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OCCUPATIONAL, COMMUTING AND LEISURE PHYSICAL ACTIVITIES AND CARDIOVASCULAR DISEASE RISK FACTORS AMONG BLUE-COLLAR WORKERS

By

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Abstract:

Background: The role of Physical activity in the protection from cardiovascular disease risk factors (CVDr) is well known but the role of occupational and commuting physical activities is still controversial. Blue-collar workers constitute a group where the association of occupational and commuting activities to CVDr is still unclear. **Objective:** is to identify the effect of occupational and occupationally related physical activities on CVDr among blue collar-collar workers. **Study design:** Through a cross sectional study, the occupational, commuting and leisure physical activities of a representative sample of 356 blue-collar workers were evaluated by interview questionnaire. Their clinical profile {body mass index (BMI), waist to hip ratio (WHr), systolic blood pressure (SBP) and diastolic blood pressure (DBP)} and biochemical profile {total cholesterol (TC), triglycerides(TG), High density lipoprotein (HDL), low density lipoprotein (LDL), fasting blood sugar (FBS), and glycosylated Hemoglobin (Hb A1c)} were measured. **Results:** The rate and median duration of occupational, commuting and leisure physical activities were low. The mean of all evaluated anthropometric and biochemical parameters were within the desired levels except BMI (26.28). The occupational activity and the total sum of all types of activities were negatively and significantly correlating with all clinical parameters of CVDr, while their correlation with all biochemical parameters were non-significant. The association between other

types of activities (commuting and leisure activities) and both clinical and biochemical parameters of CVDr were not significant. The clinical and biochemical profiles of CVDr were not significantly different according to subcategory job title (skilled, unskilled and service workers). **Conclusion:** Occupational activity was significantly associated with more favorable cardiovascular risk profile while other types of activities (commuting and leisure) were not significantly associated with better profile. **Recommendations:** Encouragement of commuting and leisure activities among blue collar workers (BCW) is recommended to prevent CVDr. Further studies are needed to explore the role of job stress and nutritional habits in increasing incidence of CVD in BCW.
Key words: Occupational activity – physical activity - cardiovascular disease – risk factors

Introduction

The protective role of physical activity from cardiovascular diseases (CVD) and their risk factors is well established (Pate et al., 1995 and Prasad and Das, 2009), whereas the role of occupational activity is still unclear. Many studies revealed high rates of CVD among physically active blue-collar workers (BCW) who are earning an hourly wage and performing manual labor (OPM, 2009). These studies related these findings to occupational or non-occupational factors (Barbini et al., 2007, Chen et al., 2007 and Sofi et al., 2007). Some studies mentioned the presence of an association between CVDr and reduced skills among BCW (Dorner et al., 2006). However, other fewer studies revealed non significant difference in the rates of cardiovascular disease risk factors (CVDr) between blue-collar and white-collar workers (Oberlinner et al., 2008). It was stressed that occupational and non-occupational physical activities should be considered differently as the most common physical effort at work applies to a limited group of muscles with a high component of static effort (Makowiec-Dabrowska, 1995). Therefore physical effort at work is not optimal from the training point of view, and affects negatively the circulatory system.

In Kingdom of Saudi Arabia, blue-collar workers constitute an important sector of the working force. Therefore, enhancing the preventive programs for CVD may lead to saving this important sector especially skilled part and reducing the expenses of health care services allover the country.

Identifying the association between occupational or occupationally-related physical activity and CVDr is important information for decision makers to facilitate the prevention of their morbidity

and mortality. This study was therefore structured to identify such an association.

Subjects and Methods:

Subjects:

The sample of World Health survey that represents Riyadh population was the sampling frame of this study. All blue collar workers (356 workers) in this sampling frame were Identified during the basic survey (the household questionnaire meeting) [BCW in this study were divided into skilled and unskilled groups, and were involved in the factory work, building and construction trades, mechanical work, as well as maintenance or technical installations]. The service workers in this study were selected according to the criteria of BCW (OPM, 2009), being involved in cleaning and maintenance operations.

