Seven-Year Changes of Leisure-Time and Occupational Physical Activity among Iranian Adults (Tehran Lipid and Glucose Study)

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Abstract
Background: Considering the lack of data available on changes of physical activity over time in Iran, this study was designed to evaluate changes in physical activity levels among Iranian adults over a median 6.5 yr period.
Methods: In this population-based cohort study, 3515 participants, aged ≥ 20 yr (2100 females and 1415 males) were followed from phase II (2002-2005) to phase IV (2008-2011) of the Tehran Lipid and Glucose Study. Information on physical activity, both leisure time (LTPA) and occupational (OCPA), was collected using the Modifiable Activity Questionnaire. Scores ≤600 METs-min/wk were considered as having low physical activity. Wilcoxon test was performed for comparing MET values between the two phases. McNemar test was used to evaluate differences between paired qualitative data.
Results: In both phases, 59.8% of adults were women, with mean±SD age 44.3±14.6 and 50.9±14.6 yr, in phases II and IV respectively. The prevalence of low physical activity decreased significantly in the follow up period (from 45.9% in phase II to 42.6% in phase IV, P=0.004). In both genders, a non-significant decrease in OCPA was observed. However, there was a significant decrease in LTPA among women (P=0.031), but not in men.
Conclusion: Despite the high levels of physical activity in Tehranian adults, a decreasing trend was observed. Significant decrease in LTPA among women indicates the urgent need to target women for prevention and implementation of public educational programs to promote physical activity levels and LTPA in particular, to compensate the reduction in OCPA.
Keywords: Physical activity, Trend, Leisure time, Occupational, Iran

Introduction

Physical inactivity is one of the main risk factors for chronic diseases, which are responsible for 5.3 million deaths annually worldwide (1). In 2009, the global prevalence of inactivity was 17% (2), with more than 30% of the world population not meeting the minimum recommendations for physical activity (3). In Iran, 40% of adults (31.6% men and 48.6% women) are reported to be in the low physical activity category, while about 15% (4.7 million people) do not have any physical activity (4). To reduce the burden of diseases like cardiovascular disease, cancer, diabetes mellitus, obesity, and depression, it is strongly recommended that individuals engage in regular physical activity of at least moderate intensity (5).

Given this scenario, information on changes in health-risk behaviors like physical activity over time is vital to planning effective programs and policies. Hence, evaluating changes in physical activity levels of populations over time has become a public health priority (3, 6). Since no data are available on time changes of physical activity in Iran, this study was designed to evaluate...
changes in physical activity levels over a median follow up of 6.5 yr among Tehranian adults.

Materials and Methods

The Tehran Lipid and Glucose Study (TLGS) is a prospective population based study performed on a representative sample of Tehran’s population, with the aim of determining the prevalence of noncommunicable disease (NCD) risk factors and developing a healthy lifestyle to improve them (7). The baseline survey was performed from 1999 to 2001 and 4751 families, which included over 15000 residents of district 13 of Tehran, aged ≥ 3 yr were selected by cluster random sampling method. After this cross-sectional prevalence study of NCD risk factors, subjects were enrolled into a cohort and a prospective interventional study and were followed every three years. Data on the physical activity status of subjects were collected using the Modifiable Activity Questionnaire (MAQ) from phase II of TLGS. Considering the high numbers of missing physical activity data in phase III, in the current paper, subjects were examined just for phases II (from 2002 to 2005) and IV (from 2008 to 2011) i.e. a 6.5 yr-follow up. The study was approved by the Ethics Committee of the Research Institute for Endocrine Sciences of Shahid Beheshti University of Medical Sciences. All participants provided written informed consent.

Study population
From 7268 subjects who completed the follow up period, participants who took part in lifestyle intervention through community education (n=3753) were excluded; the data of 3515 subjects aged ≥ 20 yr (2100 females and 1415 males) were analyzed to determine the changes of physical activity levels over a median follow up of 6.5 yr.

Physical Activity Assessment
Information on physical activity was collected using the MAQ (8). High reliability (98%) and moderate validity (47%) were found for the MAQ translated into Persian (9). Intra-class correlation coefficients between the two pretest and post-test MAQs for all activity domains in the past year, including leisure time, occupational, and total (leisure and occupational combined) physical activity were 0.94, 0.98, and 0.97, respectively.

Data were collected by participants, assisted by trained interviewers when needed. Participants were asked to report the activities that they had participated in (at least 10 sessions) during the past 12 mo in their leisure time and then identified the frequency and duration for each LTPA. Total numbers of minper year, calculated for every physical activity were summed up and then divided by 52 to estimate the minper wk of total leisure time physical activity. The calculation of MET-min/wk is summarized as MET-min/wk = (MET × mo per year × sessions per mo × minper session) / 52.

MET-min/wk of leisure time activity was calculated by multiplying the number of minper wk of each leisure time activity to its metabolic equivalent (MET). One MET is set at 3.5 ml of oxygen consumed per kg of body weight per min and represents the resting metabolic rate. The numbers of METs corresponding to each activity were calculated using the average metabolic cost for each activity (10).

