

The Association between Flow-Mediated Dilatation and Physical Function in Older Men

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ABSTRACT

WELSCH, M. A., D. A. DOBROSIELSKI, A. A. ARCE-ESQUIVEL, R. H. WOOD, E. RAVUSSIN, C. ROWLEY, and S. M. JAZWINSKI. The Association between Flow-Mediated Dilatation and Physical Function in Older Men. *Med. Sci. Sports Exerc.*, Vol. 40, No. 7, pp. 1237–1243, 2008. The probability that an individual is able to live independently decreases sharply below the threshold score of 57 units on the physical functional performance (PFP-10) test. **Purpose:** To examine the relation between brachial artery flow-mediated dilatation (BAFMD) on individual and total scores on the PFP-10. We hypothesized that lower scores on the PFP-10 test would be associated with lower BAFMD. **Methods:** Sixty-four men (age, 84 ± 11 yr) from the Louisiana Healthy Aging Study were studied. Participants were classified by their performance on the PFP-10 test (Class I, score <26; Class II, score between 26 and 57; and Class III, score > 57). BAFMD was assessed after 5 min of forearm occlusion, using high-resolution ultrasonography. **Results:** The average total score on the PFP-10 test and BAFMD were 42.9 ± 22 U and 2.76 ± 2.13%, respectively. The BAFMD was associated with total PFP-10 score ($r = 0.45$, $P = 0.0001$) and age ($r = -0.36$, $P = 0.003$). BAFMD was significantly different ($P = 0.001$) between the PFP-10 classes (Class I, 1.44% [95% CI, 0.49–2.39]; Class II, 2.67% [95% CI, 1.95–3.38]; and Class III, 4.01% [95% CI, 3.16–4.85]). **Conclusions:** This study reports significant relationships between BAFMD and individual and combined measures of physical function in elderly men. More specifically, when individuals were categorized based on their PFP-10 total score, those in the highest functional class, exhibited the highest BAFMD, compared to those in the middle class, who had greater vasoreactivity than those in the lowest functional class. **Key Words:** AGING, FUNCTIONAL ABILITY, VASCULAR FUNCTION, CS-PFP-10

Advancing age is associated with a progressive decline in aerobic capacity (14) which may contribute to a loss of independence and ultimately result in functional disability (1). Recently, Cress and Meyer (7) examined the relationship between aerobic capacity ($\dot{V}O_{2peak}$) and a measure of physical function using the continuous-scale physical functional performance test (CS-PFP-10) in a group of community-dwelling older adults. The authors identified a threshold score thought to accurately predict the risk for losing independence. This score of 57 on the CS-PFP-10 was associated with a $\dot{V}O_{2peak}$ of 20 mL·kg⁻¹·min⁻¹. For those whose functional scores fell below this threshold, a steeper decline in physical function and a heightened risk of losing independence was noted with only a moderate decrease in aerobic capacity (7).

A decline in aerobic capacity with advancing age is, in part, a consequence of changes in vascular conductance thought to limit blood flow distribution to skeletal muscle (21). Recent evidence indicates that a major factor involved in the reduction of vascular conductance is a progressive decrease in endothelial-dependent vasodilation (17). The reduced capacity of large conduits and resistance vessels to dilate may contribute to a reduction in muscle blood flow and ultimately limit the ability of older adults to perform functional tasks. Importantly, a decline in endothelial function has also been implicated in the pathogenesis of atherosclerotic lesions (32). Consequently, understanding how to preserve endothelial function may provide important clues in regards to the retention of physical function, and perhaps the manner in which atherosclerosis can be controlled.