Methods:

The study population was subjected to a structured questionnaire covering the following items:

A. The socio-demographic characteristics.

B. History of cardiovascular disease or risk factors.

C. Work history.

D. Activity assessment (occupational, commuting and leisure).

Activity was considered occupational when taking place at the work site. On the other hand, the commuting activity is occurring in the way to or from work. All durations were calculated whether full or part time work. Whatever the type of activity, only the regular weekly activities were considered and computed. Each type of activity was evaluated separately by the activity assessment questions included in the study Questionnaire (part D) which was recommended by WHO (WHO, 2007). These questions were accompanied by a list containing examples for each activity to help in classifying it into moderate or vigorous (Ainsworth et al., 2000). The duration of activity was computed in min/week.

The duration of walking or biking from home to work or from work to home were considered a commuting activity and expressed also in min/week. Using cars or automated ways for transportation were not considered significant commuting activities.

Light activity (not associated with increase in respiratory or heart rate) was not taken into consideration in this study. Vigorous activities were added to the moderate activities for each type of activity (occupational or leisure) and expressed in

min/week. In this study a total activity of 150 min/week was considered a sufficient activity to prevent overweight and cardiovascular diseases whether carried out in one session or divided into sessions being not less than 10 minutes per sessions (WHO, 2007).

Measurements:

Anthropometric measurements: were performed in the morning following a 12 h fast. Waist circumference (WC) was measured at the end of normal expiration, with the measuring tape positioned at the level of noticeable waist narrowing. When narrowing could not be determined, the circumference was measured at the level of the lower floating rib. For hip circumference, the tape was positioned around the hips at the level of the symphysis pubis and greatest gluteal protuberance. Height was measured with participants standing on a hard surface against a wall, using tape fixed to the wall. All measurements were recorded to the nearest centimeter. Weight was measured to the nearest 100 g using a calibrated balance beam scale. Body mass index (BMI) was calculated as the ratio of weight to height squared (kg/m2). Waist / hip ratio (WHR) was calculated as waist circumference in cm divided by hip circumference in cm. Individuals were considered to be overweight when BMI was >= 25 and obese when BMI >= 30. A Waist to hip ratio of >=1 were considered high.

Blood pressure measurements: (systolic and diastolic) were taken at the beginning and end of the interview. The mean of both measurements was used.

Individuals were considered to have hypertension if their average systolic blood pressure was >=140mmHg or if their average diastolic blood pressure was >=90mmHg, or if they were under treatment for hypertension. Treatment for hypertension included prescription medication or nonpharmacological treatment (weight control or sodium/salt restriction).

Laboratory measurements:

Individuals were considered to have diab-etes if their fasting blood sugar were >= 126 mg/dL or under treatment of diabetes. Fasting blood samples were obtained and subsequently analyzed at the Ministry of health hospitals.

The presence of abnormal lipid levels, fasting blood sugar or glycosylated hemoglobin were defined as that recommended by WHO (WHO, 2006). Levels were abnormal when TC >= 240

mg/dL, LDL >= 160 mg/dL, HDL < 40 mg/dL, TG >= 200 mg/dL, FBS >= 126 mg/dL, and Hb A1c >= 6.1%.

Statistical analysis

SAS (SAS Institute Inc., 2006) software was used for data entry and analyses. Descriptive characteristics for the study sample as well as descriptive statistics of biochemical and clinical parameters were carried out. The chi-square test was used to analyze categorical variables across occupational categories. The Kruskal-Wallis test was used to compare physical activity levels in the different occupational catigories. Correlation matrix was used to test the association between the durations of different types of activities and detected levels of biochemical and clinical parameters.

Results

The Personal characteristics of the study population (table 1) show that the highest proportion of the study sample is in the 30-44 age group while the lowest is in the 60 or more age group. Females were under represented (8.43%). Married workers constituted 80.62% of the total workers while single workers constituted 19.38%. As regards the level of education, postgraduates form the lowest proportion (10.11%) while illiterate form the highest proportion (30.62%). Non-nationals constituted the three fourths of the total sample. The highest proportion of workers was skilled (41.29%), while the lowest were service workers (23.315). Smokers constituted 22.47% of the study sample.

The total duration of vigorous and moderate (occupational, commuting and leisure) physical activity differ according to occupational category, but using kruskal Wallis test the difference appear to be significant only for commuting activity (table 2).

