Social Structure and Intracohort Variation in Physical Fitness Among Elderly Males in a Traditional Third World Society

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This paper examines the relationship between physical fitness and activity among elderly males in the traditional rural community of Chetbesi, Nepal. It takes advantage of the unique character of the Hindu caste system to implement a quasiexperimental research design that approximates random assignment to high and low activity levels. The members of the Sarki caste have lower heart rates and systolic blood pressure, relative to other castes, at each of three submaximal workloads and during recovery from bicycle ergometer exercise. Direct observation and physiologic monitoring show that the Sarkis engage in more frequent and extended periods of heavy labor. Thus intracohort variation in physical fitness and activity patterns among the Chetbesi elderly is a function of birth into a socially defined group rather than of self-selection. This pattern of differential fitness may typify the process of aging in many stratified traditional and modernizing societies where socially delimited segments of the population perform the bulk of the hard work. Intrapopulation differences aside, comparison of Sarkis and non-Sarkis with other samples reveals that both lie within the reported range of variation. The rural, unmechanized, agricultural lifestyle and mountain environment of Chetbesi do not result in exceptional fitness for residents. The Chetbesi data suggest that the popular notion that aging is less debilitating in traditional agrarian societies located in rugged mountain terrains may be a myth. The demonstration of the influence of social forces on physical fitness suggests that future research might concentrate profitably on identifying social structures that produce high levels of physical fitness.
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Identification of lifestyle factors promoting functional capacity in old age is a major goal of gerontological research. One of the most promising avenues of research in this sphere concerns the relationship between activity and physical fitness. Whereas most studies find that more active people are more physically fit, it has been extremely difficult to determine whether this fitness is a result of activity patterns or of the fact that the fit choose to be more active. Random assignment of subjects to varying long-term activity levels would be one method of eliminating such self-selection bias, but this is not feasible. Quasiexperimental research designs offer another means of addressing the issue.

This paper reports the results of a study that used this approach by taking advantage of the unique character of the Hindu caste system found in Nepal, a small Himalayan kingdom. In this caste system, birth into one of several hereditary social units determines to a very large extent an individual's lifelong activity pattern. Thus the social subdivisions of this population afford an approximation of randomization into experimental and control groups. The purpose of this paper is to (1) describe intracohort variation in the physical fitness of elderly males from different subgroups (castes), and (2) examine the caste-determined activity patterns that underlie this variation.

Materials and Methods

POPULATION

The research was conducted during the peak agricultural season from May to July 1983 in Chetbesi village (pseudonym), Lamjung district, central

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Nepal. Chetbesi is a traditional, rural community perched on the steep slopes rising from the Marsyangdi River. It has a low altitude (918 meters) and a monsoonal climate and is inhabited by several ethnic groups, including the Nepali-speaking Hindus who are the subject of this study. In this roadless, rugged mountain terrain, lacking such facilities as electricity, a sanitation system, and machinery, human and animal muscle power is the source of energy for transportation and production. Farming is the basis of the local economy and arable land the critical economic resource.

In Hindu society occupation is largely determined by the caste (hereditary social group) into which a person is born. In many Nepali villages such as Chetbesi, the social system segments these castes into a two-part hierarchy consisting of socially pure high castes (Brahmins and Chetris) and socially impure untouchable castes (Kami, blacksmiths; Damai, tailors; and Sarki, leather workers). Associated with these notions of social purity and pollution are sets of restrictions on behavior, including occupation. For example, a person born into the untouchable Kami (blacksmith) caste cannot adopt tailoring as his occupation, nor can a Damai (tailor caste) adopt smithing. Occupation, in turn, is the principal source of differences in activity, as there are no vigorous leisure activities. Moreover, hard work and physical exertion are not valued in and of themselves; people work hard when necessary, not because they want to or are socially encouraged to do so.

