed to undergo a 12-hour food fast and a 24-hour fast from alcohol.

Serum lipids, inflammatory markers, and lipoproteins were measured in fresh serum samples using the following ADVIA

Chemistry Systems™ assay Kits for: Cholesterol, Hs-CRP, HDL-C, LDL-C, and Triglycerides. All assays measure to within 0.01 mmol·L^{-1}. Two weeks after completion of health-related fitness assessments, a follow-up was conducted on individuals who had not completed the blood lipid analysis. After four weeks, any remaining participants were deemed to have dropped out of the study and excluded from the final analysis.

Blood analysis results were classified using two different CVD risk assessment systems; current CCSG (Genest et al., 2009), and the National Cholesterol Education Program Guidelines (NCEP; Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2002). By using both classification systems, multiple potential areas of interest could be highlighted related to CVD risk assessment in young Canadian adults.

Statistical Analyses

Descriptive statistics were used to examine and describe sample demographics. Specifically, means and standard deviations were used to group and categorize HPAPQ and FLC scores, as well as health-related fitness and biological CVD risk factor results. To examine the relationship between each health-related fitness measure and each biological CVD measure, Pearson Correlation Coefficient analysis was used.

Results

All 67 participants completed the health-related fitness assessment and blood lipid analysis. In the final analysis, one female measure of aerobic capacity was not included due to a faulty heart rate monitor, and another female's baseline body composition measures were excluded from the analysis, at the request of the participant. In addition, two wall-sit assessments and one partial curl-up test were deemed incomplete and excluded from the final analysis. There were no reported injuries, and no tests had to be interrupted for health and safety reasons.

Sample Demographics

Mean BMI and WC classified the sample as having low CVD risk (healthy), with one standard deviation in BMI placing some participants as overweight. Mean HPAPQ scores for men and women indicated they were receiving excellent health benefits from current levels of weekly physical activity. Mean FLC scores indicated that most participants, in the 30 days prior to completion of the questionnaire, had engaged in healthy lifestyle behaviours that are known to reduce CVD risk. Together these findings indicate that the sample population consisted of physically active non-smoking young adults who engaged in healthy lifestyle practices that are known to reduce CVD risk. Mean body composition results for both men and women indicated low CVD risk associated with obesity. BMI for men and women was classified as normal, while mean WC measures suggested low CVD risk associated with abdominal obesity. Demographic results are presented in Table 2.

All remaining health-related fitness results (except wall-sits) were classified using normative data from the American College of Sports Medicine 8th Edition guidelines (2009). Mean aerobic power for both men and women was classified as excellent and suggest a high cardio-respiratory fitness in the sample. In men, mean push-up and partial-curl-up results were classified as fair and excellent respectively, indicating that upper body and core muscular and endurance was at or above average. In women, mean push-up and partial curl-up results were borderline below average/fair. Trunk flexibility results for both men and women were classified as needs improvement. Overall, the results suggest that the health-related fitness of the sample was homogenously good/desirable, with the exception of flexibility. Men significantly outperformed women in estimated aerobic fitness ($t(64) = -5.77$, $p = 0.000$), push-ups ($t(65) = -4.85$, $p = 0.000$), and partial curl-ups ($t(64) = -0.209$, $p = 0.04$). Table 3 displays health-related fitness assessment results by gender.

Biological CVD risk factor findings reflect previously reported research by Pletcher et al. (2010) concerning the high percentage of participants (83.5%) with one or more non-optimal lipids. Blood lipid analysis also revealed a high percentage of participants with two or more non-optimal lipids (25.4 %). In men, all participants with non-optimal LDL-C (21.4% of men) also had non-optimal HDL-C. In women, 25.6% had non-optimal LDL-C and HDL-C. Details are presented in Table 4.

According to the Canadian Cardiovascular Society Guidelines (CCSG; Genest et al., 2009), which uses Framingham 10 yr CAD Risk Calculator, all participants are classified as having low risk (< 10%). In low risk patients, current CCSGs indicate that before any treatment or intervention strategy is implemented, one of the following two criteria must be met; LDL-C >5.0 $mmol \cdot L^{-1}$ or TC/HDL-C > 6.0 $mmol \cdot L^{-1}$. All of the participants in this study were classified as low risk, having levels below these criteria, and thus would not be candidates for treatment and/or intervention. However, research by Pletcher et al. (2010) suggests that in young adults, non-optimal LDL-C (> 2.59 $mmol \cdot L^{-1}$) and HDL-C (< 1.55 $mmol \cdot L^{-1}$) may be significantly related to the development

Table 2: Male and female demographic and health results.