A popular clinical tool to assess vascular function is the brachial artery flow-mediated dilatation (BAFMD) technique. Typically, a diminished flow-mediation dilatation response of the brachial artery has been interpreted as indicating poor functionality of the endothelium and possibly an increased risk of vascular disease or cardiac events (3,27). Recognizing there is considerable debate concerning several technical (e.g., the role of the shear stimulus on the BAFMD response) (27) and interpretive issues (e.g., Is BAFMD a reflection of nitric oxide-mediated dilatation?) (18,33) associated with the BAFMD technique, it is important to appreciate that there is an apparent link between the vasoactivity of the brachial

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artery and the coronary arteries (3,32). Thus, the BAFMD technique is thought to represent a "barometer" of cardiovascular disease risk (5). To that extent, older individuals or those with cardiovascular risk factors generally have a diminished BAFMD, whereas those who are physically fit have higher BAFMD responses (28,29). Lastly, exercise training improves vascular reactivity of the brachial artery in a variety of populations indicating the plasticity of the vasculature (19).

Interestingly, the association between vascular reactivity and objectively measured physical function in the elderly is not clear. Examining such a possible link may eventually lead to a greater understanding of the role of vascular reactivity in preserving physical function in the elderly. For example, the role of vascular reactivity may be particularly important in the transition from rest to activities of daily living or for the continuation of such activities, by ensuring adequate muscle blood flow. Accordingly, the purpose of the present investigation was to examine the relationship between BAFMD and performance on the 10-item CS-PFP-10 in older adults. We hypothesized that those individuals with lower BAFMD would have lower PFP-10 scores.

METHODS

Participants

Individuals 60 yr of age or older, enrolled in the Louisiana Healthy Aging Study, were eligible to participate in this study. Sampling of potential participants for the Louisiana Healthy Aging Study was based on a population-based sampling design strategy that included Medicare Beneficiary Enrollment data provided by the Center for Medicare and Medicaid Services. Potential subjects were subsequently recruited from a 40-mile radius from the Pennington Biomedical Research Center in Baton Rouge, Louisiana. Exclusion criteria for the present study included current smokers, individuals scoring below 25 on the minimal status exam (16), and individuals in American Heart Association Class D (i.e., symptoms of cardiovascular and/or metabolic disease at rest). Each participant signed an informed consent approved by the institutional review boards of the Pennington Biomedical Research Center, The Louisiana State University Health Sciences Center, and The Louisiana State University and Agricultural and Mechanical College.

Measurements

Vascular assessment. All brachial artery imaging was conducted by the same sonographer using a Toshiba Powervision SSA-380A in accordance with the guidelines set forth by the Brachial Artery Reactivity Task Force (5). Specifically, investigations were conducted at least 4 h after medication use in a quiet temperature-controlled laboratory. Participants were instructed to avoid tobacco products and to fast for 12 h and avoid exercise for 24 h before the

testing procedures. Brachial artery ultrasound measures were obtained with participants in the supine position using a 7.5-MHz linear array transducer before, during, and after 5 min of forearm occlusion. Baseline ultrasound images were obtained after 20 min of supine rest. All images were obtained in the longitudinal view, approximately 4 cm proximal to the olecranon process, in the anterior/medial plane. Image depth was initially set at 4 cm, and gain settings were adjusted to provide an optimal view of the anterior and posterior intimal interfaces of the artery and kept constant throughout. The arm of the participant was immobilized and slightly supinated. Forearm occlusion consisted of inflation of a blood pressure cuff, positioned approximately 1 cm distal to the olecranon process, to at least 50 mm Hg above systolic pressure for 5 min. Images were obtained at rest and continuously from the final 30 s of occlusion until 5 min after the release of the blood pressure cuff. In addition, blood pressure and heart rate were monitored throughout the imaging process. All ultrasound images were recorded on compact discs for subsequent analysis.

Resting and peak brachial artery flow velocity measurements were obtained using a pulsed Doppler signal at an angle of approximately 60° to the vessel. Resting velocities were determined after the initial 10 min of supine rest. Peak brachial artery flow velocity was assessed immediately after the release of the blood pressure cuff.

All data were analyzed by the same technician using the Brachial Imager software (Medical Imaging Applications, LLC). Arterial diameters were calculated as the mean distance between the anterior and posterior wall at the blood vessel interface, with the image in diastole, defined as the peak of the *r*-wave. Base diameter was defined by the average of 30 s of data obtained after 10 min of resting conditions. Peak dilation was defined (by visual inspection of the arterial diameter curve) as the largest diameter after the release of the occluding cuff. Its value was calculated by the average of 10 images (5 s) surrounding this highest observable peak. The reproducibility of this technique in our laboratory has yielded average mean differences in brachial artery diameter change for days, testers, and readers of 1.91%, 1.40%, and 0.21 mm, respectively, with intraclass correlation coefficients of 0.92, 0.94, and 0.90, respectively (35).

