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The Association between Physical Activity and Fitness: The Influence of Muslim and Non-Muslim

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Abstract

The aim of this study is to investigate the nature and magnitude of the relationship between self-reported physical activity and fitness and the extent to which the association varies with Muslim and Non-Muslim group. Fitness was assessed by use of sub-maximal bicycle ergometer test to predict maximal aerobic capacity, an assessment of body composition and the measurement of upper and lower body strength. Activity pattern and health status will be assessed by questionnaire. A total of 112 subjects focused on male of the staff, postgraduate, and undergraduate student of Birmingham University undergone fitness testing by bicycle ergometer, body composition and self-reported health questionnaire. The inter-relation of the physical characteristics, self-reported exercise behavior, fitness measures, health risk factors such as smoking and alcohol consumption is discussed. Age has the strongest association with fitness measures. Involvement in strenuous exercise as well as exhausting exercise appears to be related to fitness. Percentage body fat is also associated, inversely, with fitness. The difference between the younger and older participants in % body fat undoubtedly reflects the much greater time spent in vigorous exercise by the Muslim and Non-Muslim participants. However, the differences in BMI between the Muslim and Non-Muslim, for the Muslim and Non-Muslim cohorts respectively, reflect additional mechanisms, as they are largely driven by differences in height rather than mass. These data emphasize the importance of not relying solely on BMI as a measure of size.

Keywords

Fitness, Physical Activity, Lifestyle, Body Composition, Muslim, Non-Muslim

1. Introduction

Aerobic fitness, which refers to maximal aerobic capacity (VO_{2max}), is usually, but not always, adjusted for body composition or weight. VO_{2max}, can be accurately measured directly by gas exchange assessment during maximal exercise on a bicycle ergometer or a treadmill. However, VO_{2max} can also be estimated using sub-maximal exercise testing and this has proved to be a valid and reliable technique (Åstrand & Rodhal, 1987). Aerobic fitness (VO_{2max}) is positively associated with a variety of health outcomes; in particular, high levels of fitness are protective against coronary heart disease (CHD) and cardiovascular disease (CVD) morbidity and mortality, as well as risk factors for these outcomes (Yoshiga & Higuchi, 2003; Strong, Malina, Cameron, Stephen, Roodney, Bernad, Albert, Aviva, Patricia, James, Thomas, Stewart, & Francois, 2005). A longitudinal study undertaken by (Lee & Blair, 2002), in a study of men aged 30 to 83 years, reported that low fitness men, irrespective of the fact that they were lean, had a relatively high risk, both all-cause and CVD mortality over an average 8-year follow-up. Indeed, fitness was a more potent predictor of subsequent health status than fatness. More recently, fitness and mortality were observed to be inversely associated for diabetic men of average aged 49 (Church, Cheng, Earnest, Barlow, Gibbons, Priest, & Blair, 2004). Again, fitness was a stronger predictor of subsequent mortality than body composition. Adjusting for fitness abolished any association between body mass index and mortality.

Levels of physical activity, whether occupational activity (e.g. patrolling, lifting or carrying loads), home maintenance activity (e.g. housework, yard-work), or as part of leisure pursuits (sports participation, walking, golfing, gardening), are often used as a proxy for physical fitness in epidemiological research. This undoubtedly reflects relative ease of measurement. Physical activity can be measured by self-report as the frequency or the volume of time spent in various types or various intensities (light, moderate, and vigorous). Regular physical activity is associated with numerous health benefits, such as reduced risk for cardiovascular disease, diabetes, obesity, some cancers and musculoskeletal conditions. Further, risk for CHD, CVD, and other condition can be reduced through increases in physical activity. The positive association between physical activity and health is now well established (Blair, LaMonte, & Nichaman, 2004).

The evidence from studies on aerobic fitness and morbidity (particularly for CHD and CVD) is also consistent (Blair, Cheng, & Holder, 2001). Many studies have now shown a strong inverse relationship between fitness and morbidity (Kemper, Twisk, Koppes, Van Mechelen, & Post, 2001). A cross-sectional study (McMurray, Ainsworth, Harell, Griggs, & Williams, 1998) reported increased aerobic power among 1664 law enforcement trainees had a positive influence on CVD risk factors. They concluded that the roots of this association may be traced to adoles. Thus, the negative consequences of low fitness for CHD and CVD morbidity and risk may begin very early in life (Balducci, Zanuso, Cardelli, Salvi, Mazzitelli, Bazuro, Iacobini, Nicolucci, & Pugliese, 2012; Fogelholm, 2010). More recently, (Talbot, Morrell, Metter, & Fleg, 2002) found that higher cardio-respiratory fitness predicted reduced risk of CHD in individuals who were less than 65 years old. For older participants (>65 years old), both higher cardio-respiratory fitness and high intensity of exercise were associated with fewer indications of CHD among 689 men from the Baltimore Longitudinal Study of Ageing.

