Assess workers’ needs and preferences first before planning a physical fitness programme: findings from a polytechnic institute in Singapore

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Workplace physical fitness programmes are usually poorly attended because the activities do not meet workers’ needs. We investigated leisure-time physical activity and its relation to sociodemographic characteristics and cardiovascular risk factors in a polytechnic institute in Singapore before planning a physical fitness programme. Low leisure-time physical activity (defined as no activity or engaging in physical activity less than once per week) was more prevalent among older women, married workers, smokers and men with unhealthy dietary habits. The type of physical activity varied with age and gender, with a preference for walking by women and older men and jogging by younger men. Low physical activity was significantly associated with sickness absence and self-reported stress in women and higher values of triglycerides and low density lipoprotein cholesterol in men. This survey helps to identify target groups for physical fitness programmes and determine leisure-time physical activities specific to workers’ preferences by age and gender.

Key words: Age; cholesterol; gender; leisure-time physical activity; sickness absence; stress; triglycerides.

INTRODUCTION

Regular physical activity is critical in health promotion. Physical activity has been defined as any bodily movements produced by skeletal muscles that result in energy expenditure. Physical activity has generally been conceptualized as consisting of two components: occupational and leisure-time. Therefore, questionnaires typically assess either of these separately, or both. Physical activity is closely related to but distinct from exercise. Exercise is a subset of physical activity defined as planned, structured and repetitive bodily movements done to improve or maintain physical fitness. Recent evidence shows that regular moderate physical activity at the level of brisk walking at 3–4 miles per hour, if carried out intermittently, can lead to improved metabolic and physiological functions, reduces risk of heart disease, colon cancer, diabetes and high blood pressure and reduces stress. There is also evidence of benefits of regular exercise on productivity at the workplace. The three-times-a-week exercise programme developed by the National Aeronautics and Space Administration (NASA) showed impressive results. Half of the regular participants improved job performance and attitudes toward work improved as compared to only 12% who only occasionally participated in the programme. All the regular participants claimed that they felt better and reported improved stamina (89%), weight loss (60%), sounder sleep, and 50% said that they paid more attention to
their diets and many quit or cut down on smoking.

In recent years, many worksites have incorporated physical fitness and exercise activities in their health promotion programmes, whereby fitness and exercise facilities, aerobic classes and health club memberships were provided to workers. However, participation in on-site exercise programmes was low, ranging from 5–26%.⁷ Participants were more likely to be better educated, younger and to come from upper management positions. Many workers did not participate in the aerobics and physical fitness activities because of lack of time and embarrassment. They felt embarrassed to wear leotards and dance in the aerobic classes. The physical fitness activities were thus viewed as inappropriate for the majority of the workers.⁸,⁹ It is important to assess workers' interests and needs, their existing physical activity pattern and preferred leisure-time physical activities before planning a programme of physical fitness for them. We carried out this study to determine the prevalence of leisure-time physical activity in a working population and its relation to sociodemographic characteristics and other lifestyle habits such as diet, smoking and drinking. The effects of physical activity on stress and cardiovascular risk factors such as cholesterol, triglycerides and blood glucose were also investigated.

A tertiary learning institution (polytechnic institute) in Singapore was selected for the study for the following reasons. Most of the workers in such institutions were sedentary or moderately active older workers and therefore an important group to target for physical activity. Secondly, workers in a tertiary institution can be important role models for students to emulate and tertiary institutions, unlike schools, do not have mandatory regular physical fitness classes for students and teachers. Nevertheless, it is an appropriate venue for planning health promotion programmes as we can tap on the educational and fitness facilities as well as the expertise available in the institute to plan an effective health education programme to increase leisure-time physical activity among this captive audience.