Flow velocity profiles were obtained at rest and immediately after release of the blood pressure cuff. From each velocity profile, the flow velocity integral (FVI) (cm) was manually traced, using Image Pro 4.0 software. The FVI was then divided by the ejection time (s) from that cardiac cycle to subsequently determine the mean velocity ($\text{cm}\cdot\text{s}^{-1}$). At rest, the average of three velocity profiles was used to calculate resting mean velocity (V_{meanrest}). Within 10 s of cuff deflation, an average of three velocity profiles was used to calculate mean hyperaemic velocity ($V_{\text{meanhyper}}$). The vessel radius (cm) at rest and immediately postocclusion was used in the equation, $(V_{\text{mean}} \times \text{heart rate}) \times \pi r^2$ to calculate mean

TABLE 1. Participant characteristics.

	Mean ± SD
Age (yr)	84 ± 11
Height (cm)	172 ± 8
Weight (kg)	80.8 ± 13.9
BMI	27.2 ± 3.8
Systolic blood pressure	141 ± 20
Diastolic blood pressure	78 ± 10
Pulse pressure (mm Hg)	63 ± 17
Resting heart rate (bpm)	66 ± 10

n = 64 men.

blood flows ($\text{mL}\cdot\text{min}^{-1}$) at rest and hyperemia, respectively. Finally, the mean wall shear rate upon release ($V_{\text{meanhyper}}/\text{diameter}$) was calculated according to recently published findings (9).

Physical function assessment. The PFP-10 was used to assess physical functionality. The scale has been validated elsewhere (8) and is based on the performance of 10 activities of daily living performed at a maximal effort that is safe and comfortable for the individual. Participant instructions and measurement protocols were standardized. Tasks are scored based on data collected on older adults with a wide range of abilities (8). The type of task performed determines whether it is quantified by time, distance, or weight carried. For instance, carrying groceries is quantified by both weight and time, whereas transferring laundry from a washer to a dryer is quantified by time alone. Five separate physical domain scores are averaged to yield a total score between 0 and 100. The physical domains assessed include, upper body strength, lower body strength (LBS), upper body flexibility (UBF), balance and coordination, and endurance.

The final assessment of the PFP-10 consisted of a 6-min walk test conducted in an internal hallway, 40 m in length. This test of exercise tolerance is a useful, simple, noninvasive alternative for assessing physical activity in many patient populations. Participants were instructed to walk up and down the hallway and to cover as much distance as possible in the 6-min period. The participants were asked to report chest pain, marked dyspnea, or other symptoms. To standardize the protocol, the participants were not coached during the test, but were made aware of time remaining to completion. Details regarding the scoring of the PFP-10 and tasks performed on this test have been published elsewhere (6).

Statistical Analyses

Statistical analyses were performed using SPSS for Windows (version 11.0). Data are presented as means and SD. To examine the associations between BAFMD, age, and the PFP-10 scores, Pearson correlation coefficients were calculated. To further examine the influence of BAFMD on physical function, an ANCOVA was used to compare participants classified as low (below 25), moderate (between 25 and 57), and high (above 57) on the PFP-10 test. The rationale for this classification is based on the probability of independence graph developed by Cress and

Meyer (7). In that study, individuals who scored above the threshold score of 57 were classified as independent, those who scored below 26 rated themselves as limited in physical function, leaving the middle group as a possible "at risk" population. Significance was tested at the 95% confidence level ($P \leq 0.05$).

