



Influence of Participation in Leisure Time Physical Activity on Tobacco and Alcohol Consumption among Former Athletes and Non Athletes

by
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The purpose of the study was to recognise relationships between participation in leisure time physical activity (LTPA) and smoking and alcohol consumption among former athletes (FA) and individuals with no sports experience (NA). In Spring-Summer periods in the years 1997-2002 within the purposively sampled groups of FA (n=312) and people NA (n=417) - an anonymous survey was conducted concerning their socioeconomic status, participation in LTPA, smoking and alcohol consumption. The age of examined FA and NA ranged from 18 to 51 years. Respondents' participation in LTPA was measured as follows: frequency, time and forms of LTPA. For evaluation of respondents' smoking status in the last six months the following categories were used: I do not smoke, I smoked occasionally, I smoked 1 to 10 cigarettes/day, and I smoked more than 10 cigarettes/day. Variables describing alcohol consumption involve frequency of drinking alcohol beverages and type of consumed alcohol beverages. It has shown that among male FA was a significantly lower rate of non-smokers, as compared to male NA. No correlation was found between LTPA and smoking and alcohol consumption among women FA and NA. Negative correlation between participation in LTPA and smoking and alcohol consumption was found in both male groups. The results obtained allow us to draw a conclusion that promoting participation in competitive sports or LTPA is a valuable means to complement intervention programmes focused on the reduction and elimination of tobacco smoking and alcohol consumption addressed to men..

Key words: former athletes, non athletes, lifestyle risk factors, public health recommendations

Introduction

Unfavourable health-related behaviours (poor diet, physical inactivity, smoking, heavy drinking) result in an increase in morbidity and mortality at any age (US Department of Health and Human Services, 1991). Indices of mortality and disability among people practicing pro-health habits are lower by half as compared to people practicing bad health habits. People with several different anti-health habits cause a substantial increase in unnecessary health-care costs (Health Care Spending to Consume 14% of Gross National Product in 1992, 1992)

whereas practicing of multiple pro-health habits is correlated with considerable savings of costs born by health-care (Leigh and Fries 1992).

Numerous studies demonstrate that participation in leisure time physical activity (LTPA) may be a factor entailing change of different negative behaviours. Several cross-sectional studies confirm a weak inverse relationship between leisure time physical activity (LTPA) and smoking among adults, both men and women (Kannas 1981, Bjartveit et al. 1983, Klesges et al. 1990, Peel et al. 2005). The study conducted in The United States students population also document that the percentage of smokers among

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practicing school sports is lower than among subjects of the same age not participating in sports (Pate et al. 1996). However, other researchers find no evidence of any relationship between smoking and LTPA (Sedgwick et al. 1980, Marti et al. 1987, Krick and Sobal 1990, Johansson et al. 1991, King et al. 1996). In these studies most of the respondents reported lower than recommended level of LTPA. Presumably, studies conducted among individuals more active would deliver more information about associations between exercises and smoking.

Compared to non-smokers, smoking men and women seem to be not only more likely to be inactive, but also to consume more alcohol (Emmons et al. 1994). However, other investigators underline that physical activity has differentiated effects on particular factors, such as smoking or alcohol consumption (Sobal et al. 1992, Dishman and Sallis 1994).

The numerous studies do not find any proofs for any correlations between physical activity and alcohol consumption among men and women (Sallis et al. 1992, Wankel and Selfton 1994, Johnson et al. 1998, Schuit et al. 2002, Chung et al. 2007). However, the inverse relationship between level of LTPA and alcohol consumption is noticed among young female Europeans from 21 countries (Stoptoe et al. 1997).

The purpose of this study was to recognise the relationship between participation in competitive sports and LTPA and tobacco smoking and alcohol consumption among adults. The following hypotheses were assumed:

1. There are significant differences in tobacco and alcohol consumption among former athletes and non-athletes.
2. Participation in LTPA is negatively associated with smoking and alcohol consumption in both groups (men and women).