MATERIALS AND METHODS

A self-administered questionnaire was administered to all workers in a polytechnic institute. A total of 613 out of 1,000 workers participated in the survey with a response rate of 61.3%. The questionnaire included questions on sociodemographic characteristics, dietary habits and leisure-time physical activity. Leisure-time physical activity was defined as self-reports of physical activity carried out during the worker's leisure-time that was of 20 minutes duration and vigorous enough to cause sweating and heavy breathing. Participants were asked to specify their frequency and duration of leisure-time physical activity during the past year for the following: brisk walking, jogging, swimming, cycling, aerobics and other exercises. Subjects were also asked for their average weekly frequency of consuming selected food categories: deep fried foods, eggs, sweet snacks, fresh fruits and vegetables. They were also asked for the frequency (always, sometimes, never) of certain food practices such as trimming fat off food when eating or cooking and adding salt to food. Stress was based on self-reporting. The number of days absent from work in the past 6 months was also based on self-reporting as medical certificates were not routinely recorded. The duration of 6 months was taken to aid recall as the survey was conducted in the first month of July.

Blood pressure, height and weight measurements were taken by trained nurses at the health lifestyle centre and fasting venous blood samples were taken for glucose, cholesterol and triglycerides.

Data analysis

The variables: Low leisure-time physical activity (or physical inactivity) was the primary dependent variable. Subjects with low leisure-time physical activity were defined as those who never participated or participated less than once per week in any physical activity. Predictor variables likely to influence physical activity selected for our study included age, marital status, ethnicity, occupation, diet, smoking and drinking status. Drinking status was categorized into five groups, namely: drink daily or most days; once or twice per week; once to three times per month; less than once per month or never or on special occasions only. For analysis, the first three subcategories were combined (drink daily to at least once per month) as the numbers in each subcategory were very small and there were no discernible differences in physical activity among these groups. This combined group formed the drinkers' group and the other two categories (drink less than once per month or never) formed the non-drinkers' group. The median days of sick leave and percentage of persons with self-reported stress by physical activity group were also determined.

Statistical methods: All analyses were sex-specific. Sex-specific distributions of categories of sociodemographic characteristics and leisure-time physical activity were used to describe the study population. The statistical association of predictor variables (sociodemographic characteristics and other lifestyle behaviours) on the dependent variable (risk of low leisure-time physical activity) was estimated by the rate ratio. The rate ratios for low leisure-time physical activity were adjusted for potential confounding variables using a modification of Cox's proportional hazards model for cross-sectional data.¹⁰,¹¹ Although statistical adjustment of confounding in the comparison of rates and proportions derived from a dichotomous dependent variable is usually carried by multiple logistic regression, it is known that the logistic model has one drawback in that it yields the odds ratio as a measure of association. The odds ratio is less
Results

Table 1 shows the sociodemographic characteristics of the working population. The majority of the men (79.7%) and women (84.0%) were Chinese. Women workers were younger than the male workers (35.8 years versus 41.0 years). A higher per cent of men (86.4%) than women (68.9%) were married (68.9%). About two-thirds (66.7%) of the men were lecturers compared to about half of women (47.1%). About one-quarter (24.8%) of the women were clerks compared to 1.3% of men. The mean body mass index for men and women were 23.1 and 21.6 respectively. Only 4.3% of the men and an insignificant per cent (0.8%) of the women were smokers. Median health care expenditure on outpatient care and hospitalization in the last six months was highest in women aged 50 years and above ($60.00) and it was about three times more than the expenditure of women aged less than 30 years.

Participation in physical activity

Overall, 14.5% respondents reported not engaging in any form of leisure time physical activity, with a higher per cent in women (21.0%) compared to men (10.4%) (Table 1). The median duration of leisure-time physical activity per week was 30 minutes for men and 20 minutes for women and it decreased with age in both men and women (Figure 1). There was a sharp decline in duration of leisure time physical activity with age among men from a median duration of 85 minutes per week (mean = 113 minutes) in the 20–29 year age group to a median duration of 30 minutes (mean = 42 minutes) in the 30–39 year age group. The decline was quite gradual after that to 22.5 minutes in the 40–49 year age group and 20 minutes in the 50–69 year age group. For women, the decline was less sharp in the younger age groups but the sharpest decline was seen from the 40–49 year age group to the 50–69 year age group where the median duration was 0 minutes.