RESULTS

Participant characteristics. Sixty-four (age, 84 ± 11 yr) men completed all facets of the study. The characteristics of these individuals are presented in Table 1. Twenty percent of the participants were between 61 and 70 yr, 34% between 71 and 90 yr, and nearly 46% over the age of 90. Nearly 45% of the participants were classified as having stage I hypertension from their systolic blood pressure. Only 5% of the study population was considered hypertensive from their diastolic pressure. The average BMI for the group was 27 ± 3.85 U, with approximately 77% of the individuals above the average category for 60 to 79 yr. Importantly, many of the participants in the current study suffered from several chronic diseases (e.g., cardiovascular disease, cancer, and arthritis). In particular, approximately 30% of participants had evidence of coronary artery disease (myocardial infarction [16%] and coronary artery bypass [14%]). Consequently, a high number of participants were taking vasoactive agents including antihyperlipidemics (38%), ACE inhibitors (17%), and alpha-adrenergic blockers (20%).

Brachial artery diameters, reactivity, and blood flow. The brachial artery diameters, reactivity, and blood flow responses for the participants are presented in Table 2. The average brachial artery diameter at rest during diastole was 4.67 ± 0.60 mm and increased to a peak diameter of 4.79 ± 0.60 mm within 45 to 90 s after cuff release. The average percent change (BAFMD) for the entire group was 2.76%, ranging from -0.92% to 7.97% . The BAFMD was significantly related to age ($\text{BAFMD} = -0.06x + 8.18$ yr; $r = -0.36$, $P = 0.003$).

The average preocclusion blood flow was approximately 68 ± 45 $\text{mL}\cdot\text{min}^{-1}$, and increased to 595 ± 301 $\text{mL}\cdot\text{min}^{-1}$ immediately postrelease. Estimated mean wall shear rate during peak hyperemia was 130 ± 71 s^{-1} . The association between the estimated mean wall shear rate and BAFMD was highly significant ($\text{BAFMD} = 0.02x + 0.77$; $r = 0.51$, $P = 0.0001$). Importantly, there was no significant association between the estimated mean wall shear rate and age ($r = -0.19$, $P = 0.13$).

TABLE 2. Brachial artery diameters, BAFMD, and blood flow parameters.

	Mean ± SD
Brachial artery resting diameter	4.64 ± 0.61
Brachial artery peak diameter (mm)	4.79 ± 0.60
BAFMD (% change)	2.76 ± 2.13
Blood flow at rest ($\text{mL}\cdot\text{min}^{-1}$)	68 ± 46
Hyperemic blood flow ($\text{mL}\cdot\text{min}^{-1}$)	595 ± 301
Mean wall shear rate at hyperemia (s^{-1})	130 ± 71

n = 64 men.

TABLE 3. Individual and total PFP-10 scores.

	Mean	SD	Range
Upper body strength	41.84	25.13	84.8
Upper body flexibility	54.33	23.28	99
Lower body strength	38.44	23.68	82.1
Balance/coordination	41.56	22.33	92.5
Endurance	43.72	23.82	93.7
Maximum walking distance (m)	369	143	590
CS-PFP total score	42.91	22.75	86

n = 64 men.

Physical function scores. The individual and total scores for the PFP-10 are presented in Table 3. With respect to the domain scores for the PFP-10, the average upper body flexibility (54 ± 23 U) yielded the highest average score, whereas lower body strength (38 ± 24 U) was the lowest. The distance walked during the 6-min walk test averaged 369 ± 143 m. Thirty-three percent of individuals scored below 300 m on the 6-min walk test. The average score for the Total PFP-10 was 43 ± 23 U, with 16, 28, and 20 participants scoring below 25 U, between 25 and 57 U, and above 57 U, respectively.

Relationships between age, brachial artery diameters, reactivity, and PFP-10 scores. Several statistically significant relationships between BAFMD, age and the individual and total PFP-10 scores are worth noting. Specifically, PFP-10 scores ($\text{PFP-10} = 173.63 - 1.56(\text{age})$; $r = -0.75$, $P = 0.001$) and BAFMD ($\text{BAFMD} = 8.18 - 0.06(\text{age})$; $r = -0.36$, $P = 0.003$) declined with age. Moreover, BAFMD was significantly associated with the Total PFP-10 score ($\text{BAFMD} = 1.19 + 0.04(\text{PFP-10})$; $r = 0.44$, $P = 0.001$) (Fig. 1.). This association remained significant even when age was added to the model ($r = 0.29$, $P = 0.03$). There was no significant association between estimated mean wall shear rate and the total PFP-10 score.