	Males			Females		
	N	**M**	**SD**	**n**	**M**	**SD**
Age (yr)	28	19.6	2.3	39	19.6	2.2
BMI ($kg \cdot m^{-2}$)	28	24.6	3.0	38	23.8	4.9
WC (cm)	28	84.0	8.2	38	82.0	12.6
HPAPQ Score	28	9.4	1.9	39	8.9	1.9
FLC Score	28	75.0	8.4	39	73.1	14.3

Note: According to the procedures of Gledhill and Jamnik (2003) HPAPQ scores health benefits of current physical activity levels and classification is: 0 = Needs Improvement, 1 to 3 = Fair, 4 to 5 = Good, 6 to 8 = Very Good, 9 to 11 = Excellent. FLC scores lifestyle habits during the previous 30 days and classification is: 0 to 34 = Needs Improvement, 35 to 54 = Fair, 55 to 69 = Good, 70 to 84 = Very Good, 85 to 100 = Excellent.

of coronary atherosclerosis two decades later. In our study, 83.5% of participants were classified as having at least one non-optimal lipid. According to Pletcher et al., (2010), these individuals may be at greater risk for developing coronary atherosclerosis later in life (45+ yr). Differences were also observed between genders. Women had significantly higher total cholesterol ($t(65) = 3.09$, $p = 0.003$), HDL-C ($t(65) = 3.39$, $p = 0.001$), and Hs-CRP ($t(65) = 2.77$, $p = 0.007$). Details of blood lipid results are illustrated in Table 5.

Pearson correlations were performed to assess the degree of association between the biological markers; HDL-C, LDL-C, total cholesterol, TC/HDL-C, triglycerides, and Hs-CRP, and the health-related fitness measures; body mass index, waist circumference, estimated aerobic fitness, trunk flexibility, number of right angle push-ups, number of partial curl-ups, and time maintaining a 90 degree wall-sit.

In examining the results for the males, three associations were noted, while one expected association was not apparent. First, a moderate inverse relationship between trunk flexibility and LDL-C ($r(28) = -0.409$, $p = 0.031$) was observed. Second, a moderate inverse relationship between aerobic fitness and triglycerides ($r(28) = -0.50$, $p = 0.007$) was observed in men. Third, both measures of body composition were positively associated with serum triglycerides, body composition ($r(28) = .408$, $p = .031$), and waist circumference ($r(28) = .541$, $p = 0.003$). Finally, in men, measures of body composition were not associated with LDL-C or HDL-C, both major predictors of future CVD risk (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2002; Genest et al., 2009).

These results differed from established relationships in previously reported research involving middle-aged and older populations (NIH, 1998; WHO, 2004).

Table 3: Male and female health related fitness results.

	Males			**Females**		
	n	**M**	**SD**	**n**	**M**	**SD**
Aerobic Fitness ($mL \cdot kg^{-1} \cdot min^{-1}$)	28	53.7	5.4	38	45.5	5.9
Sit & Reach (cm)	28	6.5	10.9	39	7.2	9.7
Push-ups (reps)	28	31.0	9.4	39	20.0	9.4
Curl-ups (reps)	27	40.0	12.8	39	33.0	11.7
Wall-sits (s)	28	135.0	71.3	37	108.0	54.1

Note: For men, mean estimated aerobic fitness, partial curl-ups, and 90° push-ups results were classified as desirable/fair or excellent and mean sit and reach results as needs improvement. For women, mean estimated aerobic fitness was classified as excellent while mean partial curl-ups, 90° push-ups, and sit and reach results were borderline needs improvement/fair. Wall-sits do not have any known validated normative data.

Table 4: Percentage of non-optimal lipids in males, females, and overall.

	Overall		Males		Females	
	n	%	n	%	n	%
Optimal LDL-C	41	62.7	21	78.6	20	51.3
Non-Optimal LDL-C	25	37.3	6	21.4	19	48.7
Optimal HDL-C	21	31.4	2	7.1	19	48.7
Non-Optimal HDL-C	46	68.6	26	92.9	20	51.3
At least 1 Non-optimal	56	83.5	26	92.9	30	76.9
2 or more Non-optimal	17	25.4	6	21.4	11	28.2

Note: Non-optimal is defined by the NCEP as: LDL-C > 2.59 $mmol \cdot L^{-1}$, HDL-C < 1.55 $mmol \cdot L^{-1}$, or Triglycerides > 1.77 $mmol \cdot L^{-1}$. Optimal is defined by the NCEP as: LDL-C < 2.59 $mmol \cdot L^{-1}$, HDL-C > 1.55 $mmol \cdot L^{-1}$, or Triglycerides < 1.77 $mmol \cdot L^{-1}$. M = Mean; SD = Standard Deviation.