Figure 2 shows the common leisure-time physical activities by gender and age group. Overall, the two most popular leisure-time physical activities reported by men were jogging (28.8%) followed closely by walking (26.7%). Among women, the two most popular leisure time physical activities were walking (45.2%) and aerobics (26.2%). The type of physical activity varied with age in both men and women. Walking was...
preferred by older men while jogging and swimming were commoner in younger men, with 52.4% of men in the 20–29 year age group engaging in jogging. There was little variation in cycling with age. Among women, type of physical activity also varied with age. Walking and aerobics were the two most common leisure-time physical activities in the first three age groups (20–29, 30–39, 40–49 years). Swimming was however more popular with middle aged than younger women. Aerobics among women declined markedly with age from 26.2% engaging in aerobics activity in the 20–29 year age group to 13.8% in the 30–39 year age group and none in the 50–59 year age group. Of those women who engaged in aerobics activities, only 27.9% joined the aerobics and fitness classes organized by the institute. Married women were also less likely to engage in aerobics (12.7%) compared to single women (22.2%).

Determinants of low physical activity

Table 2 shows the percentages, unadjusted and adjusted prevalence rate ratios and 95% confidence intervals for low leisure-time physical activity by selected socio-demographic characteristics and lifestyle habits such as smoking, drinking and dietary habits among men and women. For men, factors significantly associated with low physical activity were being married, non-drinking status and practice of not trimming fat off food. The relationships were not substantially altered even after adjustment for confounding variables like age, ethnicity, occupation, smoking and history of chronic illnesses. Married men were 1.83 times (95% CI 0.95-3.48) more likely to engage in low physical activity than single men.

Table 2. Rate ratios for low leisure-time physical activity in relation to sociodemographic characteristics, smoking and drinking

<table>
<thead>
<tr>
<th>Age group (yrs)</th>
<th>% Unadjusted rate ratio (95% CI)</th>
<th>Adjusted rate ratio (95% CI)</th>
<th>% Unadjusted rate ratio (95% CI)</th>
<th>Adjusted rate ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–29</td>
<td>23.8 (1.00)</td>
<td></td>
<td>35.7 (1.00)</td>
<td></td>
</tr>
<tr>
<td>30–39</td>
<td>40.5 (1.70 0.78-3.7)</td>
<td>1.77 (0.71-4.41)</td>
<td>61.1 (1.71 1.12-2.61)</td>
<td></td>
</tr>
<tr>
<td>40–49</td>
<td>37.9 (1.60 0.69-3.67)</td>
<td>1.16 (0.69-4.34)</td>
<td>90.9 (2.55 1.63-3.98)</td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>1.00 (1.00 1.00)</td>
<td></td>
<td>3.01 (1.25-7.23)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>23.9 (1.00)</td>
<td>1.00 (1.00)</td>
<td>39.4 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>Ever married</td>
<td>41.6 (1.73 1.02-2.96)</td>
<td>1.83 (1.00-4.34)</td>
<td>65.5 (1.66 1.21-2.29)</td>
<td>1.62 (1.06-0.50)</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technician</td>
<td>39.4 (1.00)</td>
<td>1.00 (1.00)</td>
<td>46.7 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>Lecturer</td>
<td>37.6 (0.94 0.72-1.27)</td>
<td>0.96 (0.66-1.40)</td>
<td>60.7 (1.30 0.92-1.84)</td>
<td>1.42 (0.76-2.65)</td>
</tr>
<tr>
<td>Managers</td>
<td>50.0 (1.27 0.46-3.48)</td>
<td>1.27 (0.31-5.30)</td>
<td>63.6 (1.36 0.79-2.35)</td>
<td>1.25 (0.64-2.46)</td>
</tr>
<tr>
<td>Clerks, telephone operators</td>
<td>60.0 (1.60 0.77-3.32)</td>
<td>1.53 (0.70-3.34)</td>
<td>60.0 (0.98 0.75-1.27)</td>
<td>1.89 (0.75-4.77)</td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>30.9 (1.00)</td>
<td>1.00 (1.00)</td>
<td>28.6 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>40.5 (1.31 0.86-1.99)</td>
<td>1.32 (0.78-2.22)</td>
<td>59.0 (2.06 0.64-6.69)</td>
<td>2.30 (0.56-9.71)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>50.0 (1.62 0.86-3.04)</td>
<td>1.78 (0.74-4.31)</td>
<td>50.0 (1.75 0.28-10.7)</td>
<td>1.31 (0.12-14.7)</td>
</tr>
<tr>
<td>Drinking status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>20.6 (1.00)</td>
<td>1.00 (1.00)</td>
<td>50.0 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>No</td>
<td>43.1 (2.09 1.27-3.45)</td>
<td>2.00 (1.13-3.54)</td>
<td>58.4 (1.16 0.52-2.62)</td>
<td>1.30 (0.40-4.25)</td>
</tr>
<tr>
<td>Trim fat off food</td>
<td>37.2 (1.00)</td>
<td>1.00 (1.00)</td>
<td>47.1 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>No</td>
<td>56.3 (1.51 1.08-2.12)</td>
<td>1.58 (0.96-2.61)</td>
<td>58.6 (0.80 0.48-1.34)</td>
<td>0.84 (0.41-1.72)</td>
</tr>
</tbody>
</table>