Employed persons were asked to indicate how many h a wk they usually worked. According to the questionnaire, individuals had to identify the number of mo and h they participated in physical activity at work (standing, housework, work activities more intense than standing) over the past year. The assessment of occupational activity was based on summing up the number of h per wk of light, moderate and hard intensity activities, multiplying the sum by 60 in order to express minper wk of occupational activity over the past year. Final occupational (MET-min/wk) activity was calculated by multiplying the number of minper wk of each of the three categories of occupational activity by MET values (10).

Definition of Terms

total physical activity was expressed in MET-min/wk by adding leisure time to occupational activity; scores < 600 METs-min/wk were considered as low physical activity (11).
Statistical Analysis
Data are summarized as median (IQR). Paired Wilcoxon test was performed for comparison of average values between the two phases. McNemar test was used to evaluate differences between paired qualitative data. Analyses were carried out using SPSS software version 20.0 (SPSS, Chicago, II., USA). *P<0.05 was considered statistically significant.

Results
In both phases, 59.8% of adults were women and the mean ± SD of age was 44.3 ± 14.6 years in phase II and 50.9 ± 14.6 yr in phase IV. After 6.5 years, a significant decrease in LTPA was observed among women, but not among men (Fig. 1).

![Fig. 1: Levels of physical activity domains (METs-min/wk) in Tehranian men and women in phases II and IV of Tehran Lipid and Glucose Study. LTPA, Leisure Time Physical Activity level; OCPA, Occupational Physical Activity level. *P<0.05 between phases.](http://ijph.tums.ac.ir)

The prevalence of low physical activity in the total population decreased significantly between phases II and IV, being 45.9% and 42.6% respectively (P<0.05). As shown in Table 1, the decrease was significant in men, but not in women. Regarding age groups, this table also indicated that the prevalence of low physical activity has decreased significantly among older men (≥60 yr).
Table 1: Prevalence of low physical activity (<600 METs-min/wk) stratified by sex and age groups in phases II and IV of TLGS

| Sex     | Age groups (yr) | Phase II n (%) | Phase IV n (%) | P-value |
|---------|-----------------|----------------|----------------|---------|
| Men     | 20-39           | 87 (53)        | 104 (45.6)     |         |
|         | 40-59           | 139 (48.6)     | 177 (42.5)     |         |
|         | ≥60             | 113 (48.7)     | 122 (40.4)*    |         |
|         | All             | 339 (49.7)     | 403 (42.6)*    |         |
| Women   | 20-39           | 130 (45.6)     | 170 (40.7)     |         |
|         | 40-59           | 197 (43.3)     | 301 (43.5)     |         |
|         | ≥60             | 110 (41.2)     | 167 (43.3)     |         |
|         | All             | 110 (48.2)     | 167 (43.3)     |         |

TLGS, Tehran Lipid and Glucose Study
*P<0.05 by McNemar test

Regarding the activities in LTPA, there was a significant increase in proportion of individuals participating in swimming, aerobics/dancing, martial arts, and football/handball; however, there was a significant decrease in jogging/walking (Table 2).

Table 2: Comparison of LTPAs in phases II and IV of TLGS

| Activities            | Phase II n (%) | Phase IV n (%) | P-value* |
|-----------------------|----------------|----------------|----------|
| Jogging/walking       | 1012 (48)      | 813 (36.2)     | <0.001   |
| Running               | 78 (3.7)       | 64 (2.8)       | 0.225    |
| Swimming              | 175 (8.3)      | 239 (10.4)     | 0.001    |
| Mountain climbing     | 73 (3.5)       | 62 (2.8)       | 0.324    |
| Aerobics/dancing      | 427 (20.3)     | 503 (22.4)     | 0.003    |
| Martial arts          | 13 (0.6)       | 35 (1.6)       | 0.002    |
| Wrestling             | 12 (0.6)       | 14 (0.6)       | 0.832    |
| Body building         | 102 (4.9)      | 182 (8.1)      | <0.001   |
| Skipping              | 23 (1.1)       | 13 (0.6)       | 0.134    |
| Bicycling             | 24 (1.1)       | 21 (0.9)       | 0.749    |
| Football/Handball     | 88 (4.2)       | 115 (5.1)      | 0.044    |
| Volleyball            | 25 (1.2)       | 34 (1.5)       | 0.272    |
| Basketball            | 8 (0.4)        | 6 (0.3)        | 0.791    |
| Badminton/Table tennis| 33 (1.6)       | 31 (1.4)       | 0.694    |
| Skiing                | 2 (0.1)        | 2 (0.1)        | 1.00     |
| Others                | 6 (0.3)        | 112 (5)        | <0.001   |

TLGS, Tehran Lipid and Glucose Study; LTPA, Leisure Time Physical Activity.
*McNemar test for differences between proportions in two phases.