The Hindu social hierarchy also tends to be associated with the economic hierarchy. In Chetbesi the two high castes (Brahmins and Chetris) are the main landholders and are predominantly middle-income or well-to-do (in relative village terms). The untouchables also own or lease land, but these are usually small plots of poor quality whose yield suffices for only a few months' food supply. They are forced to rely, therefore, on providing services to large landowners and earn their livelihood predominantly as craftsmen and manual laborers. They are typically low-income, although in a few cases their households are equivalent to the middle-income stratum among the high castes.

For complex historical and sociocultural reasons, the Sarki caste has formed the agricultural labor force for the high castes, whereas the Kami and Damai castes have subsisted mainly by practicing their less strenuous traditional crafts of smithing and tailoring. The Sarkis perform all the heavy work for the Brahmins, particularly plowing, as Brahmins do not plow because of religious proscriptions. They also do most of it for the Chetris, who rarely plow because they are affluent enough to hire labor. The Sarkis also commonly work as porters and masons and on construction. The Sarkis' subsistence mode, therefore, is distinct from both that of the high castes and that of the other low castes in that it derives primarily from hard labor performed throughout their lives.

In addition to differences in social standing and land ownership, the high and untouchable castes in Chetbesi differ in their family developmental cycles and the expectations held by elderly males regarding work in old age. High-caste males expect to give up most physically arduous tasks as they grow old, and they expect to retain managerial control over their agricultural land and therefore their household economies. Low-caste elderly males, however, must continue to work and earn wages in old age if they are to maintain their household position and status. Once they cease working and earning, they quickly lose control of the household and become dependents. There is, therefore, not only an important difference in the strenuousness of activities associated with different castes, but also a set of powerful social forces that pressure elderly Sarkis to continue to engage in heavy labor until they are absolutely physically unable to do so.

SAMPLE

All the native high- and low-caste Hindu males 60 years of age and over living in three wards of Chetbesi were identified by a census survey and then invited to participate in a study of the health of the elderly (The methods of age assessment are outlined in an earlier work[1]). Forty-three (88 per cent) of the 49 eligible people participated in the study, including 9 Brahmins, 16 Chetris, 6 Damais, 3 Kamis, and 9 Sarkis (mean age 67 ± 7 years, range 60–88). Among the nonparticipants, one Chetri was bedridden and unable to conduct cogent conversation, one Damai and three Sarkis declined to participate and one Sarki could not be scheduled during the time available. Just 12 per cent (four Sarkis and two non-Sarkis) did not participate. They share no particular set of characteristics that would introduce bias into the sample. Each participant underwent a medical exam and anthropometric measurements and was interviewed about sociocultural issues.

The results of the medical exam plus a 12-lead EKG determined eligibility to perform a bicycle ergometer test of physical work capacity. An individual was ineligible if he manifested any medical contraindications for exercise testing in an out-of-hospital setting[2] or if he was too weak to pedal. Nine of the 43 (21 per cent) were excluded from the exercise test. One Damai and one Brahmin were excluded because of chronic obstructive pulmonary disease (4.5 per cent), one Brahmin was excluded because of severe arthritis/weakness (2.3 per cent), one Brahmin was excluded because of probable remote inferior wall myocardial infarction (2.3 per cent), and one Damai and four Chetris were excluded because of chronic stable angina (11.4 per cent). The remaining 35 (mean age 66 ± 5 years, range 60–77) participated in a symptom-limited test of physical work capacity according to an intermittent multistage protocol detailed elsewhere.[1] One Sarki failed to give a good effort on the bicycle test and was eliminated from analysis; his average HR throughout a day of monitoring was greater than the peak HR attained during the bicycle ergometer test.

Several sources of possible bias are minimized with this sample. Because it includes virtually all eligible individuals, the possibility of subject self-selection leading to an overrepresentation of especially healthy/sick, active/inactive, or rich/poor individuals is avoided. The sample is homogeneous for many lifestyle factors that affect fitness in Western industrial society. Individuals in traditional rural settings such as Chetbesi live very similar lives regardless of caste or economic status. The diet consists principally of rice and other grains eaten with lentils or vegetables. All castes consume some form of meat and fish and all castes smoke. All castes but Brahmins consume alcohol. All engage in the same leisure activities, none of which require vigorous physical exertion. Whereas there are important social and economic differences between castes, these are not associated with lifestyle differences likely to influence fitness—with one outstanding exception. The high-caste large landowners employ those with little or no land to provide skilled services such as smithing or sewing or, as in the case of the Sarkis, to provide manual labor in exchange for a portion of the crop or wages.