Vigorous and/or moderate occupational physical activities were reported among 48.03% of the study sample while commuting and leisure time activities were reported among 44.1% and 9.27%, respectively. The frequency of all types of activities differ according to the occupational category but this difference was only significant with commuting activities such as walking or biking to or from work (table 3). Accordingly, the highest prevalence of occupationally or non-occupationally induced activities was found to belong to unskilled group of workers.

Individuals carrying out a sufficient duration of activity to prevent CVD constituted 57.30% (n = 204). However, the frequency distribution of activity sufficiency among the different occupational categories was not significant, though the prevalence of sufficiency was higher among unskilled worker (79, 62.7%) compared to service (42, 50.6%) and skilled (83, 56.46%) workers. (data not shown)

Regarding the rates of abnormal biochemical and clinical findings (table 5), skilled workers showed the highest rates of high TG (34.33%), low HDL (52.46%), high LDL (38.66%), overweight (43.06%) and high WHR (21.77%). The highest rates of high TC (22.64%) and diabetes (67.80%) were detected for unskilled workers while the highest rates of hypertension (24.10%) and obesity (20.00%) were detected for service workers. In general, the rate of low level of HDL (48.48 %) and overweight (38.84%) were the highest rates of abnormal biochemical and clinical findings respectively.

Evaluation of biochemical and clinical parameters for the study population revealed within normal level ranges except for the BMI which was found to be 26.28 [Missed cases were shown especially among biochemical parameters profile due to refusing to give blood sample or due to insufficient samples to run the test].

Correlation of these parameters with the total duration of occupationally induced activity among the different occupational categories revealed the presence of a significant negative correlation for the SBP, DBP, BMI and WHR only (table 4).

Table (1) Frequency distributions of the personal characteristics among the study sample (n = 356)

Variables		Count	%
Age group	18 - 29	77	21.63
	30 - 44	179	50.28
	45 - 59	82	23.03
	> = 60	18	5.06
Sex	Male	326	91.57
	Female	30	8.43
Marital status	Single	69	19.38
	Married	287	80.62
Education	Illiterate	109	30.62
	Primary	74	20.79
	Intermediate	59	16.57
	Secondary	78	21.91
	University or higher	36	10.11
Nationality	Saudi	88	24.72
	Non-Saudi	268	75.28
Occupational category	Service workers	83	23.31
	Skilled workers	147	41.29
	Unskilled	126	35.39
Smoking habits	Smokers	80	22.47
	Non smokers	276	77.53

Table (2): Analysis of the duration of physical activities (min/week) according to occupational category

Type of physical activity*	Service workers**	Skilled workers**	Unskilled workers**	All
Occupational [ns]	0 (0 , 1440)	0 (0 , 1680)	105(0 , 1372)	0 (0 , 1440)
Commuting [ss]	0 (0 , 60)	0 (0 , 140)	22(0 , 180)	0 (0 , 140)
Leisure [ns]	0 (0 , 0)	0 (0 , 0)	0 (0 , 0)	0 (0 , 0)
Total activities [ns]	150(0 , 1440)	240(0 , 1890)	23, 1510))495	300(0 , 1800)

*Using Kruskal Wallis Test ss = Statistically significant ns = Non-significant

**Median (25th, 75th percentile)

Table (3): The frequency distributions of Occupational, commuting and leisure activities among the different occupational categories

Type of activity		Occupational category						Total	
		Service workers N = 83		Skilled workers N = 147		Unskilled workers N = 126			
		No.	%	No.	%	No.	%	No.	%
Occupational activity ns	Yes	36	43.37	69	46.94	66	52.38	171	48.03
	No	47	56.63	78	53.06	60	47.62	185	51.97
Commuting activity ss	Yes	29	34.94	60	40.82	68	53.97	157	44.10
	No	54	65.06	87	59.18	58	46.03	199	55.90
Leisure activity ns	Yes	7	8.43	11	7.48	15	11.90	33	9.27
	No	76	91.57	136	92.52	111	88.10	323	90.73

Ss= Statistically significant ns= Non-significant

Table (4): Correlation of the clinical and biochemical parameters versus the different types of activities among the study population