Discussion

The results of present study indicated a 3.3% decrease in the prevalence of low physical activity during a 6.5 yr follow up from 45.9% to 42.6%, among a Tehranian adult population. Although this is encouraging, it is difficult to estimate the clinical impact of such superficial changes, al-
though, on a population level they may lead to
decrease in morbidity; i.e., recently, from the
NHANES data it has been indicated that each
additional min daily of high intensity activity low-
d the odds of obesity by 2% for men and by 5% for
women (12).

Similar to our findings, a Brazilian and a peri-
urban Nepalese population showed a high preva-
ience of low physical activity, i.e. 43.3% and
>50%, respectively (13, 14). Although most stu-
dies indicated a decreasing trend in physical activi-
ty levels of populations (15-17); recently, in an
urban Swiss population, a significant increasing
trend was reported in physical activity levels from
1999 to 2009 (18), indicating a shift from low in-
tensity physical activity towards moderate/high or
vigorous physical activity among this population.
Surprisingly, this increasing change occurred out-
side the occupational setting, demonstrating an
increase in LTPA.

With respect to OCPA, our results indicated a de-
crease over time, which is a result of the greater
automation in the workplace, a problem that most
populations are facing (19-23). Similar to our find-
ings, in the Madrid region, a decrease in LTPA,
which mainly resulted in increased physical inac-
tivity, was accompanied by a decreased OCPA
(17), demonstrating a shift from occupations that
need moderate to high intensity physical activity
to occupations that mostly include sedentary and
sitting behavior. The same results were reported in
the peri-urban Nepalese population (13) i.e., the
reduction in OCPA was not compensated by an
increase in LTPA. Hence, concerns for public
health are increasing since OCPA is a major por-
tion of total physical activity and as long as the
decrease in OCPA is not counteracted by increase
in LTPA, the approach mentioned above that led
to increase physical activity levels in the Swiss
population (18), overall physical activity will most
likely declined.

Another main finding of the current study was
that LTPA decreased significantly among women
during a median follow up of 6.5 years. The asso-
ciation between employment and LTPA reports
earlier in this population (24) indicated higher
prevalence of inactivity among those employed
compared to the unemployed. These findings can
be easily explained by less leisure time among em-
ployed individuals, which is often reported as a
barrier to participate in physical activity and exer-
cise programs. Again, in another study of this
population (25), the prevalences of obesity and
abdominal obesity in women were found to be
higher than in men, indicting the urgent need to
target women for prevention and implementation
of public educational programs to promote physi-
cal activity levels and LTPA in particular, to cur-
tail the rising trend in obesity and abdominal obesity.
Physical inactivity is responsible for 6-10% of the
major non-communicable diseases includes coro-
nary heart disease and type 2 diabetes (1). Taking
into account that, regarding coronary heart disease
risk, about one-quarter of Tehranian adults are
reported to be eligible for therapeutic interventions
(therapeutic lifestyle changes and/or additional
drug therapy) (26) and also there is a marked in-
crease in the prevalence of obesity and abdominal
obesity (25), significant importance given to our
results. Furthermore, since the increasing trend in
abdominal and general obesity is also observed in
Tehranian adolescents (27) and taking into ac-
count that sports activities in Iran is publicized
mostly through physical education classes, schools
can play an important role in promoting physical
activity in younger groups of this society.

The increasing proportion of individuals partici-
pating in physical activities such as swimming and
aerobics/dancing reflects a preference shift in the
type of physical activity performed by adults in
leisure time. Such preferences in types of activities
may be a result of the growing number of gyms,
increased knowledge and awareness about the
beneficial effects of physical activity for health,
and achieving a desirable body shape. Similar to
our findings, in the Madrid region (17), activities
which mostly contribute to the decrease in LTPA
were those of low and moderate intensity, like
walking and jogging, implying that a significant
decrease in the proportion of subjects participat-
ing in these activities can be responsible for de-
crease in overall LTPA in this population.

The major strength of current study is its large
and diverse population, which is representative of
Tehranian adults. Moreover, the reliability and convergent validity of the Persian version of questionnaire used for physical activity assessment (MAQ) had been confirmed before. However, some limitations may have affected accuracy; first, the questionnaire we used (MAQ) differs to those of other studies, and any comparison of physical activity domains between studies using different methods is problematic; second, it cannot be overlooked that health promotion publicity induces a tendency for socially desirable answers; lastly, in such studies, the clinical significance of the changes in physical activity is difficult to determine.

**Conclusion**

Our analysis of physical activity level changes over a 6.5 yr follow up in Tehranian adults indicates a decreasing trend in the proportion of subjects with low physical activity. However despite these encouraging findings, approximately fifty percent of Tehranian adults still have physical activity levels below the minimum level recommended, emphasizing the necessity to implement programs encouraging increase in physical activity levels of Tehranian adults. Moreover, significant decrease in LTPA among women indicates the urgent need to target women for prevention and implementation of public educational programs to promote physical activity levels and LTPA in particular, to compensate the reduction in OCPA.

**Ethical considerations**

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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