MEASUREMENTS AND ANALYSIS

Heart rate (HR) and systolic blood pressure (SBP) were measured throughout 34 bicycle ergometer tests of physical work capacity. This paper reports measures obtained in the third minute of exercise at each of three submaximal workloads (150, 300, and 450 kpm), at peak effort, and during a postexercise recovery period. These measures were used to calculate rate pressure products (RPP = HR × SBP/100) at each submaximal stage and at peak tolerated heart rate (PTHR). This paper also reports anthropometric data on the same 34 men, obtained according to standard protocol.[3] Differences between the sample means are evaluated by *t*-tests.

The physical activity of the entire sample of 43 men is measured by interview responses, direct day-long observation, and continuous day-long heart rate monitoring. Local students accompanied subjects for an average of 12 hours 40 minutes per day (roughly 5–5:30 AM to 6–6:30 PM) and wrote a running account of their major activities and the time spent on each one. Accounts of observed activities were obtained from 42 people on 97 person-days. 25 people were observed on 2–5 different days. Each day's activity account is summarized by totaling the number of minutes engaged in light, moderate, and heavy tasks plus walking and by calculating the percentage of the day passed in each activity category. Published values of the energy costs of various activities or analogous ones served as guidelines for classifying tasks.[4]

Light activity includes personal care, food preparation, leisure activities such as visiting neighbors or teashops, animal husbandry tasks (milking, grazing, and feeding), cutting grass, weeding, sewing, and making rope. Moderate activity includes blacksmithing, masonry, and some agricultural field work, such as digging and repairing irrigation walls and carrying loads under 10 kg on level ground. (Blacksmithing produces mainly household and agricultural implements and is primarily isometric work performed while seated on the haunches next to a small, hand-fired charcoal forge. HR monitoring reveals that it causes only modest HR elevation.) Heavy activity includes carrying loads of more than 20 kg or carrying loads uphill, plowing, and breaking up the clods to level the ground after plowing. Walking is reported separately as an activity with moderate and heavy components. The ruggedness and unevenness of the terrain, with its ridges, gullies, and terraces, make it difficult to classify each walk in terms of number of minutes uphill or downhill, and therefore walking is estimated to be ⅔ level and downhill and ⅓ uphill, i.e., roughly ⅔ moderate and ⅓ heavy work.

A record of HR throughout the day was obtained on 41 days using a small, battery-run monitoring unit manufactured at the University of Wisconsin. It is attached to the chest by electrodes and is worn in a beltpack at the subject's waist. It is triggered by the QRS complex of the electrocardiogram and accumulates an average HR during each of a series of six-minute intervals and stores these for subsequent readout. The monitor was attached early in the day at the subject's home and detached in the early evening after an average of 126 six-minute intervals (12 hours 36 minutes). Concurrent HR monitoring and direct observation occurred on 25 days. A day-long average HR is calculated by averaging the HR measurements of all six-minute intervals.

The average HR relative to resting HR provides

TABLE 1. Anthropometry and Physiologic Responses to Exercise Among Elderly Nepalese Men

