NOVÉ VZORCE PRO VÝPOČET MAXIMÁLNÍ SPOTŘEBY KYSLÍKU PŘI ZÁTĚŽOVÝCH TESTECH PODLE REGISTRU FRIEND

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AHA SCIENTIFIC STATEMENT

Importance of Assessing Cardiorespiratory Fitness in Clinical Practice: A Case for Fitness as a Clinical Vital Sign

A Scientific Statement From the American Heart Association

ABSTRACT: Mounting evidence has firmly established that low levels of cardiorespiratory fitness (CRF) are associated with a high risk of cardiovascular disease, all-cause mortality, and mortality rates attributable to various cancers. A growing body of epidemiological and clinical evidence demonstrates not only that CRF is a potentially stronger predictor of mortality than established risk factors such as smoking, hypertension, high cholesterol, and type 2 diabetes mellitus, but that the addition of CRF to traditional risk factors significantly improves the reclassification of risk for adverse outcomes. The purpose of this statement is to review current knowledge related to the association between CRF and health outcomes, increase awareness of the added value of CRF to improve risk prediction, and suggest future directions in research. Although the statement is not intended to be a comprehensive review, critical references that address important advances in the field are highlighted. The underlying premise of this statement is that the addition of CRF for risk classification presents health professionals with unique opportunities to improve patient management and to encourage lifestyle-based strategies designed to reduce cardiovascular risk. These opportunities must be realized to optimize the prevention and treatment of cardiovascular disease and hence meet the American Heart Association's 2020 goals.

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CLINICAL STATEMENTS AND GUIDELINES