The rate ratios are adjusted for confounding from all the other variables shown in the table as well as history of chronic illness and ethnicity. The rate ratio is obtained by dividing the per cent of low leisure-time physical activity in each subcategory by the per cent in the referent group. For example the unadjusted rate ratio of 1.73 for low physical activity in ever-married males is obtained by dividing 41.6% by 23.9%.
CI = 1.00–3.40) more likely to be physically inactive than single men. Non drinkers were two times (95% CI = 1.13–3.54) more likely to be physically inactive than drinkers even after adjusting for age, occupation and smoking status. Men engaging in unhealthy eating habits like not trimming fat off food were 1.58 times (CI = 0.96–2.61) more likely to be physically inactive.

For females, factors significantly associated with low physical activity were age and marital status. A dose-response gradient of age on low physical activity was found. Women in the 30–49 year age group were 1.71 times (95% CI = 1.12–2.61) more likely than women in the 20–29 year age group to be physically inactive and this increased to 2.55 times (95% CI = 1.63–3.98) among those aged 50 years and above. Adjustment for potential confounders such as occupation, smoking status, ethnicity and pre-existing chronic diseases increased the rate ratios to 3.01 (95% CI = 1.25–7.23) in the 50 year-old age group. Married women were also 1.66 times (95% CI = 1.21–2.29) more likely to be physically inactive and the rate ratio remained unchanged even after adjustment for confounders like age, occupation and smoking.

There was no statistically significant relationship with other dietary habits such as frequency of eating fruits, deep fried food or high cholesterol foods like eggs and trimming fat off food (not shown in table).

**Low physical activity and its effects on sickness absence and stress**

Table 3 shows the percentages of male and female workers who took sickness absence leave and reported being almost or always stressed by frequency of exercise. Subjects with chronic conditions such as hypertension, diabetes and asthma were excluded from the analysis. A much higher per cent (61.1%) of women who rarely ever or never exercised took sickness leave compared to women who exercised at least thrice per week (39.4%). This relationship was still observed after stratifying by age. Among women aged 40 years and above, 57.9% of those who rarely or never exercised took sickness leave compared to 47.4% among those who exercised once to twice per week and 28.6% among those who exercised at least thrice per week (not shown in table). The median number of days of sickness absence leave among regular exercisers was 0 and this differed significantly (p < 0.05) from a median of one day among women who rarely or never exercised (not shown in table). The relationship of sickness absence with exercise frequency was not seen in men however. A higher per cent of non-exercisers (39.4%) among women also reported being almost or always stressed compared to regular exercisers (18.2%).