Variable	Caste				Sarkis		Non-Sarkis	
	Low		High					
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Anthropometry								
Height (cm)	158.6	5.6	162.1	6.9	158.3	7.0	161.2	6.3
Weight (kg)	43.5	5.3	47.6	4.5	46.1	3.7	45.6	5.7
Arm circ (cm)	22.9	2.3	23.3	2.7	23.5	1.5	23.0	2.8
Thigh circ (cm)	40.7	4.0	41.8	3.4	42.8	2.1	40.8	4.0
Calf circ (cm)	30.0	2.8	31.3	2.5	31.3	1.6	30.5	2.9
Triceps SF (mm)	6.0	1.8	6.7	2.9	6.1	1.9	6.4	2.7
Thigh SF (mm)	6.1	2.9	8.3	4.4	4.3	2.1	8.0	4.3*
Calf SF (mm)	4.5	1.3	5.3	1.3	5.2	1.3	4.9	1.4
SBP (mm Hg)	122.1	16.3	124.2	22.7	121.5	9.4	123.8	22.2
DBP (mm Hg)	77.2	10.1	85.3	12.6*	76.3	7.8	83.4	12.9
Resting HR (f/min)	72.1	16.6	78.2	13.4	63.5	9.4	79.2	14.6*
N	15		18		8		25	
Physiologic responses to exercise								
150 kpm								
HR (f/min)	97.7	23.4	109.8	22.9	87.1	11.7	109.8	23.9*
SBP (mm Hg)	145.2	23.8	148.0	34.4	133.5	14.7	151.0	32.1*
RPP	145.0	58.6	163.8	56.6	117.1	27.2	167.5	59.5*
300 kpm								
HR (f/min)	107.6	16.7	128.4	19.0*	98.7	8.8	126.2	18.6*
SBP (mm Hg)	148.1	22.4	162.7	26.8	146.5	16.5	159.4	27.7
RPP	158.7	30.0	209.6	49.4*	145.3	25.7	201.2	46.2*
N	12		14		8		19	
450 kpm								
HR (f/min)	131.3	15.6	149.9	20.0*	125.0	11.9	148.9	18.2*
SBP	171.6	25.6	175.3	22.6	160.3	14.0	181.0	25.2*
RPP	226.6	50.1	264.4	57.9	201.0	32.2	269.9	51.3*
N	12		9		8		12	
PTHR	140.7	16.4	148.8	24.5	136.5	12.5	147.9	22.9
SBP at PTHR	174.2	27.0	167.2	36.8	168.7	10.5	170.5	36.3
RPP at PTHR	251.0	56.6	252.3	74.5	236.2	19.7	255.5	73.4
Recovery HR 1 min	93.0	20.6	101.6	22.8	82.5	10.2	102.6	22.6*
Recovery HR 11 min	85.7	15.6	90.9	17.4	79.1	9.7	91.5	17.3*
N	12		17		8		24	

* $p < 0.05$, t-test of difference between two sample means: high versus low caste or Sarkis versus non-Sarkis.

a measure of the workload: a greater elevation represents a heavier workload. The average HR relative to the age-predicted maximal HR provides a measure of the strain of the workload: a higher HR represents a greater proportion of the predicted maximum HR (220 − age) and a greater strain. A cumulative frequency distribution curve of the HR throughout the day, divided according to 10-beat intervals, describes visually the strain on the cardiovascular system imposed by the day's activities and facilitates interindividual comparison.

Results

FITNESS

Table 1 describes the anthropometry and the physiologic responses to exercise of elderly members of the two principal social subdivisions: high-castes and untouchables. They did not differ in body size or nutritional status as measured by height, weight, three limb circumferences (upper arm, thigh, and calf), and the associated skinfolds (triceps, thigh, and calf). Low-caste males had lower HR at two submaximal workloads during bicycle ergometer exercise, indicative of greater physical fitness. However, this coarse subdivision into high-caste and untouchable is misleading. A single untouchable caste, the Sarkis, accounted for the high-low caste contrast, whereas the untouchable Kami and Damai castes resembled the high-caste Brahmins and Chetris in physiologic response to exercise.

Table 1 also subdivides the sample into Sarkis and non-Sarkis and presents the means of the same set of anthropometric and physiologic variables. The Sarkis differed systematically in physiologic measurements. Sarkis had lower resting HR, HR, SBP, and RPP at the 150, 300, and 450 kpm submaximal workloads (with the exception of SBP at 300 kpm) and lower HR 1 and 11 minutes after terminating exercise. This indicates a more efficient, better-trained physiologic adaptation to exercise stress. The two groups did not differ in PTHR or in SBP or RPP at PTHR. There was no difference in body size or nutritional status, apart from smaller Sarki thigh skinfolds. The close correspondence of values describing the high castes and those describing all the non-Sarkis emphasizes the physiologic similarity of the Damais, Kamis, Brahmins, and Chetris and highlights the contrast between these four groups and the Sarkis.