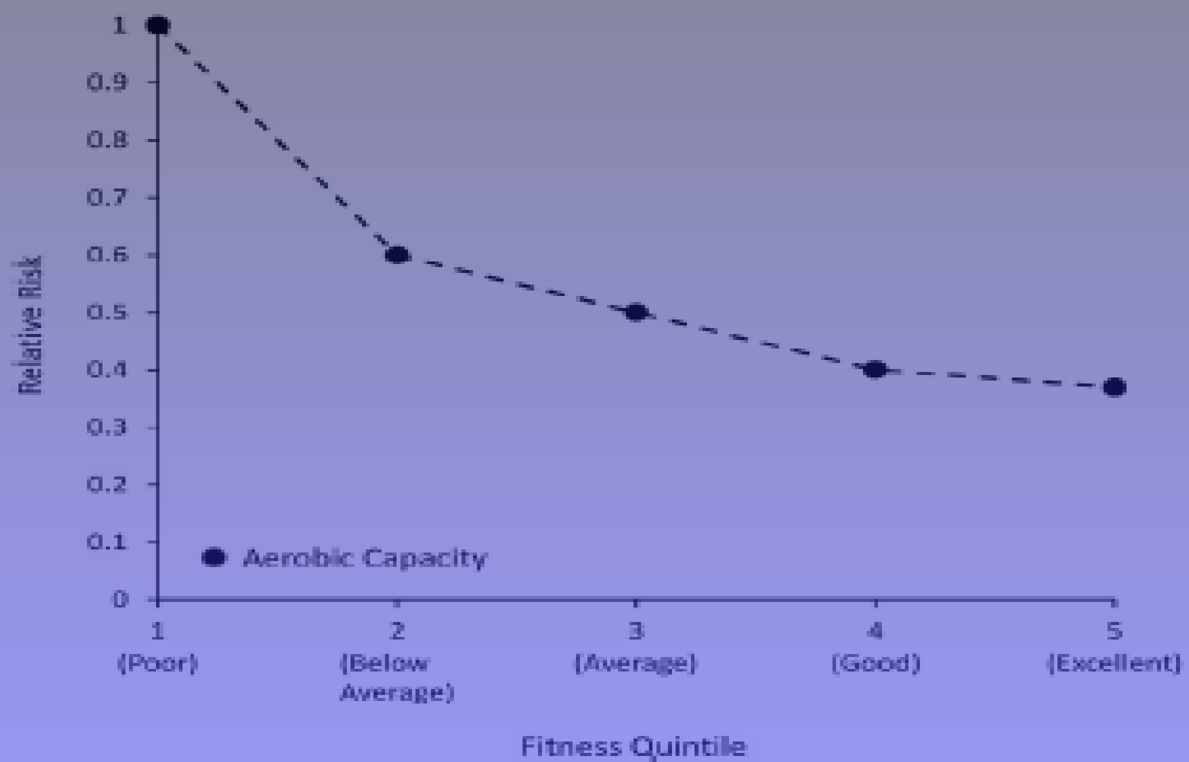

Figure 1. The risks of coronary heart disease and cardiovascular disease decrease in association with increasing quintiles of CRF or aerobic capacity. There is a precipitous drop in risk when comparing the lowest (poor) with the next-lowest quintile (below average) for aerobic capacity, with a 64% decline in the overall risk of heart disease from the least to the most fit. Interestingly, little or no additional benefit occurs when moving from quintile 4 to 5, that is, "good" to "excellent" aerobic capacity, suggesting a plateau in reduced relative risk. Adapted from Reference 17.

- Standardním testem pro zjištění kardiorespirační zdatnosti je zátěžový test do maxima spojený s měřením různých kardiorespiračních parametrů včetně maximální spotřeby kyslíku (VO_2 max (peak)).
- VO_2 max je parametr, který lze nejen pro stanovení funkční zdatnosti jedince, ale také pro prognózu pacienta a k předpisu pohybové aktivity. Přímé stanovení VO_2 max bylo v minulosti složité a finančně náročné a proto byly v minulosti vytvořeny regresní rovnice, které odhadovaly VO_2 max.

V roce 2014 byla proto založena iniciativa The Fitness Registry and the Importance of Exercise National Database (FRIEND). FRIEND je multi institucionální projekt, který si kladl za cíl stanovit normativy pro kardiorespirační zdatnosti pro USA.

Bicyklová ergometrie

- Celkově soubor obsahoval 5 100 osob (3378 mužů, průměrného věku 35,9±12,1 let a 1722 žen průměrného věku 47,5±14,0 let).

Maximální spotřeba kyslíku (VO_2 max, ml/kg/min)

Muži = 1,76 x (watt x 6,12/ hmotnost (kg)) + 3,5

Maximální spotřeba kyslíku (VO_2 max, ml/kg/min)

Ženy = 1,65 x (watt x 6,12/ hmotnost (kg)) + 3,5

Maximální spotřeba kyslíku (VO_2 max, ml/kg/min)

Bez zohlednění pohlaví = 1,74 x (watt x 6,12/ hmotnost (kg)) + 3,5

Běhátko

- Celkově soubor obsahoval 7 983 osob průměrného věku 47±13 let (4 798 mužů, 3 183 žen).

Maximální spotřeba kyslíku (VO_2 max, ml/kg/min) rychlost (m/min) x (0,17+ procenta sklonu x 0,79) + 3,5

Using Metabolic Equivalents in Clinical Practice

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Metabolic equivalents, or METs, are routinely employed as a guide to exercise training and activity prescription and to categorize cardiorespiratory fitness (CRF). There are, however, inherent limitations to the concept, as well as common misapplications. CRF and the patient's capacity for physical activity are often overestimated and underestimated, respectively. Moreover, frequently cited fitness thresholds associated with the highest and lowest mortality rates may be misleading, as these are influenced by several factors, including age and gender. The conventional assumption that 1 MET = 3.5 mL O_2/kg/min has been challenged in numerous studies that indicate a significant overestimation of actual resting energy expenditure in some populations, including coronary patients, the morbidly obese, and individuals taking β-blockers. These data have implications for classifying relative energy expenditure at submaximal and peak exercise. Heart rate may be used to approximate activity METs, resulting in a promising new fitness metric termed the "personal activity intelligence" or PAI score. Despite some limitations, the MET concept provides a useful method to quantitate CRF and define a repertoire of physical activities that are likely to be safe and therapeutic. In conclusion, for previously inactive adults, moderate-to-vigorous physical activity, which corresponds to ≥3 METs, may increase MET capacity and decrease the risk of future cardiac events. (Am J Cardiol 2018;121:382–387)