There would seem to be very few data on the relationship between self-reported activity levels and fitness at different religions and no consensus as to whether the strength of the association varies with religion. This research attempts to address these questions using a cross-sectional study:

- What is the nature and size of the association between self-reported physical activity and measure of fitness and strength?
- What are other factors related to fitness and strength?
- How do physical activity levels and fitness change with Muslim and Non-Muslim?
- Does the association between physical activity and fitness vary with Muslim and Non-Muslim?

2. Methodology

2.1. Participants

The male participants were volunteers from among staffs, and the postgraduate and undergraduate body at the University of Birmingham. The final effective sample comprised 112 men. Because recruitment was opportunistic, a substantial proportion (64%) of the current sample was recruited from the Malaysian Muslim community resident in Birmingham. For this study, participants had to be over 16 years of age and not suffering from any of the following: existing cardiovascular or respiratory disease as revealed by the School of Sport and Exercise Sciences' general health questionnaire, which was administered at the outset. The local ethics committee approved the study and all participants received an information sheet, providing details of the protocol and provided written informed consent.

2.2. Design

This study adopted a cross-sectional correlational design. Participants completed a series of questionnaires, assessing among other things, the extent to which they engaged in exercise at different intensities, and had measurements taken of their fitness levels. Of primary interest was the extent to which fitness levels were associated with self-reported exercise behavior.

2.3. Questionnaire Assessment

Participants were administered a questionnaire package developed by (Tuxworth, Nevill, White, & Jenkins, 1986). Leisure physical activity was measured in a number of domains and the frequency of participants' exertions at different intensity level assessed. With regard to other moderate intensity exertions, participants were asked about their involvement in activities such as gardening, fishing, and golfing. They were also being required to indicate whether they smoked and, if so, had to state how many cigarettes they smoked: under 10 a day, 10 or more a day but less than 20, 20 or more a day but less than 30, or 30 a day or more. Alcohol consumption within the past 12 months was reported in terms of whether participants drank twice a day or more, almost daily, once or twice a week, on special occasions only, or not at all during the last 12 months. Information about marital status was acquired through having participants choose from six alternatives: single, never married, separated, divorced, widowed, married, or living as married.

2.4. Anthropometric Assessment

Mass of participants were measured in kilograms wearing minimal clothing, on digital GEC Avery (Model 824/890) scales, and their height determined, with shoes removed, using a SECA stadiometer (Model 220). Body fat assessment was undertaken using the four-site skinfold method (Durnin & Rahaman, 1967) Harpenden calipers were used to measure the thickness of skinfolds (in millimetres) at the four-designated sites, namely the midpoint of the upper arm over the biceps and over the triceps muscles as well as subscapular and suprailiac sites. The four-skinfold thicknesses were summed and converted, using the formula of (Durnin & Womersley, 1974) to estimate the percentage body fat. Body mass index (BMI) was calculated from the ratio of mass (kg) to height $(m)^2$.

2.5. Exercise Test and VO_{2max} Determination

Upper body strength was assessed by having the participant perform a maximum handgrip test, using a Takei Hand-grip Dynamometer. Maximal isometric strength of the knee extensors was determined using a TORNVAL chair. With arms folded across the chest subject performed three maximal efforts attempting to extend the knee against the restraining limb attachment. Each trial was separated by a 60 seconds rest period. The highest force recorded in the three trials was taken as maximum voluntary strength.

Maximum oxygen uptake (VO_{2max}) was estimated from submaximal cycle exercise, using a Lode Excalibur Sport cycle ergometer. For the handgrip test, participants were instructed to grip as hard as they could on the bar of the dynamometer. They used their dominant hand and were tested while standing. They were also allowed to engage in vocal self-encouragement. The highest score from three trials, each separated by a 30-second recovery period, was adopted as the measure of upper body strength measure. The lower body strength was determined using the leg extensor chair (TORNVAL chair) measuring maximum torque achieved by large muscles at the quadriceps and the hamstrings on the dominant leg. The best recording of the three maximum lifts of the legs, each separated by a 60-second recovery period, was adopted as the measure of the lower body strength.