Examination of brachial artery flow-mediated dilation based on PFP-10 classifications in older men. The results of the ANCOVA comparing BAFMD with the PFP-10 classes revealed significant group differences ($P = 0.001$). Specifically, those in Class III (BAFMD, 4.01% [95% CI = 3.16–4.85]) had significantly higher BAFMD than those in Class II (BAFMD, 2.67%

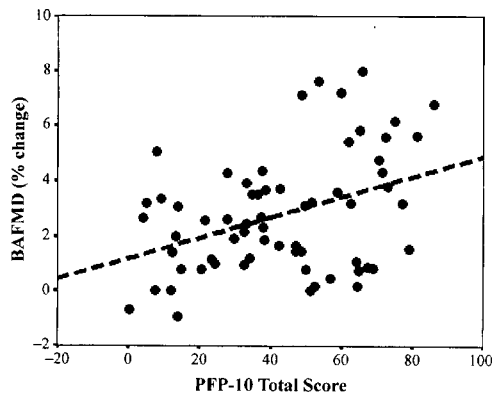


FIGURE 1—The relation between total PFP-10 score and BAFMD in older healthy men.

[95% CI = 1.95–3.38]), who were significantly higher from Class I (BAFMD, 1.44% [95% CI = 0.49–2.39]). These differences are depicted in Figure 2. When age was entered into the model as a covariate, the BAFMD for Class III and Class II were not statistically different from one another, yet both were significantly greater than Class I. Importantly, there were no significant differences for estimated mean wall shear rate and the PFP-10 classes.

DISCUSSION

The aim of the present study was to examine the possible relation between a measure of vascular function and physical performance, as determined by the PFP-10, in elderly men. The study findings indicate significant relationships between BAFMD and individual items as well as the total scores achieved on the PFP-10. More specifically, individuals in the highest functional class, as defined by the PFP-10 total score, exhibited the highest BAFMD, compared to those in the middle class, who had greater vasoreactivity than those in the lowest functional class, independent of age. These findings fit “the disablement process” (34) and suggest that lower physical function may in part be a consequence of deterioration of peripheral vascular function.

Influence of age on brachial artery indices. Aging is associated with alterations in many structural and functional properties of large arteries including diameter, wall thickness, wall stiffness, and endothelial function (23). Consistent with this statement, we also observed a decline in BAFMD with advancing age. This finding confirms work by others (4,20). In fact, the regression equation for BAFMD in this study ($y = 8.18 - 0.06(\text{age})$) is very similar to that reported by Herrington et al. (20).

In contrast, no association between age and brachial artery diameter was noted, as has previously been observed (20). This suggests that the lower BAFMD, in the present study, may indeed be a consequence of changes within the mechanisms associated with the reactivity response rather

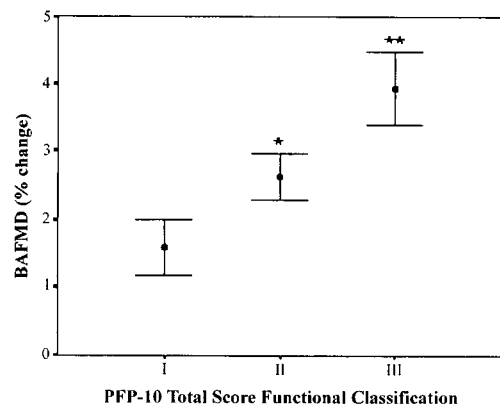


FIGURE 2—Brachial artery flow-mediated dilation per PFP-10 category. axis label: (I) PFP-10 score lower than 26; (II) PFP-10 score 26–57; (III) PFP-10 score higher than 57. *Significantly different from 1; **Significantly different from 1 and 2.

than merely a consequence of differences in vessel size (30). These potential mechanisms include reduced synthesis and/or release of nitric oxide (13) or other endothelial-derived dilators (22). Reduced BAFMD may be the result of increased formation of endothelium-derived vasoconstrictor factors (31) or production of reactive oxygen species (31).