Methods

Participants

The research conducted in Spring-Summer periods in the years 1997-2002 embarked two groups: former athletes (FA) (n = 312; men n=175, women n=137) and a group of people with no professional sports experience – either in the past or at present – non-athletes (NA) (n = 417; men n=197, women n=220).

The definition of FA was taken from previous study (Telama 1994) and was as following: people who (in the past) took part in training and competition in sports clubs.

Purposive sampling has been conducted with the use of the easy access method. The age of examined FA and NA ranged from 18 to 51 years. Sports career duration of former athletes (both men and women) ranged between 1 - 18 years, most frequently it was 7 - 15 years. The participants of Poland, Europe, world and Olympic Games comprised 20% of this group.

Data collection and procedures

As the research technique, the method of diagnostic poll was used with an anonymous mail questionnaire including 72 closed and semi-open questions concerning socio-economic characteristics of the respondents and their health-related behaviours and attitudes. This paper considers only this part of the material collected that concerned participation in LTPA and smoking and alcohol consumption.

Respondents' participation in LTPA was measured as follows:

- frequency of undertaking LTPA in the week preceding the survey,
- time spent on LTPA in the week preceding the survey,
- LTPA forms practiced in the last workday preceding the survey.

For evaluation of respondents' smoking status in the last six months the following categories were used: I do not smoke, I smoked occasionally (not every day), I smoked 1-10 cigarettes/day and I smoked more than 10 cigarettes/day.

Variables describing alcohol consumption involve frequency of drinking alcohol beverages and type of consumed alcohol beverages in the last six months.

Data analysis

Distributions of socioeconomic and health behaviours by gender and participation in competitive sports were evaluated using a one-sided two-element structure test. In statistical analysis of the relationship between the variables describing participation in LTPA and smoking and alcohol consumption χ^2 test for independence with Yates' correction was used. The power and direction of the association between the variables were tested with Kendall's $\tau - c$ correlation coefficient. The value of this coefficient ranges between < 1 and $1 >$, where $\tau = 0$ means no correlation between the tested variables,

<i>Distributions (%) of socioeconomic by gender and participation in competitive sports</i>						
Variables	Female			Male		
	FA	NA	P ^a	FA	NA	P ^a
Age category:						
18-34	54.0	44.1	n.s.	45.7	34.5	*
35-51	46.0	55.9	n.s.	54.3	65.5	*
Educational level:						
vocational and elementary	53.3	28.6	**	9.6	33.5	**
higher and secondary	46.7	71.4	**	90.4	66.5	***
Type of work:						
pupil/student	9.5	25.5	***	10.3	16.0	n.s.
non-employment	9.5	18.6	***	13.1	26.0	n.s.
physical worker	13.1	21.8	n.s.	22.3	30.0	n.s.
white-collar worker	67.9	34.1	***	54.3	28.0	***
Marital status:						
married/living as married	65.6	49.6	*	70.3	54.0	**
single/divorced/widowed	34.4	50.4	n.s.	29.7	46.0	*
Place of residence:						
Rural area	13.1	9.5	n.s.	13.1	15.2	n.s.
Town	51.1	60.9	n.s.	54.9	53.3	n.s.
City	35.8	29.6	n.s.	32.0	31.5	n.s.
Net income level^b:						
< 600	52.5	64.6	n.s.	53.1	58.4	n.s.
≥ 600	47.5	35.4	n.s.	46.9	41.6	n.s.

$\tau > 0$ – positive correlation, and $\tau < 0$ – negative correlation. The following levels of statistical significance of tested correlations were used: $p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$. Statistical analysis of results was conducted by gender and participation (or not) in competitive sports in the past. Statistica 7.0 Pl software package (StatSoft, Inc. Poland) was used to make calculations.

