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TITLE: Examining Indices of Cardiometabolic Health and Muscular Strength in Adults of Filipino Descent

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Thesis Proposal—Examining Indices of Cardiometabolic Health and muscular strength in Adults of Filipino Descent

Running head: cardiometabolic health and muscular in adults of Filipino decent

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**Abstract**

**Background:** In the United States, obesity is a public health concern with 35% of the adult population considered obese according to body mass index (BMI) (U.S. Census Bureau, 2020). However, one frequently neglected population is Filipinos, which is a subgroup of the Asian population (Javier JR et al., 2020) and is rarely studied with respect exercise intervention.

**Purpose:** The purpose of this study is to measure maximal oxygen consumption (VO$_2$max), muscular strength, and visceral adipose tissue (VAT) of Filipino adults to better understand their health status and overall health risk for future exercise interventions. **Methods:** 18 (age and BMI = 28.00 ± 9.68 yr and 27.24 ± 6.53 kg/m$^2$) Filipino American Women (N= 13) and Men (N= 5) completed 2 laboratory-based test sessions. Filipino was classified by a self-report from each participant identifying at least 1 parent as Filipino. Session 1 included assessment of VAT using DEXA followed by progressive cycling to assess VO$_2$max. Power output began at 30 – 40 W for 5 min followed by 15 – 20 W/min increments in work rate every 4 min until fatigue. Subjects returned 4 – 7 d later at the same time of day, and muscular strength was assessed via isokinetic dynamometry at the knee joint using 1 set of 5 repetitions at 30 deg/s. **RESULTS:** Mean VO$_2$max and peak power output were equal to 30.56 ± 3.87 mL/kg/min and 186 ± 22 W, respectively. Mean VAT 3.4 ± 2.6 cm$^3$ and mean visceral adipose tissue was 28.7 ± 7.0 kg/m$^2$. Knee extension and flexion torque was equal to 154.05 ± 51.69 and 51.69 ± ft/lb, respectively. **CONCLUSION:** These data acquired in this small convenience sample document low VO$_2$max, high BMI and %BF, and low fat oxidation in Filipino adults. Additional studies are needed to confirm the validity of these findings so that more precise exercise training strategies may be implemented in this population to improve their health outcomes and reduce potential risk of chronic disease.
Key words: intermittent exercise; anaerobic threshold; peak power output; cardiorespiratory fitness; individual responses; Filipino American; Health disparities; Epidemiology

Abbreviations

BLa       blood lactate concentration
CON       control group
HIIT      high intensity interval training
MICT      moderate intensity continuous training
PPO       peak power output
SIT       sprint interval training
TE        typical error
VT        ventilatory threshold
VO_{2max} maximal oxygen uptake
Epi       Epidemiology
In the United States, obesity is a public health concern with 35% of the adult population considered obese according to body mass index (BMI) (U.S. Census Bureau, 2020). Obesity increases the risk for all-cause mortality (Flegal et al., 2013) and there are data showing that non-Caucasian adults, including Hispanics and non-Hispanic African Americans, face greater health disparities from obesity (Byrd et al., 2018) and social risk factors such as education, household income, marital status, chronic stress, harassment/discrimination, and health-related beliefs (Gordon NP et al., 2020). However, one frequently neglected population is Filipinos, which is a subgroup of the Asian population (Javier JR et al., 2020) and Since 1960, the number of Filipino Americans (FA) living in the U.S. has exponentially grown (U.S. census bureau, 2020). FA’s are the second largest Asian subpopulation in the United States (U.S. Census Bureau, 2020) with this classification including individuals primarily coming from, the Philippines, Japan and China.