**Physical activity and cardiovascular risk factors**

Table 4 shows the mean values for fasting triglycerides, low density lipoprotein cholesterol, high density lipoprotein cholesterol, glucose and diastolic blood pressure adjusted for age, body mass index and ethnicity in males and females. Subjects with pre-existing chronic conditions like hypertension, diabetes or heart disease were excluded from the analysis. Among males, triglycerides and low-density lipoprotein cholesterol showed a statistically significant increase with decreasing levels of physical activity (p < 0.05). Blood glucose levels and diastolic blood pressure also increased with decreasing physical activity although the relationships were not statistically significant. Among females, there was no significant association of the parameters with physical activity. The triglycerides level was however lower in those subjects who exercised at least three times a day compared to those who never or exercised only once to twice per week.

**DISCUSSION**

Limitations of the study included the cross-sectional design and the reliance on self-report measures. A major problem of cross-sectional data is that self-reported physical activity or diet may not reflect long term lifestyle practices which may affect stress and other biologic measures. The study findings are also limited to a working population in a learning institution. However, this is a large and important group to understand and target health promotion programmes on physical activity.

The level of physical activity among both men (median = 30 minutes per week) and women (median = 20 minutes per week) in this institute was low when compared to the recommendation by the Centres for Disease Control and Prevention and the American College of Sports Medicine of 30 minutes or more of moderate-intensity physical activity most preferably all days of the week. Only 17.1% of men and a smaller per cent of women (10.1%) engaged in physical activity of 20 minutes duration without stopping, which is hard enough to make their heart rate and breathing increase a large amount and is carried at least three times a week. The figures were also low when compared
to Sallis’s study in the USA where 46% of men and 45% of women less than 50 years reported vigorous exercise. The percentages were however similar to the findings of a local study in 1982–85 which showed 18% of men in the same age group engaging in regular vigorous exercise. Thus, after a decade there appears to be no increase in physical activity among men. Among women, there has been an increase from 3.7% to 10.1%.

Factors significantly associated with low physical activity in women were age and marital status. In men, it was also significantly associated with marital status. Controlling for age, occupation and other lifestyle behaviours did not alter the relation of low physical activity with marital status in both gender. This finding is in contrast to studies in the United States where marital status was not associated with participation in physical fitness programmes. Low physical activity in men was also significantly associated with other lifestyle behaviours such as not drinking and the practice of not trimming fat off food. It also appears to be associated with smoking with smokers being 1.78 times more likely than ex-smokers to be physically inactive. However, the relationship was not significant (95% CI = 1.74–4.31) and this could be due to the small numbers. Although age was not associated with the frequency of physical activity in men, the amount of time engaged in physical activity was related to age with younger male workers spending a significantly longer time (median duration: 85 minutes per week) on exercise compared to older men (median duration: 35 minutes per week).

The most important factor contributing to low physical activity in women was age, with a steep increase in physical inactivity after age 50. This was also the high risk group who reported higher sick days leave (median: four days compared to one day in the 20–29 year age group). Diabetes (9.1%) and hypertension (18.2%) were also more prevalent among them and their reported health care expenditure (median = S$60) on hospital and outpatient treatment was much higher compared to the workers in the 20–29 year age group (median = S$21).

An interesting finding was the higher physical activity among drinkers (workers who consumed alcohol at least once per month) in men. The relationship was not confounded by age, marital status, occupation, smoking and ethnicity as the relationship remained significant even after adjustment for these confounders. Drinkers probably engaged in outdoor activities quite a lot. This could be the influence of the mass media and advertisements that often depict strong, physically fit men taking a drink after some sports or physical activity.

The type of physical activity was also found to differ with age and gender, with preferences for walking by older men and women; aerobics by younger women and jogging by younger men. For example, the preferred leisure-time physical activity among women aged 50 years and above is walking and none in this age group engaged in jogging or aerobics classes. Therefore, aerobics and fitness classes organized by the institute are unlikely to attract or encourage them to exercise.

In summary, this survey showed that low physical activity was most prevalent among older women and married workers regardless of gender and age. Older women also incurred the highest health care expenditure. Thus they are an important target group for physical fitness programmes. As the type of physical activity varied with age and gender, management should place greater emphasis on planning leisure time-physical activities specific to the preferences and concerns of men and women in the various age groups.