Results

Analysis of socio-economic characteristics of respondents revealed that women with previous sports experience, as compared to the NA women, had significantly higher educational level, higher rate of white-collar workers, and of married individuals. The rate of pupils and students and women professionally inactive was lower among FA than among NA. The men FA, as compared to men NA, were younger, had significantly higher educational level, higher rate of professionally active individuals – in particular white-collar workers, and higher rate of married individuals (Table 1). Distribution of socio-economic features found in groups of male and

<i>Distributions (%) of health behaviours by gender and participation in competitive sports</i>						
Variables	Female			Male		
	FA	NA	P ^a	FA	NA	P ^a
Smoking						
I do not smoke	61,3	59,1	n.s.	57,7	45,0	*
I smoked occasionally	20,4	27,3	n.s.	21,1	20,5	n.s.
I smoked 1-10 cigarettes/day	10,2	10,4	n.s.	12,6	21,0	n.s.
I smoked >10 cigarettes/day	8,1	3,2	n.s.	8,6	13,5	n.s.
Frequency of alcohol consumption						
I do not drink alcohol	24,1	22,8	n.s.	10,3	11,1	n.s.
≤ once a month	33,6	37,7	n.s.	29,7	22,1	n.s.
1/month to 1/week	38,7	34,2	n.s.	49,8	46,7	n.s.
several times/week	3,7	4,8	n.s.	9,1	18,1	n.s.
everyday	0,0	0,5	n.s.	1,1	2,0	n.s.
Type of alcohol beverages consumed						
I do not drink alcohol	24,1	22,8	n.s.	10,3	11,1	n.s.
Beer	17,0	11,7	n.s.	20,5	21,0	n.s.
Low-grade beverages	40,1	34,1	n.s.	24,6	17,0	n.s.
Various alcohol beverages, including the high-grade ones	18,8	31,4	n.s.	44,6	51,0	n.s.

Note:

^a P for the test of difference between two structural components; n.s. – no statistical significance; * statistical significance at $p \leq 0.05$

female NA was similar to this typical of the middle-aged Polish population but in the FA groups a higher-than-average social status was found (Central Statistical Office 2004).

The surveyed female groups did not differ with respect to smoking habits. Among male FA a significantly lower rate of non-smokers was found, as compared to male NA ($p \leq 0.05$) (Table 2). Male FA habits with respects to smoking did not differ significantly from these habits among FA women, as well as among NA women.

In the surveyed material – both among women and among men – no significant correlation occurred between professional sports experience in the past and frequency of alcohol consumption (Table 2). However, statistical analysis performed in paired groups FA women – FA men and NA women – NA men confirmed significantly higher frequency of alcohol consumption among men than among women (FA: $p \leq 0.01$ and NA: $p \leq 0.001$).

The type of consumed alcohol beverages was not related to previous sports experience among women and men (Table 2). Significant difference with respects to the type of alcohol consumed was related

Table 3

Associations between variables describing participation of female (F) and male (M) former athletes (FA) and non athletes (NA) in LTPA and smoking

Variables	F – FA	F – NA	M – FA	M – NA
Frequency of participation in LTPA and smoking:				
χ^2	15.50	18.02	22.34	32.86
p	n.s.	n.s.	*	***
$\tau - c$	-0.12	-0.08	-0.20	-0.25
Duration of LTPA practicing and smoking:				
χ^2	15.05	16.58	21.95	30.54
p	n.s.	n.s.	**	**
$\tau - c$	-0.14	-0.07	-0.20	-0.25
Forms of participation in LTPA and smoking:				
χ^2	13.40	9.46	18.20	14.92
p	n.s.	n.s.	n.s.	n.s.
$\tau - c$	-0.12	-0.04	-0.17	-0.10

Note: Number of degrees of freedom (df) = 12; n.s. – correlation non-significant statistically; * - correlation significant at $p \leq 0.05$; ** - correlation significant at $p \leq 0.01$; *** - correlation significant at $p \leq 0.001$

to the sex of the subjects; both in the FA group and in the NA group alcohol consumption structure was more favourable among women than among men (FA: $p \leq 0.001$ and NA: $p \leq 0.001$).