ACTIVITY

The fitness difference is most likely the outcome of differences in habitual activity patterns. Performance of tasks categorized here as heavy, i.e., those causing the largest HR elevations, was probably the source of training effects. The population description given above presented the cultural and historical factors channeling castes into contrasting activity patterns.

Sarkis are the most likely to perform heavy manual labor throughout the year and throughout their lives. We suggest that it is this socially produced work pattern that underlies their higher levels of physical fitness. Interviews and direct observations support this sociocultural assessment. All but one Sarki indicated that he did manual labor for others: plowing/leveling, stone cutting, masonry, construction, and portering. The sole exception was a 77-year-old who had discontinued plowing with the current season. In contrast, just one Kami and two Damais hired out as laborers occasionally in addition to plying their traditional trades entailing moderate and low activity. The Brahmins and Chetris of Chetbesi do not supplement their agricultural incomes with manual labor for others, although they may perform heavy tasks for themselves.

Ninety-seven days of direct field observation of the daily activities of Sarkis and non-Sarkis confirmed these self-reports. Whereas Sarkis performed heavy labor on half of ten days of direct observation, non-Sarkis performed heavy labor on just 25 per cent of the 87 days of observation. Moreover, when undertaking heavy tasks, the Sarkis worked at them for long periods—a median of 58 per cent of the observed day, compared with 16 per cent for non-Sarkis. Heavy tasks occupied 47–66 per cent of the day on 80 per cent (4/5) of the days when Sarkis engaged in such tasks, whereas they occupied an equivalently large proportion on just 23 per cent (5/22) of the days when non-Sarkis engaged in such tasks. Sarkis and non-Sarkis differed in both the frequency and the pattern of heavy work in a way that could have produced the measured differences in physical fitness.

Walking in the rugged terrain has a component of heavy activity, but Sarkis and non-Sarkis walk outside the house compound for equivalent amounts of time—on the average, 12 and 14 per cent of the day, respectively. This is additional evidence that *occupational* activity requirements are the source of different fitness levels. The Sarkis spent an average of 59 per cent of the day engaged in light activity (range 22–94 per cent), compared with non-Sarkis, who spent an average of 73 per cent (range 20–100 per cent) of the day engaged in light activity. Overall, the Sarkis spent more time engaged in heavy labor, the same amount of time walking, and less time at light tasks than non-Sarkis.

Day-long HR monitoring provided further evidence that the Sarkis' daily work load was generally heavier. The day-long average HRs of individual Sarkis and non-Sarkis were averaged for each group, with an average of 78 ± 16 for five Sarkis and 83 ± 11 for 28 non-Sarkis (ns). This similarity is evidence that the more fit Sarkis did more work. Because of their greater fitness and their lower resting HR, a heavier work load was required to elevate their HR to the same level. When the work loads were the same, the well-trained Sarkis had lower HRs, as illustrated by Figure 1. This presents cumulative frequency curves of HR for a 60-year-old Sarki who spent 81 per cent of the day engaged in light activity and 19 per cent walking (curve A) and for a 70-year-old Chetri who spent 80 per cent of the day engaged in light activity and 20 per cent walking (curve B). The Sarki's curve lies to the left of the Chetri's and illustrates his performance in the same category of task at a lower HR. The Sarki's day-long average HR of 66 is 41 per cent of his age-predicted maximal HR, whereas the Chetri's day-long average HR of 79 is 53 per cent of his age-predicted maximal heart rate. The X on each curve denotes the HR that is 50 per cent of the age-predicted maximum HR and the proportion of the day's HRs that falls below or above this value. The X is much lower on the Chetri's curve, indicating a larger proportion of HR above this value. Thus the Chetri's work load is more intense relative to his maximum, although he and the Sarki were performing similar activities. Curve C demonstrates that the strenuous activity of plowing/leveling constitutes a very high relative work load. The cumulative HR frequency curve for this 70-year-old Sarki, who spent 66 per cent of the observed day plowing/leveling, lies far to the right of the other two curves, and most of the day's activities were performed at an HR above 50 per cent of the age-predicted maximum HR. The day-long average HR of 106 is 71 per cent of his age-predicted maximal heart rate. The HR data are additional evidence that the specific tasks most frequently performed by Sarkis provide a greater physiologic strain than tasks most frequently performed by non-Sarkis.