One effective strategy to improve individual and population health is regular physical activity (PA). In fact, the American College of Sports Medicine (ACSM, 2018) recommends that adults perform 150 min/wk of MICE combined with 2 – 3 d/wk of resistance training. An alternative to MICT is high intensity interval training (HIIT), defined as repeated, brief, and intense exercise bouts separated by active recovery. It is apparent that HIIT elicits significant increases in VO2max (Daussin et al., 2008) and fat oxidation (Astorino et al., 2014) in turn improving exercise capacity and reducing health risks. However, only 25% of self-reported adult respondents in the U.S. met both aerobic and muscle strengthening guidelines (CDC, 2022). Despite the well-documented benefits of exercise training, many at risk individuals do not participate in physical activity citing lack of time as the largest barrier (Reichert et al. 2007). This low level of participation in PA has implications for morbidity and mortality, as cross-sectional studies (Kodama et al., 2009 and Myers et al., 2002) show that cardiorespiratory fitness (CRF) as determined through maximal oxygen uptake (VO2max) is related to health status and risk of cardiac events. Furthermore, data show that diabetes rates are higher for Asian Americans than for Caucasians (King et al., 2012). For instance, diabetes incidence among older Asians is increasing faster than in many other racial groups (McBean., 2004). In one study, the adjusted diabetes prevalence rates for Asians aged 67 years or older increased 68.0%, from 144 per 1,000 to 243 per 1,000, over a 7-year period; this was the greatest increase among all racial/ethnic groups studied (McBean et al., 2004). Disparities in diabetes-related complications are also seen for FA compared with Caucasians (King et al., 2012 and Kanaya et al., 2011). This disparity is
concerning due to the strong association between type II diabetes and elevated risk of CVD and premature mortality (CDC, 2020). Chronic disease is the leading cause of death and disability in the U. S. (CDC, 2020) and contributes greatly to the 3.5 trillion-dollar annual health care cost which 90% is preventable (CDC, 2020). Yet, the burden of chronic disease amongst adults living in the U. S. is not equally shared, as specific groups experience greater health disparities than others. Low levels of cardiorespiratory fitness (VO2max) and a high percentage of body fat (%BF) are risk factors for diabetes, hypertension, dyslipidemia, and CVD (Kannel et al., 1991; Abate 2000; Kodama et al., 2009) which increases risk of morbidity and mortality (Katzmarzyk et al., 2004). Yet, to our knowledge no study has been conducted outside of high blood pressure and cardiovascular related issues in FA, that would prevent this increased risk for all-cause mortality.

Another consequence of low levels of physical activity is poor muscular strength (Rantanen et al. 1992) which is an independent risk factor for diabetes and cardiovascular disease (CVD) (Shiroma et al. 2017) as well as all-cause mortality (Rantanen et al. 2000). Obesity is a preventable condition commonly combated by diet and exercise interventions (Pi-Sunyer et al., 1998). One study using the WHO Asian BMI cut-off points showed that FA overweight/obesity rate (78.6%) was higher than non-Hispanic whites (53.8%), African Americans (64.9%), and Hispanics (69.7%) (Jih et al., 2014) despite the adjusted cut off points which may be attributed to poor diet, lack of exercise, behavioral and cultural factors (Jensen et al., 2017). However, It must be noted that the majority of prospective studies investigating the effect of physical activity dose (exercise interventions) on all-cause mortality have been performed in mostly males of European descent (Gill et al., 2013) which adds to existing health disparities and results may not be generalizable to FA populations. Interestingly, one prominent study demonstrates that the trainability of VO2max is highly familial and includes a significant genetic component with differences of up to 50% in VO2max response (Bouchard et al., 1999). Additional research is needed to examine this relationship to better quantify health status within different ethnic populations.

Therefore, it is necessary to measure VO2max, VAT, and muscular strength in different populations other than non-Hispanic white Caucasian males to investigate effective strategies. It is anticipated that the results will better inform scientists of this population’s exercise capacity
and potentially encourage clinicians to assess chronic responses to time effective exercise training regimes. Due to the high rate of obesity in this population, we hypothesize that there will be below average to average VO2max and muscular strength and high presence of VAT.

Methods

Study design

A within-subjects design requiring two separate visits to the laboratory 4 – 7 d apart was utilized in this study. A total of 2 sessions was completed in the laboratory. On day 1, VAT and VO2max was assessed while day 2 assessed muscular strength. On both days, participants arrived at the laboratory in exercise attire and were hydrated and well-rested. Time of day of assessment was standardized between subjects. In addition, subjects abstained from intense physical activity for 24 h before each session and arrived 3 h post-meal.