In both studied groups of women no correlation was found between frequency, duration and forms of participation in LTPA and tobacco smoking. A negative correlation between tobacco smoking and frequency and duration of LTPA was, however, found in both male groups; the power of this correlation was slightly higher in the male NA group. LTPA forms undertaken by the respondents were not related to their smoking habits (Table 3).

Frequency of alcohol consumption showed no significant association with any of the variables describing participation of male FA and both groups of

women in LTPA. To the contrary, among male NA significant increase of alcohol consumption frequency, accompanied by low frequency of participation in LTPA and low-intensity forms of LTPA, was found (Table 4).

In both groups of women no correlation was found between any of variables characterising participation in LTPA and alcohol consumption structure, either. The type of alcohol consumed was, however, positively correlated with the time spent by male FA on participation in LTPA although the power of this correlation was poorly marked. In the male NA group all analysed LTPA-related variables (in particular its frequency) were significantly negatively correlated with alcohol consumption structure. Low Kendall's τ coefficients are indicative of low

Table 4

Associations between variables describing participation of female (F) and male (M) former athletes (FA) and non athletes (NA) in LTPA and frequency of alcohol consumption

Variables	F – FA	F – NA	M – FA	M – NA
Frequency of participation in LTPA and frequency of alcohol consumption:				
χ^2	19.52	19.80	14.60	30.33
p	n.s.	n.s.	n.s.	*
$\tau - c$	0.01	0.01	0.08	-0.12
Time spent on LTPA and frequency of alcohol consumption:				
χ^2	13.37	11.74	19.68	22.57
p	n.s.	n.s.	n.s.	n.s.
$\tau - c$	-0.02	0.03	0.08	-0.13
Forms of participation in LTPA and frequency of alcohol consumption:				
χ^2	5.80	7.94	23.01	26.20
p	n.s.	n.s.	n.s.	*
$\tau - c$	-0.02	-0.01	-0.04	-0.16

Note: Number of degrees of freedom (df) = 16; n.s. – correlation non-significant statistically; * - correlation significant at $p \leq 0.05$

Table 5

Associations between variables describing participation of female (F) and male (M) former athletes (FA) and non athletes (NA) in LTPA and type of consumed alcohol beverages

Variables	F – FA	F – NA	M – FA	M – NA
Frequency of participation in LTPA and type of consumed alcohol beverages:				
χ^2	19.01	11.48	10.78	39.35
P	n.s.	n.s.	n.s.	***
$\tau - c$	-0.06	0.02	-0.05	-0.12
Time spent on LTPA and type of consumed alcohol beverages:				
χ^2	13.19	13.01	23.97	30.56
P	n.s.	n.s.	*	**
$\tau - c$	-0.09	0.03	0.01	-0.12
Forms of participation in LTPA and type of consumed alcohol beverages:				
χ^2	7.04	13.12	14.26	22.70
P	n.s.	n.s.	n.s.	*
$\tau - c$	-0.13	0.03	-0.10	-0.19

Note: Number of degrees of freedom (df) = 12; n.s. – correlation non-significant statistically; * - correlation significant at $p \leq 0.05$; ** - correlation significant at $p \leq 0.01$; *** - correlation significant at $p \leq 0.001$

power of this correlation (Table 5).

Discussion

The comparison of health-related behaviours in FA and NA has shown that participation in competitive sports in the past encourages men to reduce smoking. Because the previous study have documented that the population groups at high risk of smoking are people of young age, low income and low educational status (Pomerleau et al. 1997, Bobak et al. 1998, Laaksonen et al. 2001), it is conceivably that our results could have been partly determined by the higher social status attained by former athletes (Table 1). As far as we know, the study of smoking status among FA had not been conducted, so we were not able to compare our findings with other ones.