Variables		Occupational activity	Commuting activity (walk or bike to work)	Leisure activity	Total activities
Diastolic BP N = 365	r	-0.217	-0.017	0.025	-0.211
	P value	0.00**	0.76	0.63	0.00**
Systolic BP N = 365	r	-0.195	-0.007	0.024	-0.188
	P value	0.00**	0.89	0.65	0.00**
Body Mass Index N = 365	r	-0.130	-0.094	0.022	-0.147
	P value	0.01*	0.08	0.68	0.01*
Waist / hip ratio N = 365	r	-0.122	-0.015	-0.046	-0.123
	P value	0.02*	0.78	0.39	0.02*
Cholesterol N = 145	r	0.010	-0.124	0.055	-0.023
	P value	0.91	0.14	0.51	0.78
TG N = 145	r	-0.039	-0.036	0.054	-0.046
	P value	0.64	0.67	0.52	0.58
HDL N = 132	r	0.072	-0.024	-0.019	0.062
	P value	0.41	0.79	0.83	0.48
LDL N = 119	r	0.018	-0.004	0.078	0.020
	P value	0.85	0.97	0.40	0.83
FBS N = 144	r	-0.119	-0.017	0.123	-0.115
	P value	0.16	0.84	0.14	0.17
Hb A1c N = 138	r	-0.049	-0.014	0.009	-0.052
	P value	0.57	0.87	0.92	0.55

significant P value < 0.05 **highly significant P value < 0.005*

Table (5): Distribution of abnormal biochemical and clinical profile according to occupational category

Variables	Service workers		Skilled workers		Unskilled workers		Total	
	No (Total)**	%	No (Total)**	%	No (Total)**	%	No (Total)**	%
High TC*	3 (25)	12.00	8 (67)	11.94	12 (53)	22.64	23 (145)	15.86
High TG*	5 (25)	20.00	23 (67)	34.33	15 (53)	28.30	43 (145)	29.66
Low HDL*	9 (21)	42.86	32 (61)	52.46	23 (50)	46.00	64(132)	48.48
High LDL*	3 (19)	15.79	9(55)	38.66	9(45)	20.00	21(119)	17.65
Hypertension*	20 (83)	24.10	28(147)	19.05	24(126)	19.05	72(356)	20.22
Diabetic*	11 (25)	44.00	27(66)	40.91	13(53)	67.80	51(144)	35.42
Overweight*	29 (80)	36.25	62(144)	43.06	43(121)	35.54	134(345)	38.84
Obese*	16 (80)	20.00	27(144)	18.75	19(121)	15.70	62(345)	17.97
Waist to hip ratio (>=1)*	14 (80)	17.50	32(147)	21.77	22(125)	17.60	68(352)	19.32

* Chi square test revealed non-significant difference between occupational category.
** Total examined cases in each occupational category.
% of abnormal cases from total examined in each occupational category.

Discussion

The duration and rate of all physical activities in this study were lower than that reported in other studies (Pereiran et al., 1998 and Hu et al., 2005). These activities differed according to the occupational category, but the difference between these categories was significant only for the commuting activity. Relatively higher rate and median of occupational and commuting activities were detected among unskilled workers reflecting the high rate of sufficient activity among those workers. Unfortunately, leisure time physical activity was dramatically low in all occupational categories.

Referring to the association between type of activity and presence of CVDr, a highly significant negative correlation (increase in duration of occupational activity decrease the level of CVDr) was detected between the duration of occupational physical activities and diastolic blood pressure (DBP), SBP, BMI and waist to hip ratio. Similar significant association was detected with the total duration of all types of activities and the same CVDr while the association with commuting and leisure time activities and these CVDr was not significant. These findings indicate that the occupational activity may be a good predictor for CVDr (increased occupational activity decrease occurrence of CVDr) which is a very important observation in this study. Many old (Karvonen, 1982, Salonen et al., 1982, Salonen et al., 1988 and Olsen and Kristensen, 1991) and recent studies (Ishizaki et al., 1999, Yamamoto et al., 2003, Lee et al., 2006, Rose et al., 2006 and Barbini et al., 2007) detected similar associations between occupational physical activities and CVDr.

In the current study, the insignificant association between commuting and leisure time physical activity on one hand and the clinical parameters (DBP, SBP, BMI and WHR) on the other hand was not conforming the available literature (Hu et al., 2002 and Hu et al., 2003). This disagreement may be due to the low rates of these activities in our study or due to the low education level as more than 67% of the sample did not exceed the intermediate schools thus affecting their health habits.