Many health promotion programmes at the workplace in Singapore promote on-site aerobics and physical activity classes. These classes usually have low participation rates and many of the programmes were not sustained. Our study also showed that aerobics exercises were not popular among men, regardless of their age and not preferred by older women who may find it embarrassing to wear leotards and dance as
well as too tiring to engage in aerobics classes. Married workers with child care responsibilities may not have time to attend the classes, especially if they are conducted after work. Thus on-site aerobics and physical fitness classes might not be reaching those in greatest need for physical activity. Recent studies showed that moderate physical activity (defined as activity performed at an intensity of 3–6 METs (work metabolic rate/resting metabolic rate) — the equivalent of brisk walking at 3–4 mph) carried out intermittently can confer substantial health benefits. Therefore, the recommended 30 minutes of activity can be accumulated in short bouts of activity: walking up the stairs instead of taking the elevator; walking instead of driving shorter distances; playing actively with the children. Management can make use of these findings to tailor the physical activity programme to the workers’ needs. While the management can promote aerobics or physical fitness classes for younger workers, they should also organize programmes for the older female sedentary workers in which physical inactivity was highly prevalent. Interventions for them should be designed with their input and they should be encouraged to integrate increased regular physical activity into their daily routine such as regular walking; getting down from the bus one stop earlier and walking the remaining distance; and playing actively with their children or grandchildren. Management should also encourage workers to use the stairs instead of the elevator at the workplace by displaying reminders at the stairs or the elevators. To meet the needs of married workers, management at the workplace could also organize family-centred physical activity programmes on a regular basis.

Our finding on the association of low physical activity with other unhealthy habits such as increased fat consumption and smoking in men implies the need to plan an integrated healthy lifestyle programme on smoking, diet and exercise for this group. Workplace health promotion officers must realize however that it is difficult to change workers’ lifestyle behaviours. The key is to help workers set realistic goals and make gradual changes. For example, the programme should stress on prescribing exercises that the workers find enjoyable and that can be integrated into their busy daily routine.

Increased leisure-time physical activity was also found to be associated with visible benefits such as reduced stress and lower LDL-cholesterol, triglycerides and glucose. However the association of physical activity with cholesterol and triglycerides was only statistically significant in men. A plausible explanation is that men could be more consistent in carrying out the regular physical activity routine. The intensity of their physical activity whether brisk walking or jogging, could also be greater in men than women. In addition, they differed in the type of physical activity as they were more likely to jog or swim while women were more likely to walk. Nevertheless, our study suggests that increased activity has some beneficial effects in reducing stress, triglycerides and low density lipoprotein cholesterol. Health promotion programmes can make use of these findings, which are visible within a short period, to encourage workers to engage in leisure-time physical activity or participate in physical activity programmes organized by workplace. This could be done by regular display of the results on bulletin boards and newsletters. Specific information and personalized accounts of real life experiences of workers on how exercise has helped reduce stress and lower cholesterol values are more likely to encourage their peers to exercise rather than mere dissemination of objective facts of physiological benefits of physical activity. We also found lower sickness leave among regular exercisers. These findings can be used to persuade management to support physical fitness programmes.

In conclusion, this study shows the benefits of a needs assessment survey prior to planning a physical activity programme. In addition to identifying important target groups for physical activity, it also determines the preferred leisure time physical activity by age and gender. Physical inactivity was more prevalent among older women, married workers regardless of gender; smokers, and men who engaged in unhealthy dietary habits. Sickness absence was also more prevalent among older women with low physical activity. Thus, these are the important groups to target physical fitness programmes. The type of physical activity also varied with age and gender with preference for walking by older men and women; jogging by young men and aerobics by young women. Management should design physical activity programmes that meet their workers’ specific preferences and can be integrated into their busy daily routine. This would ensure workers’ adherence with the programme and increase its sustainability. An active lifestyle does not refer to a regimented vigorous exercise programme. Instead workplace health promotion officers should recommend small changes such as brisk walking as such activities even if carried out intermittently will enable individuals to reduce their risks of chronic diseases and stress. At the same time senior management level staff should also engage in regular physical activity not only to improve their own health but to make more credible their endorsement of healthy lifestyles.

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