Table 5: Comparison of male and female biological CVD risk factors to NCEP/AHA risk guidelines.

	Males (n = 28)			Females (n = 39)		
	M	SD	NCEP	M	SD	NCEP
TC ($mmol \cdot L^{-1}$)	3.95	0.71	<5.17	4.53	0.79	<5.17
LDL-C ($mmol \cdot L^{-1}$)	2.26	0.62	<2.59	2.48	0.52	<2.59
HDL-C ($mmol \cdot L^{-1}$)	1.27	0.29	>1.55	1.57	0.41	>1.55
TC/HDL-C	3.19	0.59	<4.11	3.00	0.71	<4.11
Triglycerides ($mmol \cdot L^{-1}$)	0.97	0.35	<1.77	1.05	0.46	<1.77
Hs-CRP ($mg \cdot L^{-1}$)	1.03	2.23	>3.00	2.73	2.64	>3.00

Note: Current NCEP cholesterol guidelines for lowering CVD risk. Risk values for Hs-CRP are defined by the American Heart Association/Centers for Disease Control (Pearson et al., 2004) as: Low risk < 1.0 $mg \cdot L^{-1}$, Average risk 1.0 – 3.0 $mg \cdot L^{-1}$, High risk > 3.0 $mg \cdot L^{-1}$. M = Mean; SD = Standard Deviation.

The relationship between health-related fitness measures and biological CVD risk factors for women appeared stronger than those found for men. BMI was moderately associated with LDL-C ($r(38) = 0.463$, $p = 0.003$), Hs-CRP ($r(38) = 0.593$, $p = 0.000$, and the ratio of total cholesterol to HDL-C ($r(38) = 0.580$, $p = 0.000$). Similarly, WC was moderately associated with TC/HDL-C ($r(38) = 0.563$, $p = 0.000$) and Hs-CRP ($r(38) = 0.411$, $p = 0.010$). WC was also weakly associated with LDL-C ($r(38) = 0.330$, $p = 0.043$). These findings reflect previously reported research (NIH, 1998; WHO, 2004).

The greatest number of associations between the health-related fitness measures and biological measures involved TC/HDL-C. Significant relationships were observed between TC/HDL-C and five of the seven health-related fitness measures; BMI and WC as reported previously; aerobic fitness ($r(38) = -0.496$, $p = 0.002$); total push-ups ($r(38) = -0.323$, $p = 0.045$); and partial curl-ups ($r(38) = -0.359$, $p = 0.025$). The clinical value of the TC/HDL-C in women is currently under investigation but does indicate promise as a clinical measure of future CVD risk (Ridker et al., 2005). Our results indicate that women with lower levels of health-related fitness and increased BMI and WC were associated with an increased ratio of total cholesterol to HDL-C, highlighting a potential avenue for future research.

Discussion

The primary goal of this study was to explore the relationship between each component of health-related fitness and biological CVD risk factors in young Canadian men and women, and the study revealed a number of issues that need to be investigated further. First, according to the FLC, HPAPQ, and health-related fitness results, our sample was homogenously physically fit and engaging in healthy lifestyle practices that lower CVD risk. However, the biological CVD risk factor results suggest otherwise. Current thinking leads us to believe that young adults are at minimal risk for CVD and thus are not targeted for screening at this younger age. As a result, the prevalence of non-optimal lipids (83.5%) in this age group was not expected. However, age plays a large role in CVD risk analysis. As our population is younger than the clinical target age that the use of the Framingham Model and the NCEP guidelines are intended for, the true CVD risk of our participants is unknown. Considering the age of the population, it is recommended by the authors that education rather than clinical intervention should be encouraged as a proactive approach to lowering future disease risk.

The current study revealed that the relationships between health-related fitness and biological CVD risk factors in young Canadian adults may be an important area of research to explore. Several relationships of interest were observed in men. First, a moderate inverse relationship between trunk flexibility and LDL-C was observed, which to our knowledge, has not been previously reported in the literature. Second, a moderate inverse relationship between estimated aerobic capacity and triglycerides was observed in men, which reflects findings reported by Berlin and Colditz (1990). Finally, BMI was moderately associated with serum triglycerides. These relationships suggest a weak to moderate inverse relationship between health-related fitness and CVD risk that could indicate elevated long term CVD risk, but more research with a larger, more heterogeneous sample is needed to explore these relationships in greater detail.