Regarding the association between duration of activity and the biochemical profile, there was no detected significant association. This finding appears to disagree with many studies (Hu et al., 2002 and Hu et al., 2003, Salsberry et al., 2007 and Martínez et al., 2009), yet other factors such as work related factors (Buring et al., 1987), life style or dietetic factors (Bojarska and Górski, 2002) to play a role among

blue collar workers (Oppert et al., 2005). Recently, Yamamoto et al. (2003) revealed significant association between many biochemical parameters and occupational activity among young male workers only (< 45 years).

However, in this study no significant association was detected between Occupational categories and increased incidence of biochemical or clinical CVD risk factors. Actually, this agrees with other studies (Oberlinner et al., 2008). An association was even reported between CVDr and reduced skills among BCW (Dorner et al., 2006).

In conclusion: Occupational activity was significantly associated with more favorable cardiovascular risk profile while other types of activities (commuting and leisure) were not significantly associated with better profile. Encouragement of commuting and leisure activities in BCW is therefore recommended to prevent CVD. Further studies are also recommended to explore the role of job stress and nutritional habits in increasing incidence of CVD among BCW.

References

1. Ainsworth, B.E., Haskell, W.L., Whitt, M.C., Irwin, M.L., Swartz, A.M., Strath, S. J., O'Brien, W.L., Bassett, D.R.JR., Schmitz, K.H., Emplaincourt, P.O., Jacobs, D.R. and Leon, A.S. (2000). "Compendium of physical activities: an update of activity codes and MET intensities". Med Sci Sports Exerc. 32(9):498-504.
2. Barbini, N., Gorini, G., Ferrucci, L. and Biggeri, A. (2007). "The role of professional activity in arterial hypertension". (in Italian) G. Ital. Med. Lav. Ergon. 29(2):174-81.
3. Bojarska, D. and Górski, P. (2002). "Ischemic heart disease risk factors in blue-collar women with different level of physical work". (in Polish) Pol. Merkur. Lekarski. 12(67):25-9.
4. Buring, J.E., Evans, D.A., Fiore, M., Rosner, B. and Hennekens, C.H. (1987). "Occupation and risk of death from coronary heart disease". JAMA 258(6):791-2.
5. Chen, J.D., Cheng, T.J., Lin, Y.C. and Hsiao, S.T. (2007). "Job categories and acute ischemic heart disease: a hospital-based, case-control study in Taiwan". Am. J. Ind. Med. 50(6):409-14
6. Dorner, T., Fodor, J.G., Allichhammer, D., Kiefer, I., Lawrence, K., D'Angelo, M.S., Huebel, U., Strunz, B., Ohnoutka, A., Antes, G., Schmidl, H., Kunze, M. and Rieder, A. (2006). "A heart for Vienna"--the prevention program for the big city. Blue-collar workers as a special target group". Wien. Med. Wochenschr. 156(19-20):552-7.
7. Hu, G., Pekkarinen, H., Hanninen, O., Yu, Z., Guo, Z. and Tian, H. (2002). "Commuting, leisure-time physical activity, and cardiovascular risk factors in China". Med. Sci. Sports Exercise 34:234 –38.
8. Hu, G., Qiao, Q., Silventoinen, K., Eriksson, J.G., Jousilahti, P., Lindstrom, J., Valle, T.T., Nissinen, A. and Tuomilehto, J. (2003). "Occupational, commuting, and leisure-time physical activity in relation to risk for type 2 diabetes in middle-aged Finnish men and women". Diabetologia 46:322–329.
9. Hu, G., Sarti, C., Jousilahti, P., Silventoinen, K., Barengo, N.C. and Tuomilehto, J. (2005).

"Leisure Time, Occupational, and Commuting Physical Activity and the Risk of Stroke". Stroke J. Am. Heart Assoc. 36: 1994-9.