Discussion

The study of virtually the entire elderly male population of Chetbesi reveals that socially defined hereditary subgroups have different levels of physical fitness in old age. This intracohort variation is accounted for by variation in occupational activity levels, which in turn is a function not of self-selection, greater initial fitness, or personal preference,[5-8] but rather of birth into a socially defined group—a caste. One caste, the Sarkis, is forced to maintain a physical activity pattern of frequent and long periods of strenuous manual labor, and this caste has greater physical work capacity in old age.

Although biomedical studies commonly treat as homogeneous the populations of technologically simple societies such as that of Chetbesi, the findings of this study illustrate the inapplicability of making such an assumption *a priori*. In fact, the pattern of differential fitness exhibited in Chetbesi may typify the process of aging in many highly stratified traditional (and modernizing) peasant societies where a socially delimited segment of the population performs the bulk of the hard work and physical fitness is concentrated in this segment. In such societies, social and economic imperatives shape differential biological aging experiences.

Higher levels of activity and physical fitness are associated with lowered risk of cardiovascular disease,[6-8] and Sarkis appear to have less cardiovascular disease and hypertension. None of the Sarkis and 18 per cent of the non-Sarkis (6/34) were diagnosed as having coronary artery disease. Five of the non-Sarkis were diagnosed as having probable coronary artery disease with chronic stable angina, and one was diagnosed as having probable coronary artery disease with probable remote inferior wall myocardial infarction. One Sarki and six non-Sarkis were diagnosed as having mild asymptomatic peripheral vascular disease. Two non-Sarkis had symptomatic peripheral vascular disease: one with recurrent leg skin ulcer and one with bilateral calf claudication on extreme exertion. On the basis of resting BP measured once during the anthropometric exam, one Sarki (11 per cent) and seven non-Sarkis (21 per cent) had hypertension (SBP $\geq$ 160 and/or DBP $\geq$ 95 mm Hg). Diastolic elevation was present in all but one case. None of the Sarkis and 24 per cent (6/25) of the non-Sarkis developed

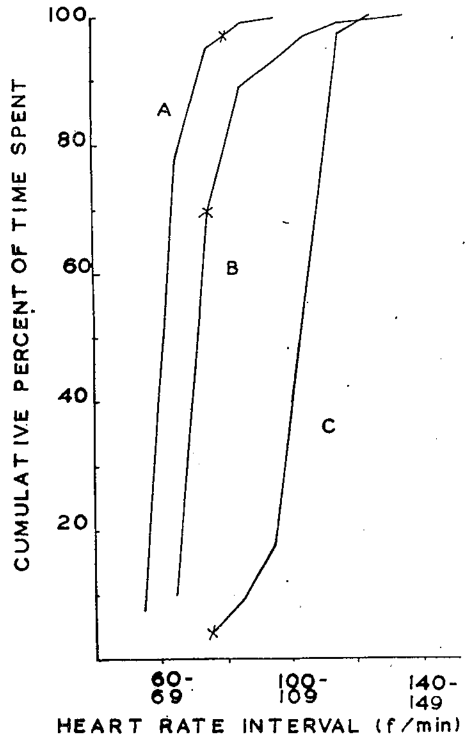

FIGURE 1. Cumulative percentage of time spent at 10-beat HR intervals throughout a day of monitoring: (A) 60-year-old Sarki, 81 per cent light activity and 19 per cent walking; (B) 70-year-old Chetri, 80 per cent light activity and 20 per cent walking; (C) 70-year-old Sarki, 34 per cent light activity and walking and 66 per cent plowing and leveling. The *X* denotes the HR that is 50 per cent of the age-predicted maximum HR.