Použití

- Prognóza pacientů
- Posudkové hledisko (MET)
- Předpis pohybové aktivity

Table 1. Sampling of Studies Expressing Exercise Capacity in Terms of Survival Benefit per MET

Reference (Year)	Population	Survival Benefit per MET	Key Findings
Blair et al (1995)[31]	9777 Men completing 2 health evaluations 5±4 y apart	16%	Survival increased in subjects who improved exercise capacity with serial testing
Dorn et al (1999)[32]	315 Post-MI men randomized to a 6-month exercise program	8%–14%	Increase in exercise capacity during cardiac rehabilitation had sustained benefits up to 19 y
Goraya et al (2000)[26]	Elderly (514) vs younger (2593) subjects referred for exercise testing	14% and 18%	14% and 18% survival benefit per MET for younger and elderly subjects, respectively
Myers et al (2002)[18]	6213 Clinically referred subjects	12%	Exercise capacity most powerful predictor of mortality
Gulati et al (2003)[23]	5721 Asymptomatic women in the St. James Women Take Heart Project	17%	Exercise capacity an independent predictor of mortality in women, higher than previously established in men
Mora et al (2003)[29]	2994 Asymptomatic women from the Lipid Research Clinics Prevalence Study	20%	Fitness-related variables more strongly associated with survival than other exercise test variables
Kavanagh et al (2003)[33]	2300 Women referred for rehabilitation	35%	Peak $\dot{V}o_2$ increase during cardiac rehabilitation
Balady et al (2004)[34]	3043 Asymptomatic men and women, Framingham study	13%	Reduction in risk of events per MET among high-risk men in Framingham Offspring Study
Myers et al (2004)[35]	>6000 Clinically referred subjects, VETS cohort	20%	1-MET increment in exercise capacity roughly equivalent to 1000 kcal/wk adulthood activity
Kokkinos et al (2008)[36]	15 660 Clinically referred subjects	13%	Moderately fit had 50% lower mortality than those with low CRF
Myers et al (2011)[37]	3834 Subjects evaluated for changes in obesity	18%	Fitness was a strong predictor of outcomes irrespective of weight status
Kokkinos et al (2013)[19]	10 043 Dyslipidemic subjects in VETS cohort	17% for those taking statins	Combination of statin treatment and higher fitness had lower mortality risk than either alone
Nes et al (2014)[38]	37 112 Healthy subjects from HUNT cohort	21% for both sexes	Simple nonexercise algorithm for CRF identifies apparently healthy people at increased risk for premature CVD and all-cause mortality

CRF indicates cardiorespiratory fitness; CVD, cardiovascular disease; HUNT, Nord-Trøndelag Health Study; MET, metabolic equivalent; MI, myocardial infarction; VETS, Veterans Exercise Testing Study; and $\dot{V}o_2$, oxygen consumption.

MET a pohyb

- Pro výpočet se používá intenzita zátěže udaná v MET krát počet minut v týdnu. Příklad: chůze o intenzitě 3,3 MET, trvá 30 minut a je provedena 5x v týdnu (3,3x30x5= 495 MET/min/týden). Celkem bychom měli dosáhnout 500-1000 **MET/min/týdně.**

Lehká <3 MET	Střední 3-6 MET	Vysoká >6 MET
Sezení u PC (1,5 MET)	Rychlá chůze (3,3 MET)	Jogging, běh (6,3 MET)
Pomalá chůze (2MET)	Úklid (okna, luxování) (3,0-3,5)	Basketbal (8,0 MET)
Lehká domácí práce (2,0-2,5 MET)	Badminton (4,5 MET)	Cyklistika po rovině střední a vysoká rychlost (8,0-10,0 MET)
Šipky (2,5 MET)	Cyklistika po rovině malá rychlost (6,0 MET)	Tenis single (8,0 MET)
	Rekreační plavání (6,0 MET)	Volejbal závodní nebo beach (8,0 MET)
	Stolní tenis (4,0 MET)	
	Tenis dvouhra (5,0 MET)	
	Rekreační volejbal (3,0-4,0 MET)	

Jan Werich

- Dobrá nálada nevyřeší všechny vaše potíže, ale naštve tolik lidí, že stojí za to si ji udržet.