However, we must remain cautious in our speculations regarding possible mechanisms to explain lower BAFMD, as our findings do show a strong relationship between the estimated shear rate at peak hyperemia and BAFMD. This implies that the magnitude of vasoreactivity is dependent on the degree of the shear stimulus (27).

Influence of age on physical function scores. The PFP-10 test measures physical function as it pertains to the execution of a combination of basic and instrumental activities of daily living. Task performance reflects the person's ability as each task is performed at maximal effort within the person's judgment of comfort and safety. Insofar as the PFP-10 scoring system is based on a continuous scale with scores between "0" and "100", the regression of PFP-10 scores against age in the present study ($y = 173.63 - 1.56(\text{age})$) suggests an approximate 1.6% per year decrease in function among adults over 60 yr. This rate of decline in the present subsample of the Louisiana Healthy Aging Study Cohort is representative of the entire study sample to date (36). Of further importance is that examination of the PFP-10 component scores suggests a similar decline across the individual components of the functional tests with age, suggesting that no one particular domain of functional fitness is responsible for lower overall functional performance with advancing age.

Relationship between brachial artery indices and physical function scores. The major focus of this article was to examine the relationship between the brachial artery indices and physical function scores. The data are consistent with the stated hypothesis that individuals with greater BAFMD have higher scores on the physical functional tests independent of age. More specifically, when individuals were categorized based on their PFP-10 total score, those in the highest functional class, exhibited the highest BAFMD, compared to those in the middle class, who had greater vasoreactivity than those in the lowest functional class. Importantly, these findings cannot be entirely explained through differences in estimated mean wall shear rate because the proposed signal for dilation of the artery was similar between the three functional classes. Secondly, even when age was added to the model, a main effect for BAFMD was observed. These findings strongly suggest that alterations in vascular reactivity (defined by BAFMD) may contribute to a decrease in physical function in elderly men. These findings are particularly interesting in light of recent data that clearly indicate that lower cardiorespiratory fitness is a significant predictor of dependence in the elderly (25).

Traditionally, the reason for the decline in cardiorespiratory fitness is ascribed to a reduction in stroke volume, and subsequent reduction in cardiac output for any given

workload (15). Presently, there is accumulating evidence that age-associated changes in local blood flow could have a major impact on functional capacity in the old (21). For example, Poole et al. (26) observed that older men had significantly attenuated leg blood flows during incremental cycle-ergometer exercise compared to younger men. Similarly, basal limb blood flow to the leg was found to be 26% lower and vascular resistance 45% higher in older men compared to younger men despite similar cardiac outputs in the two groups (11). These age-related changes in muscle blood flow could result from age differences in several mechanisms such as an increase in tonic vasoconstriction due to elevated sympathetic nerve activity (24). Alternatively, age-related blunting of endothelium-mediated vasodilation has also been identified as another potential mechanism underlying differences in vascular control (10). Finally, impaired functional sympatholysis observed in older adults may also attenuate blood flow (12) and subsequently influence exercise performance.

The relationship between BAFMD and PFP-10 scores is also intriguing with respect to bridging the gap between pathology and disability within the context of the "The Disablement Process" paradigm (34). This model suggests that disablement begins with some pathology/injury or defect resulting in impairment at the tissue, organ, and/or system level. Cardiovascular disease is well known to influence functionality among older adults, possibly through its effects on cardiorespiratory capacity (and therefore functional reserve) (25). While the present investigation does not include quantification of cardiovascular disease per se, the present data support the use of BAFMD as a measure of impairment that may quantify the influence of cardiovascular disease on functional ability/limitations in older adults.