The studies on correlation between participating in LTPA and tobacco smoking carried out so far have yielded contradictory results, e.g.: it was demonstrated that physical exercise is reversely correlated with tobacco smoking (Shephard 1989, Conway and Cronan 1992), however those findings were not confirmed in the US National Adult Fitness Survey (President's Council on Physical Fitness and Sports 1974), and other surveys (Perrier 1979, Marti et al. 1987). The results of studies measuring smoking with the number of cigarettes smoked per day or by smoker status confirmed the assumption that smoking and physical activity are negatively correlated although the power of this correlation is not a very

high one (Blair et al. 1985). A negative correlation between physical activity and smoking was also shown in a study of over ten thousands university students in 21 European countries (Steptoe et al. 1997). Sedentary lifestyle has also been documented as significant predictor of smoking in study of adults in the European Union (Varo et al. 2003). Based on a study with Navy men, Abood and Conway (1992) demonstrated that physical activity may be a healthy alternative to smoking. Mummery et al. (2007) found a reverse correlation between LTPA and tobacco smoking in a representative group of subjects aged 60 and more, residents of New Zealand. The study of Canadian adults (aged 65+ yr, n=12,611) has shown that the relationship between smoking and monthly moderate-intensity physical activity lasting > 15 minutes was especially noteworthy for men, but was significant for both gender (Kaplan et al. 2001). The earlier investigations conducted in Canada demonstrated that significant lower smoking rates were associated with higher levels of physical activity among young males (17-40 years age), older males (40-70 years of age), and young females (17-40 years of age) (Faulkner et al. 1987). Studies of Korean women and men (n=5554, age 18-74) showed that smoking male subjects were 1.48 times more likely to be physically inactive than male subjects who were former smokers or who had never smoked. In this study, no relationship between smoking and LTPA among female subjects was found (Chung et al. 2007). Some works available in the literature do not

confirm any relationship between the above behaviours. A study of 753 males showed that the probability of smoking is similar among men who increased their physical activity and among those whose activity remained unchanged. In the opinion of the study authors, correlation between physical exercise and smoking may be however modified by the socio-economic status of the subjects as professional physical activity (physical work) is more prevalent in lower-status groups where smoking is more widespread (Heath and Kendrick 1989). Other researches also found no evidence of any relation between smoking and LTPA among men (Sedgwick et al., 1980, Krick et al., 1990, Johansson et al., 1991, King et al., 1996).

Our study, reinforce the impression from published reports that participation in LTPA is associated with being non smokers among men, but not among women. Analysis of particular variables characterising participation in LTPA allows for a conclusion that frequency, time duration and forms of this participation are correlated with smoking among men in a different way and with varying power. Longer duration and higher frequency of recreational exercise show favourable association with smoking reduction. However, there is no relationship between LTPA forms and tobacco smoking in any of the above-mentioned groups. It may be henceforth concluded that in programs promoting participation in LTPA and non-smoking among men the emphasis should be put on the increase of exercise frequency and duration.

The statistical analysis of the own study results confirms a favourable correlation between frequency and forms of participation in LTPA and frequency of alcohol consumption among men with no sports experience in the past. In both studied groups of women and in the male FA groups, the discussed characteristics were independent. The type of consumed alcohol was not correlated with any variable describing participation of women in LTPA but such a correlation was found in male groups. However directions of the correlation shown was different. In the group of male FA, prolonged duration of LTPA was accompanied by an increase of the rate of subjects drinking high-grade beverages. In the surveyed male NA group, consumption of high-grade beverages was accompanied by the following factors: lower frequency, shorter duration and lower intensity of LTPA.

The data on alcohol consumption and physical activity are confusing. Wankel and Selfton (1994) have found no association between physical activity and alcohol use among men and women. Study conducted among Korean men and women (18-74 yr) has proven that there was no significant difference between drinking habits and level of LTPA (Chung et al., 2007). The study of American university women and men (n=576, mean age 24.5±2yrs) also support this conclusion (Johnson et al., 1998). Among the Dutch population (aged 20-59 yr) excessive alcohol consumption was not associated with low physical activity. Both the inactive and active groups had similar proportion of excessive drinkers. In this study any information about the location of drinking was collected. Therefore the authors cannot investigate if the active subjects, is due to drinking in canteens of sporting clubs (Schuit et al., 2002). The study conducted among young Europeans from 21 countries noticed that alcohol consumption was negatively related to level of LTPA among women but not among men. The authors suggest that team sporting events are frequently followed by drinking in the bar, and this may offset any salutagenic effects of exercise (Steptoe et al., 1997).