2.6. Data Analysis

Analysis was largely by correlation and regression. The following served as outcome variables: VO_{2max}, grip strength, leg strength, and percentage body fat. After bivariate correlational analyses, significant predictors of outcome were then tested in multiple regression models. In all cases, a stepwise approach was used. Binary variables were analyzed by χ^2. Differences between older and younger participants were tested using t-tests with continuous variables and χ^2 with binary variable. Finally, separate regression models were tested for the younger and older cohorts.

3. Results

The comparisons between these participants and the rest of the sample are summarized in Table 1.

Analysis revealed that these participants engaged in the far less exercise, particularly vigorous exercise than their non-Muslim counterparts. Although groups did not differ in terms of leg strength, the Malaysian Muslim participants registered lower leg strength and lower VO_{2max} values, whether corrected with mass or absolute VO_{2max}.

The groups did not differ in terms of Body Mass Index (BMI), but the Muslim participants were shorter, lighter, and had significantly higher percentage of body fat values. Although the groups did not vary in self-reported general health, with both groups reporting very good health, they did differ in terms of health behaviors.

The Muslim group were far less likely to drink alcohol, but much more likely to be current smokers. They were also more likely to be married, but not more likely to be in paid employment. Finally, they were, on average, older than the non-Muslim participants.

Given that religion or ethnicity and age cohort were confounded, age differences were reexamined considering Muslim and Non-Muslim. This was achieved using analyzed of covariance, with age cohort as the variate and religion as the covariate. The outcomes of these analyses are presented in Table 2. As can be seen, age cohort differences in vigorous and total exercise, VO_{2max}, and leg strength remained even when religion was considered.

4. Discussion and Conclusion

Considered as a whole, the largely student sample in this study spent more (72%) of their exercising time engaged in moderate exercise, such as walking, sport play, and golfing, than vigorous exercise, such as running and competitive sports. Previously, (American College of Sports Medicine, 1995; Weyer, Linkeschowa, Heise, Giesen, & Spraul, 1998) recommended at least 20 minutes of vigorous exercise undertaken at least 3 times per week. Thus, their weekly

Table 1. Summary statistics of the physical characteristics, self-reported exercise behaviors, and fitness measures for the Muslim (tee-total) and Non-Muslim (non-teetotal) participants.

Variable	*Muslim*			*Non-Muslim*				
	N	*Mean*	*SD*	*N*	*Mean*	*SD*	*t*	*p*
Age (years)	72	31.86	7.02	40	26.68	10.09	3.19	0.002
Height (m)	72	1.67	0.06	40	1.77	0.08	7.11	0.000
Mass (kg)	72	69.36	13.30	40	75.86	10.89	2.65	0.009
BMI ($kg \cdot m^{-2}$)	72	24.74	4.27	40	24.33	3.21	0.53	0.60
Moderate Exercise Time (hrs/week)	68	6.65	1.81	40	7.14	1.97	1.30	0.20
Strenuous Exercise Time (hrs/week)	70	1.06	1.26	40	2.65	1.57	5.81	0.000
Competitive Exercise Time (hrs/week)	70	0.64	1.05	40	1.84	1.45	5.01	0.000
Vigorous Exercise Time (hrs/week)	72	1.65	1.81	40	4.49	2.42	6.63	0.000
Total Exercise Time (hrs/week)	68	8.26	2.99	40	11.63	3.05	5.61	0.000
VO_{2max} ($ml \cdot kg^{-1} \cdot min^{-1}$)	68	41.1	11.4	39	55.3	14.9	5.54	0.000
VO_{2max} ($1 \cdot min^{-1}$)	68	2.78	6.36	39	4.13	1.04	0.008	0.000
% body fat	72	20.96	5.76	40	17.80	6.47	2.66	0.009
Leg strength (N)	66	369	105	40	544	139	7.34	0.000
Grip strength (N)	72	442	70	40	453	86	7.75	0.46

	Muslim	Non-Muslim	χ^2	p
Smokers (% current smokers)	42	13	10.49[1]	0.001
Alcohol Consumption (% not tee-total)	1	89	85.71[1]	0.000
General Health (% good/very good)	82	88	0.59[1]	0.44
Marital Status (% single)	39	88	24.69[1]	0.000
Employment (% in paid employment)	43	43	0.003[1]	0.96

[1]For binary variables, the percentage showing the characteristic is presented.

energy expenditures were well above 1000 kcal per week. With regard to moderate exercise, our participants were expending a mean estimated 1958 kcal per week and, in total, were expending an estimated 3665 kcal per week. Clearly, they were, on average, meeting current exercise recommendations for weight loss and health.