hypertension during the bicycle ergometer test (SBP $\geq$ 230 and/or DBP $\geq$ 120 for two minutes). The trend toward lower morbidity among Sarkis does not extend to diseases not thought to be influenced by physical activity. For example, 89 per cent (8/9) of the Sarkis and 94 per cent of non-Sarkis (32/34) have mild to moderate chronic obstructive pulmonary disease, and 100 per cent of the Sarkis and 97 per cent of the non-Sarkis have mild to moderate cataracts.

In addition to examining the important internal variation, it is useful to consider the Nepalese in a larger perspective and to evaluate the popular romantic notion that elderly residents of traditional agrarian societies in rugged terrains are more fit than those in Western societies. Figure 2 compares the Sarkis and non-Sarkis with their age-mates in other societies. It summarizes HR data obtained from self-selected samples of men in their sixties exercising at 300–450 kpm.[9-16] It depicts the Nepalese samples *vis-a-vis* others, although it must be recalled that the latter are eccentric, self-selected samples ranging from mental patients to health club members. The Sarkis' HRs are low to medium in the reported range, whereas the non-Sarkis are either high in the reported range or above it. Converting the mean HR to maximal oxygen uptake

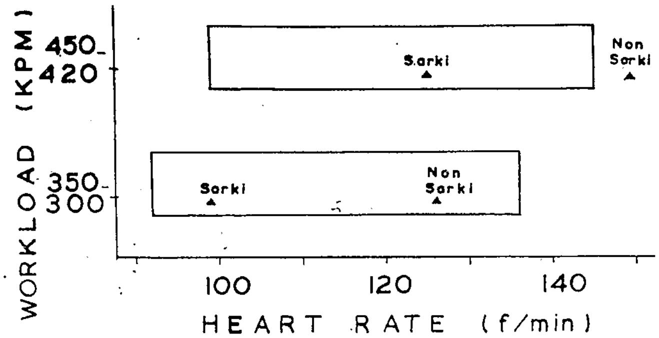

FIGURE 2. Summary of published values for HR attained by 60-year-olds exercising at 300–450 kpm. The values for the Sarkis and non-Sarkis of the present study are denoted relative to the published values for the elderly in Western society; the range of the Western values is indicated by the boxes.

values[17] yields a maximal aerobic power of 37.4 ml O_2/min/kg for Sarkis and 27.8 ml O_2/min/kg for non-Sarkis, similar to values reported for Norwegians and Canadians, respectively.[18] These confirm that the physical work capacity of both Nepalese samples lies within the previously reported range of physical fitness: the Sarkis in the middle to upper and the non-Sarkis in the middle to lower reaches of the reported range. Thus Chetbesi men are not especially fit, even though the description of the lifestyle and environment of Chetbesi conjures an image of a physically demanding life and even though the elderly can be seen out and about performing productive tasks and walking up and down steep trails. The notion that aging is somehow less debilitating in such societies is shown to be wishful thinking. Yet while these are not the hale and hearty elderly residents of rugged terrain described in popular romantic myth, neither are they inactive or decrepit. The subjects in this study engaged regularly in light tasks and walking and were productive participants in the social and economic life of the community.

Finally, note should be made that higher levels of physical fitness are not necessarily linked with more successful social and psychological adaptation to the aging process. Despite the Sarkis' relatively high level of physical fitness, they share with other low-caste males the generally negative, fearful view of growing old that results from their insecure position in their households and the economic sphere. Care must therefore be taken to distinguish between physical fitness and well-being in old age.

These results demonstrate the influence of social forces on physical fitness and suggest that future research in a range of societies may discover a set or sets of social structures promoting exceptional physical fitness in old age.

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