Conclusions

The results of our research show that taking part in competitive sports in the past favours the tobacco smoking reduction by male FA. It has also been proven that higher participation of men in LTPA is correlated with the control of tobacco smoking and lower high-grade alcohol consumption (in both studied groups) as well as less frequent alcohol use in the NA group. The demonstrated correlations between behaviours are stronger in the group of men NA (with a lower social status) than in the group FA.

The results obtained allow us to draw a conclusion that the promoting participation in competitive sports and LTPA is a valuable means to complement intervention programmes focused on the reduction and elimination of tobacco smoking and alcohol consumption addressed to men.

References

- Abood D.A., Conway T.L. Smoking status and body composition, exercise, dietary intake, and alcohol/caffeine consumption. Naval Health Research Center, San Diego, California 1992, Report No. 91-22.
- Bjartveit K., Foss O.P., Gjervig T. The cardiovascular disease study in Norwegian countries: results from first screening. *Acta Med Scand. (Suppl.)* 1983. 675: 95-130.
- Blair S.N., Jacobs D.R., Powell K.E. Relationships between exercise or physical activity and other health behaviors. *Public Health Reports*, March-April 1985. Vol. 100, No. 2: 172-180.
- Bobak M., Pikhart H., Hertzman C., et al. Socioeconomic factors, perceived control and self-reported Health in Russia. A cross-sectional survey. *Soc Sci Med.* 1998. Vol. 47, No. 2: 269-279.
- Central Statistical Office. *Statistical Yearbook*. Warsaw 2004.
- Chung L.Y., Hwang S.Y., Ham O.K. Factors Associated with Physical Inactivity among Korean Men and Women. *Am J Health Behav.* 2007. 31(5): 484-494.
- Conway T.L., Cronan T.A. Smoking, exercise, and physical fitness. *Prev Med.* 1992. 21: 723-734.
- Dishman R.K., Sallis J.F. Determinants and interventions for physical activity and exercise. In: Bouchard C, Stepward RJ, Stephens T, eds. *Physical activity, fitness, and health. International proceedings and consensus statement*. Champaign, IL: Human Kinetics; 1994, p. 214-238.
- Emmons K.M., Marcus B.H., Linnan L., et al. Mechanisms in multiple risk factor interventions: smoking, physical activity, and dietary fat intake among manufacturing workers. *Prev Med.* 1994; 23: 481-489.
- Faulkner R.A., Bailey D.A., Mirwald R.L. The relationship of physical activity to smoking characteristics in Canadian men and women. *Can J Public Health* 1987. 78: 155-160.
- Health Care Spending to Consume 14% of Gross National Product in 1992. *Business Health* 1992; February, 10.
- Heath G.W., Kendrick J.S. Outrunning the risk: a behavioral risk profile of runners. *Am J Prev Med.* 1989. 5: 347-352.
- Johansson G., Johnson J.V., Hall E.M. Smoking and sedentary behavior as related to work organization. *Soc Sci Med.* 1991. 32: 37-46.
- Johnson M.F., Nichols J.F., Sallis J.F., et al. Interrelationships between Physical Activity and Other Health Behaviors among University Women and Men. *Prev Med.* 1998. 27: 536-544.
- Kannas L. The dimensions of health behavior among young men in Finland: an overview of theories and findings. *Int J Health Educ.* 1981. 14: 146-155.
- Kaplan M., Newsom J.T., McFarland B.H., et al. Demographic and Psychosocial Correlates of Physical Activity in Late Life. *Am J Prev Med.* 2001. 21(4): 306-213.
- King T.K., Marcus B.H., Pinto B.M., et al. Cognitive-behavioral mediators of changing multiple behaviors: smoking and sedentary lifestyle. *Prev Med.* 1996; 25: 684-691.
- Klesges R.B., Eck L.H., Isbell T.R., et al. Smoking status: effects on the dietary intake, physical activity, and body fat of adult men. *Am J Clin Nutr.* 1990. 51: 784-789.
- Krick J.P., Sobal J. Relationships between health protective behaviors. *J Community Health* 1990; 15: 19-34.
- Laaksonen M., Mcalister A., Laatikainen T., et al. Do health behaviour and psychosocial risk factors explain the European East-West gap in health status ? *Eur J Public Health* 2001; 11: 65-73.
- Leigh J.P., Fries J.F. Health habits, health care use, and costs in a sample of retirees. *Inquiry* 1992. 29(1): 44-54.