Further, the age effects discussed below could be helping deflate the overall estimate for the sample of time spent in vigorous exercise in the current study; it is clear that younger participants in the study spent more than twice as much time engaged in vigorous exercise than the older participants. Whereas the younger cohort was spending the estimated 4447 kcal per week engaged in exercise, for the older cohort, the estimate was 2930 kcal per week. It should be noted, however,

Table 2. Differences between old and young cohorts considering Muslim and Non-Muslim affiliation.

Variable	*F*	*Df*	*P*
Age	260.68	1/109	<0.001
Height	1.27	1/109	0.26
Mass	6.48	1/109	0.01
VO_{2max} corrected with mass	41.23	1/104	<0.001
VO_{2max} absolute	25.64	1/104	<0.001
% body fat	29.22	1/109	<0.001
BMI	11.83	1/109	0.001
Grip strength	5.76	1/109	0.018
Leg strength	12.42	1/103	0.001
Strenuous exercise	7.92	1/107	0.006
Exhaustive exercise	37.09	1/107	<0.001
Time spent in moderate exercise	1.20	1/105	0.28
Time spent in vigorous exercise	21.32	1/109	<0.001
Total time spent in exercising	13.13	1/105	<0.001

that the older members of the present sample were still exercising at well above the recommended minimum levels.

These sorts of difference in physical activity levels are also apparent in the present study. For the non-Muslim members of the sample, the average estimated energy expenditure in physical activity and exercise was 5171 kcal per week, whereas for the Muslim participants, it was 2877 kcal per week. Again, however, this latter figure is still above the recommended exertion levels. While there is consistent evidence that leisure exercise is protective of health and is associated with reductions in premature death, particularly from coronary heart (Lee & Paffenbarger Jr., 2000; Carnethon, Sternfeld, Schreiner, Jacobs, Lewis, & Liu, 2009), there is still debate about the necessary intensity required to gain such benefits. It remains possible that reductions in risk for coronary heart disease require reasonably vigorous exercise. This is what is reported from a recent analysis of the Caerphilly study data (Yu, Yarnell, Sweetnam, & Murray, 2003). The present participants were, on average, spending 1707 kcal per week on vigorous exercise, which clearly falls within the range apparently required to gain this benefit.

Muslim participants in the present study had lower estimated VO_{2max} values of 41 $ml \cdot kg^{-1} \cdot min^{-1}$ than the rest of the cohort, who had an average value of 55 $ml \cdot kg^{-1} \cdot min^{-1}$, indicative of good levels of fitness. (Singh, Singh, & Sirisinghe, 1989) reported that VO_{2max} values for Malaysian healthy men age 13 until 59 years varied with age in systematic manner. Based on the formula developed to determine VO_{2max} value; VO_{2max} value ($ml \cdot kg^{-1} \cdot min^{-1}$) = 67.7 - 0.77 (age), participants with an age mean of 31.86 years would register a VO_{2max} value of 43.2 $ml \cdot kg^{-1} \cdot min^{-1}$ which is very much similar to this study's VO_{2max} value of 41 $ml \cdot kg^{-1} \cdot min^{-1}$ for our sample of Malay Muslims. However, it is likely that the differences in VO_{2max} found in the present study reflected differences in physical activity levels rather than genetic variations. (Bouchard & Rankinen, 2001) concluded from a review that ethnic variation was little involved as a determinant of physiological adaptations to regular physical activity. The differences among ethnic groups in terms of aerobic power were small, and when other factors were considered, there was little evidence for genuine ethnic differences in maximum aerobic power (Boulay, Ama, & Bouchard, 1988).

Finally, reported time spent in moderate physical activity at the original, but not the current, assessment appeared to reduce the like hood of a diagnosis of high blood pressure. In addition, those who spent more time in moderate physical activity 23 years earlier were less likely to have at least one of the risk factors for coronary heart disease at current assessment. For the future study, the researcher should do the biggest scope to get the best result with differences gender, carrier, and status.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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