Participants:

FA women (N =13) and FA men (N =5) were recruited via word of mouth, email announcements, and flyers that were placed around various approved locations. Inclusion criteria included adults 18-50 years old; body mass index (BMI) <35kg/m²; ≤ 2 pre-existing health conditions, no use of any medications that altered metabolism; weight-stable for 3 months, and no injuries that may have had adverse effects on exercise performance. Participant ethnicity was classified by self-report and Filipino was classified as an individual who self-identified at least 1 parent as Filipino. Each participant completed a physical activity and health history questionnaire before initiating this study. Written informed consent was obtained from participants before initiating the study and procedures were approved by the University Institutional Review Board.

Body composition and Maximal Oxygen Uptake

On day 1, Dual-energy X-ray absorptiometry (DXA) was used to assess the VAT of participants (GE Lunar Prodigy, GE Corp). Participants reported to the laboratory in the morning approximately 8-12 hrs after their last meal in a hydrated state to standardize the testing conditions. Then, participants had their height and weight recorded. Subjects then laid supine
while a full-body scan was conducted. All scans were performed by a trained and licensed technician and all scans were processed using the same software for assessment of visceral adipose tissue (GE CoreScan v. 17, GE Lunar Corporation, Madison, WI, USA).

To assess VO2max, participants performed a progressive exercise test to volitional exhaustion on an electronically braked cycle ergometer (Velotron DynFit Pro, Quarq, Spearfish, SD). Power output began at 20-30 W for 5 min and was increased by 10 – 15 W/min in a step like manner until respiratory exchange ratio (RER) was greater than or equal to 1.0. At this time, work rate was increased 10 – 15 W/min until volitional exhaustion. Oxygen uptake, (VO2), Ventilation (V_e), Carbon dioxide production (VCO2) and respiratory exchange ratio (RER) was acquired every 15 sec with a metabolic cart (ParvoMedics TrueOne, Sandy, UT) which was calibrated prior to assessment according to the manufacturer’s recommendations. Heart rate (HR) was continuously measured via telemetry (Polar Electro, Woodbury, NY). Maximal oxygen uptake was determined as the mean of the two highest consecutive values within the last three values of the test. Verbal encouragement was given throughout the test. Peak power output (PPO) was identified as the work rate consistent with volitional fatigue, which was identified as when the pedal cadence dropped below 50 rev/min.

Gas exchange data (VO2, VCO2, and RER) was used from the last minute of each stage prior to attainment of RER = 1.0 to determine fat and CHO oxidation at each intensity. In addition, ventilatory threshold (VT) was determined using gas exchange data acquired during the graded exercise test. To validate ventilatory threshold, two experimenters independently examined plots of change in the ventilatory equivalents of oxygen and carbon dioxide (VEVO2 and VEVCO2) versus time, using the criteria developed by Caiozzo et al. (1986) of “the time at which VEVO2 exhibited a systematic increase without a concomitant increase in VEVCO2.” If disagreement occurred between experimenters, a third researcher was consulted. This value was expressed in watts as well as a percentage of PPO and HRmax. To estimate changes in time trial performance, cycling time (seconds) and mean power output (in watts) was recorded.

Assessment of muscular strength

On day 2, participants completed a 5 min warm up of cycling at a light intensity on the cycle ergometer (Monark, 828 E, Sweden) before muscular strength testing using an isokinetic
dynamometer (Biodex system 3, Shirley, NY). A series of straps were placed across the trunk, abdomen, and exercising limb and range of motion of the knee was set. Participants performed one “all-out” set of five repetitions at 60 deg/s with their dominant leg to determine peak knee extension (KE) and peak knee flexion (KF) torque. The coefficient of variation in torque at this velocity was 1% (Drouin et al. 2004). Verbal encouragement was given throughout the test.

*In this study, the term Filipino denotes any U.S. resident originating from any of the original peoples of the Philippine Islands.

Data analysis

Data was expressed as mean ± SD and was analyzed using SPSS 24.0 (Chicago, IL). Statistical significance was set at p < 0.05.