- Marti B., Tuomilehto J., Salonen J.T., et al. Relationship between leisure-time physical activity and risk factors for coronary heart disease in middle-aged Finnish women. *Acta Med Scand*, 1987. 222: 223-230.
- Mummary W.K., Kolt G., Schofield G., et al. Associations between physical activity and other lifestyle behaviours in older New Zealanders. *Physical Activity and Health* 2007; 4: 411-422.
- Peel N.M., McClure R.J., Bartlett H.P. Behavioral determinants of healthy aging. *Am J Prev Med*. 2005. 28(3): 298-304.
- Pate R.R., Heath W.H., Dowda M., et al. Association between physical activity and other health behaviors in a representative sample of US adolescents. *Am J Public Health* 1996. 86: 1577-1581.
- Perrier. *The Perrier study: fitness in America*. New York: Perrier, 1979.
- Pomerleau J., Pederson L.L., Ostbye T., et al. Health behaviours and socio-economic status in Ontario, Canada. *Eur J Epidemiol*. 1997. 13(6): 613-622.
- President's Council on Physical Fitness and Sports. National adult physical fitness survey. *Phys Fitness Res Digest* 1974. 4: 1-27.
- Sallis J.F., Hovell M.F., Hofstetter C.R. Predictors of adoption and maintenance of vigorous physical activity in men and women. *Prev Med*. 1992. 21: 237-251.
- Schuit A.J., van Loon A.J.M., Tijhuis M., et al. Clustering of Lifestyle Risk Factors in a General Adult Population. *Prev Med*. 2002. 35: 219-224.
- Sedgwick A.W., Brotherhood J.R., Harris-Davidson A., et al. Long-term effects of physical training programme on risk factors for coronary heart disease in otherwise sedentary men. *Br Med J* 1980. 6232: 7-10.
- Shephard R.J. Exercise and lifestyle change. *Brit J Sports Med*. 1989. 23: 11-22.
- Sobal J., Revicki D., DeForge B.R. Patterns of interrelationships among health-promotion behaviors. *Am J Public Health* 1992. 8: 351-359.
- Steptoe A, Wardle J, Fuller R, et al. Leisure-time physical exercise: prevalence, attitudinal correlates, and behavioral correlates among young Europeans from 21 countries. *Prev Med*. 1997. 26: 845-854.
- Telama R, Laakso L, Yang X. Physical activity and participation in sports of young people in Finland. *Scand J Med Sci Sports* 1994. 4: 65-74.
- US Department of Health and Human Services: *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. Public Health Service, 1991, DHHS Publication No. (PHS) 91-50213.
- Varo J.J., Martínez-González M.A., Irala-Estévez J., et al. Distribution and determinants of sedentary lifestyle in the European Union. *Int J Epidemiol*. 2003. 32:138-146.
- Wankel L.M., Selfton J.M. Physical activity and other behaviors. In: Bouchard C, Shephard RJ, Stephens T, eds. *Physical activity, fitness, and health. Champaign (IL): Human Kinetics, 1994: 530-550.*

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