In women, biological CVD markers were more closely associated with health-related fitness measures than in men. Specifically, lower levels of health-related fitness and increased BMI and WC were moderately associated with an increased ratio of total cholesterol to HDL-C. The clinical value of the ratio of total cholesterol to HDL-C in women is currently under investigation but does indicate promise as a clinical measure of future CVD risk. Research by Ridker et al. (2005) focusing on the clinical value of frequently used lipid measures, indicates that the ratio of total cholesterol to HDL-C may be a better predictor of future coronary events in women than more frequently used measures of LDL-C, HDL-C, and Hs-CRP. Our findings suggest that in healthy young Canadian adult women, health-related fitness measures may be inversely related to CVD risk, though the strength of these relationships needs to be studied in larger, more heterogeneous samples.

Both NCEP and CCSG were utilized in this study. According to CCSG (Genest et al., 2009), no participants in the current study were candidates for intervention or treatment, primarily attributed to their younger age. However, if we use NCEP guidelines combined with recent evidence presented by Pletcher et al. (2010), 83.5% of participants may be at increased long-term (20 yr) risk for developing coronary atherosclerosis. Canadian guidelines primarily use the Framingham Model to guide treatment decisions, which is a short-term (10 yr) risk assessment and thus, has been recognized to under-estimate CVD risk in young adults (Nasir et al., 2005). The evidence presented by Pletcher et al. (2010) demonstrates that short-term CVD risk assessment may not accurately reflect true risk in young adult men and women. However, despite the links between elevated CVD risk factors in young adults and disease manifestation later in life, it is unknown whether these relationships indicate causation. Most likely these risk factors are one of many that contribute to CVD.

Extensive research has illustrated that an inverse relationship exists between health-related fitness and biological CVD markers in older adults (Kesaniemi et al., 2010). The current study of young adults found similar results. Unfortunately what the current study might also suggest is that, in young adults, physical activity has no bearing on the prevention of elevated lipids and lipoproteins. What it also points to and is of an even larger concern, is that those young adults who are physically inactive and engaging in less favourable lifestyle habits could be at even greater long-term risk. If these results are duplicated in young adults using larger, more heterogeneous samples, it would suggest that physical activity and fitness alone are not adequate to overcome the negative biological effects of other external factors that were not examined in this study, such as diet. With the predicted rise of CVD mortality in the coming years, largely linked to rising rates of obesity and diabetes (NIH, 1998; WHO, 2004), the prevalence of non-optimal lipids in apparently healthy young Canadian adults is a cause for concern. Many of the current guidelines (Genest et al., 2009) suggest a greater level of surveillance in older adults as a preventative measure for avoiding CVD and other chronic diseases. Our results make a case for the need to also include surveillance of and ways to monitor young adult health status outside of traditional practices.

It is understood by the authors that the sample size of this study and the relationships reported here may be tenuous at best. However, because our population was considered low risk according to the Framingham model, the combination of elevated biological CVD risk factors identified here coupled with recent findings from Pletcher et al. (2010) should indicate a cause for concern. While our study may not have the statistical power to report relationships, we can report with confidence that our sample of healthy young adults had elevated levels of cholesterol. Whether or not these levels indicate future CVD risk requires further study.

Finally, this study has several strengths including the measurement of health-related fitness. Assessment measures used are very common, low-cost tests that require minimal time and effort to quantify health-related fitness. In addition, past research has illustrated strong connections in older adult populations between each health-related fitness measure used in this study and CVD risk. Similarly, there is an abundance of evidence that suggests, due to the effects of exposure to CVD and its symptoms, identifying young adults at increased risk earlier could allow for substantial changes in disease outcome.

Conclusions

The goal of this research study was to explore the relationship between health-related fitness and biological CVD risk factors in young Canadian men and women. Our findings revealed that although young adults may be fit and appear healthy, this might not necessarily be the case. Although young adults may not be at risk in the short term, as the Framingham Model would indicate, the prevalence of non-optimal lipids in this population suggests they may be at greater long-term risk. It may appear by the results of this study, that physical fitness has no bearing on cholesterol levels. However, it then leads one to suspect that other external factors, such as diet, may be influencing biological CVD risk factors and may be overriding the potential positive effects of exercise and physical activity on lowering CVD risk. Our findings suggest the need to study the relationship between diet and biological CVD risk factors in young adults as well as promoting the importance of nutritional education as part of CVD prevention strategies. With the upcoming predicted rise in CVD mortality rates, it is clear that research and medical practices need to address CVD screening strategies that focus on primary prevention and identifying risk as early as possible.

Author's Qualifications

The author's qualifications are: David S. Thompson MSc, HBK (Hons); Jocelyn M. Farrell PhD, MA, BSc (Hons); Tracey M. Larocque MSc, BPE; Ian J. Newhouse PhD, MSc, BPE.

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