Results

A total of 18 test subjects participated but 1 test subject failed to meet the BMI inclusion criteria therefore our Valid N=17. Mean baseline measurements for VO₂max and peak power output were equal to 30.56 ± 3.87 (N = 17) mL/kg/min and 184.33 ± 46.67 (N = 15) W, respectively. Mean VAT, BF%, and BMI were equal to 3.67 ± 2.47 kg (N = 13), 31.17 ± 7.99 % (N = 17), and 27.10 ± 6.12 % (N = 17). Knee extension and flexion torque was equal to 212.55 ± 75.23 Nm (N = 17) and 114.57 ± 45.71 Nm (N = 17), respectively.
Table 1. Descriptive characteristics of the participants

<table>
<thead>
<tr>
<th>Parameter (units)</th>
<th>Mean ± SD (N=#)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>27.94 ± 9.97 (N = 17)</td>
<td>18-50</td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td>5 : 12 ±(N = 17)</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>160.87 ± 7.92 (N = 17)</td>
<td></td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>71.00 ± 20.81 (N =17)</td>
<td></td>
</tr>
<tr>
<td>BMI (%)</td>
<td>27.10 ± 6.12 (N = 17)</td>
<td>Overweight – BMI greater than or equal to 25 to 29.9</td>
</tr>
<tr>
<td>BF (%)</td>
<td>31.17 ± 7.99 (N = 17)</td>
<td></td>
</tr>
<tr>
<td>VAT (kg)</td>
<td>3.67 ± 2.47 (N = 13)</td>
<td></td>
</tr>
<tr>
<td>KEt (N*m)</td>
<td>212.55 ± 75.23 (N = 17)</td>
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<tr>
<td>KFt (N*m)</td>
<td>114.57 ± 45.71 (N = 17)</td>
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<tr>
<td>PPO (W)</td>
<td>184.33 ± 46.67 (N = 15)</td>
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<tr>
<td>MHR (BPM)</td>
<td>173.67 ± 18.02 (N = 12)</td>
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</tr>
<tr>
<td>VO2MAXrel (mL/kg/min)</td>
<td>30.56 ± 3.87 (N = 17)</td>
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</table>

Discussion

This study expanded existing empirical data in a population underrepresented in scientific literature related to exercise capacity. Overall, this studies main outcomes, VO2max, VAT, and muscular strength in a small group of FA suggest poor health outcomes related to chronic disease prevention. This would provide clinicians and researchers a foundation to create and test exercise interventions known to lower all cause mortality risk for CD. CVD remains the leading cause of death in FA and hypertension is the single greatest heart disease risk, particularly in women after menopause, to this population. Overweight and obesity are major risk factors for hypertension and is disproportionately prevalent in this population. research has reflected this concern but appears to be inadequately addressing this disease. To our knowledge, this is the first study to record the VO2max, muscular strength, and VAT in the FA population.