Another unique finding of the present study is that individuals with PFP-10 scores above the threshold score of 57 had the highest BAFMD in comparison to those with scores below 57. In fact, all but one individual in the lowest functional class had a BAFMD below 4% versus 12 out of

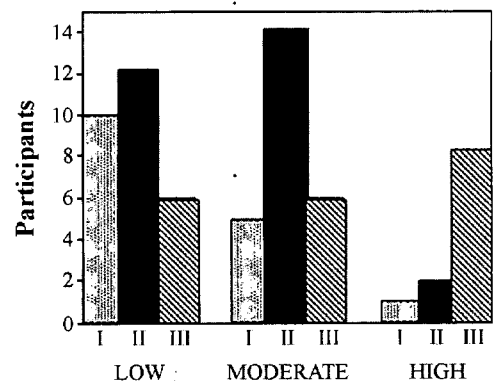


FIGURE 3—Number of participants who are low, moderate, or high BAFMD responders classified according to PFP-10 Category. Axis Label: (I) PFP-10 score lower than 26; (II) PFP-10 score 26–57; (III) PFP-10 score higher than 57. Low responders, less than 2% BAFMD, moderate responders, 2%–5% BAFMD, and high responders, greater than 5% BAFMD.

20 individuals or 60% in the highest functional score exhibiting a BAFMD over 4% (Fig. 3). This is particularly intriguing given the work by Cress et al. (7) who reported that individuals below the 57 threshold were more likely to report functional limitations, and at risk for the need of dependent care. It is also intriguing as it raises the question whether particular attention should be given to those with BAFMD below 5%, as they may be at greatest risk for loss of independence.

Clinical relevance. According to the most recent predictions by the National Institute on Aging, the United States population aged 65 and over is expected to double within the next 25 yr. It is estimated that in 2030, almost 1 out of every 5 Americans—some 72 million people—will be 65 yr or older. Moreover, the age group 85 and older is now the fastest growing segment of the US population. Although, the proportion of older Americans with a disability fell significantly from 26.2% in 1982 to 19.7% in 1999, many are disabled and suffer from chronic conditions. In fact, 14 million people aged 65 and older reported some level of disability in Census 2000, mostly linked to a high prevalence of chronic conditions such as heart disease or arthritis.

Expanding the current knowledge regarding predictors of “healthy” aging is critical in the creation of preventive and compensatory interventions to improve the functional lifespan, thereby reducing the demands placed on families and communities. The results of the present study are clinically relevant insofar as they extend our understanding of the influence of cardiovascular health on functional fitness. In addition to providing clinicians and scientists with information about the severity of cardiovascular disease, measures of brachial artery flow-mediated dilation also have potential to provide a relatively simple and noninvasive approach for identifying individuals at risk of losing independence. Furthermore, from the results of this study, it is hypothesized that interventions such as physical training, aimed at preserving or improving vasoreactivity may compress morbidity and prolong functional lifespan.

Study limitations. We remain cautious in our interpretations considering the limitations inherent to a cross-sectional design. It is also recognized that the lack of longitudinal data regarding vascular status, physical function, and many other important factors that contribute to the “successful” aging of an individual are not accounted

for in the present study. For example, this study does not fully appreciate the possible influence of certain vasoactive agents on the BAFMD response. Our intentions are to continue our efforts along these lines to account for these shortcomings in future studies. However, we do believe that the present observations contribute to the existing literature as it identifies several unique aspects that warrant further discussion and research.

We also recognize our inability to identify possible mechanisms for the changes in BAFMD and the relationship to the functional measures in this population. The lack of a mechanistic approach in the current study prevents more sophisticated speculation regarding the development of possible preventive or compensatory interventions for the elderly. However, given our and other researchers findings that exercise training can improve vasoreactivity (2,10), we hypothesize that physical training interventions may be an excellent way to maintain and/or improve vascular function and contribute to the preservation of functional ability and independence in the elderly. Our efforts along these lines are continuing in our present studies.

CONCLUSIONS

The present study indicates significant relationships between vascular function, defined by brachial artery flow-mediated dilation and individual items as well as the total scores achieved on the PFP-10. More specifically, when individuals were categorized based on their PFP-10 total score, those in the highest functional class, exhibited the highest BAFMD, compared with those in the middle class, who had greater vasoreactivity than those in the lowest functional class. These findings fit “The Disablement Process” and suggest that lower physical function may in part be the consequence of some pathology, injury, or defect in peripheral vascular function, which contributes to functional limitations and ultimately contribute to loss of dependence and disability in the elderly.

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