Our FA population, using the WHO Asian BMI cut off points, revealed to be in the overweight/obese category and may explain why VO2max and peak power output was low. A
Rancho Bernardo study compared BMI and VAT and despite similar BMI, Filipinas had the highest volume of VAT, when compared to non-Hispanic white and African American women. The majority of observational studies support that BMI is not comparable across different ethnic groups and may underestimate ethnic differences highlighting the need to use standardized cut off points with this population. This can be seen in a study by Ursua et al. who used both international guidelines and the WHO Asian BMI cut off points in a Filipino population in the New York area. The international guidelines showed that 48.4% of participants had normal BMI and 51.6% were overweight/obese. Whereas when the WHO guidelines were implemented, 25.5% of participants had normal BMI and 74.5% were overweight or obese. Furthermore, FA’s have been found to have significantly higher visceral adiposity than Caucasians and African Americans thus, knowing the aptitude of the fitness level in this population is critical. Aerobic exercise of moderate to vigorous intensity are shown to have a greater effect on VAT than low intensity aerobic exercise or strength training. In fact, a systematic review and meta-analysis that investigated the effect of exercise without diet on visceral adipose tissue in overweight and obese and found there to be a strong association between VAT and increase risk for CD (Mathieu et al. 2010; Ritchie et al. 2007) independent of weight reduction (shaw et al. 2006). In the HERITAGE family study, trainability of VO2max was highly familial and included a significant genetic component (47%) in response to exercise. Another study in non-Hispanic Whites, Hispanics, and Asians, found BMI to be significantly associated with obesity (McEligot et al., 2021) and Fitness parameters such as VO2 max, % body fat were significantly associated with obesity ( McEligot et al., 2021). Overall, our results show that our overweight FA population is at a high risk for obesity and may benefit from high-intensity interval training regimes. HIIT is seen to increase cardiorespiratory fitness and body composition in women with obesity yet have no effect on muscle force production or body weight. Studies beyond acute results may be needed to see if HIIT increases muscle force with longer periods of HIIT intervention. These data apply to clinicians who implement exercise regimes in individuals who are overweight or at risk for Class I obesity. It is apparent that low VO2max and obesity are associated with increased risk of chronic disease (Abate 2000; Field et al. 2001). Nevertheless, studies show that HIIT increases cardiorespiratory fitness in persons with class I and II obesity (Kong et al. 2016; Vella et al. 2017) which may lead to decreased risk of chronic disease (Kodama et al. 2009). A 20% increase in VO2max was shown in response to 8 weeks of HIIT at 90–95%HRmax in adults with
BMI=36 kg/m² (Sawyer et al. 2016). Lanzi et al. (2015) reported an 11% increase in VO₂max after 8 HIIT sessions at 90%HRmax in men with class II and III obesity. In a randomized-controlled trial in overweight patients with metabolic syndrome, something prevalent in the FA population, a 35% increase in VO₂max was observed in response to 16 weeks of high-volume HIIT consisting of four 4 min intervals at 90%HRmax (Tjonna et al. 2008). However, the differences in overall intensity of training should be considered for these responses and utilize the same protocol in future studies with different ethnic homogeneous populations.

Results from a previous study in overweight and obese men and women (%BF=32.7±6.5%) showed that nine sessions of HIIT increase muscle cross-sectional area by 14% (Blue et al. 2018). However, some studies reported no change muscular strength in response to HIIT possible because the neuromuscular stimulus may being inadequate to increase muscular strength. Considering the relationship between muscular strength and mortality (Rantanen et al. 2000), a maintenance of this outcome through any intervention, including HIIT, could be viewed as a favorable response especially in an inactive population, and we encourage other authors to identify exercise-based approaches to enhance muscle strength which are practical and effective in this at-risk population.

Overall, VO₂max and PPO was low and accompanied with high VAT and low muscular strength. Further studies should investigate the utility of different regimens of high-intensity interval training to determine if a single HIIT protocol can modify VO₂max, body composition, and muscular strength in a representative FA population, due to their relationship to health status. In addition, researchers should utilize the same cut off points when looking at overweight and obesity, as their physiological responses may differ from those who are overweight or slightly obese.

**Conclusion**

Despite comprising a large and ever-growing component of the U.S. population, individuals of Filipino descent are rarely included in empirical studies examining health and fitness status in adults. This gap exists despite existing data showing that they exhibit significantly higher rates of hypertension than other groups which is deleterious to their health status as it poses a primary
risk factor for CVD (Kataoka-Yahiro et al., 2020). This cross-sectional study measured various indices of cardiometabolic health to establish a comprehensive health profile for these adults who face elevated risk of chronic disease. Failure to characterize the activity and dietary patterns of different ethnic populations may lead to poor uninformed public health policies aimed to promote and sustain a healthy and active lifestyle.

**Challenges and Limitations**

Because completing two laboratory sessions may have been burdensome for some adults, we are offered an incentive equal to $50.00 for their time. Also, results may not be generalizable to adults over the age of 50 or for those with more than 2 risk factors for CVD. Moreover, these results may have poor external validity to adults who are 25% Filipino or those with known disease.
References:


US Census Bureau. Annual estimates of the resident population by sex, race alone or in combination, and Hispanic origin for the United States, states, and counties: April 1, 2010, to