10. Ishizaki, M., Yamada, Y., Morikawa, Y., Noborisaka, Y., Ishida, M., Miura, T.K. and Nakagawa, H. (1999). "The relationship between waist-to-hip ratio and occupational status and life-style factors among middle-aged male and female Japanese workers" Occup. Med. 49(3): 177-82.
11. Karvonen, M.J. (1982). "Physical activity in work and leisure time in relation to cardiovascular diseases". Ann. Clin. Res. 34:118-23.
12. Lee, J.H., Hwang, S.Y., Kim, E.J. and Kim, M.J. (2006). "Comparison of risk factors between pre-hypertension and hypertension in Korean male industrial workers". Public Health Nurs. 23(4):314-23.
13. Makowiec-Dabrowska, T. (1995). "Is heavy physical work a risk factor for ischemic heart disease?" Med. Pr. 46(3):263-74.
14. Martínez, R.G., Alonso, K.R. and Novik, A.V. (2009). "Metabolic Syndrome: clinical and patho-physiological basis for a rational therapeutical approach". Rev. Med. Chil. 137(5):685-94.
15. Oberlinner, C., Humpert, P.M., Nawroth, P.P., Zober, A. and Morcos, M. (2008). "Metabolic syndrome in a large chemical company: prevalence in a screened worksite sample". Acta. Diabetol. 45(1):31-5.
16. Olsen, O. and Kristensen, T.S. (1991). "Impact of work environment on cardiovascular diseases in Denmark". J. Epidemiol. Community Health 45:4-10.
17. Oppert, J.M., Thomas, F., Charles, M.A., Benetos, A., Basdevant, A. and Simon, C. (2005). "Leisure-time and occupational physical activity in relation to cardiovascular risk factors and eating habits in French adults". Public Health Nutrition 9(6): 746–54.
18. Pate, R.R., Pratt, M., Blair, S.N., Haskell, W.L., Macera, C.A., Bouchard, C., Buchner, D., Ettinger, W., Heath, G.W., King, A.C., Kiska, A., Leon, A.S., Marcus, B.H., Morris, J., Paffenbarger, R.S., Patrick, K., Pollock, M.L., Rippe, J.M., Sallis, J. and Wilmore, J.H. (1995). "Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine". J. Am. Med. Assoc. 273: 402–7.
19. Pereira, M.A., Kriska, M.A., Collins, V.R., Dowse, G.K., Tuomilehto, J., Alberti, K.G.M., Gareeboo, H., Hemraj, F., Purran, A., Fareed, D., Brissonnette, G. and Zimmet, P.Z. (1998). "Occupational Status and Cardiovascular Disease Risk Factors in the Rapidly Developing, High-risk Population of Mauritius" Am. J. Epidemiol. 148(2): 148-59.
20. Prasad, D.S. and Das, B.C. (2009). "Physical inactivity: A cardiovascular risk factor" Indian J Med Sci 63(1): 33—42.
21. Rose, G., Kumlin, L., Dimberg, L., Bengtsson, C., Orth-Gomer, K. and Cai, X. (2006). "Work-related life events, psychological well-being and cardiovascular risk factors in male Swedish automotive workers". Occup. Med. (Lond.) 56(6):386-92.
22. Salonen, J.T., Puska, P. and Tuomilehto, J. (1982). "Physical activity and risk of myocardial infarction, cerebral stroke and death". Am. J. Epidemiol. 115:526-37.
23. Salonen, J.T., Slater, J.S., Tuomilehto, J., et al. (1988). "Leisure time and occupational physical activity: risk of death from ischemic heart disease". Am. J. Epidemiol. 127:87-94.
24. Salsberry, P.J., Corwin, E. and Reagan, P.B. (2007). "A complex web of risks for metabolic syndrome: race/ethnicity, economics, and gender". Am. J .Prev. Med. 33:114–20.
25. SAS Institute, Inc (2006). "Querying and reporting using SAS enterprise guide. Version 9.1.3". 4th edition. Cary, NC: SAS Institute, Inc.

26. Sofi, F., Capalbo, A., Marcucci, R., Gori, A.M., Fedi, S., Macchi, C., Casini, A,. Surrenti, C., Abbate, R. and Gensini, G.F. (2007). "Leisure time but not occupational physical activity significantly affects cardiovascular risk factors in an adult population". Eur. J. Clin. Invest. 37(12):947-53.
27. United States Office of Personnel Management (OPM) (2009). "Handbook of Occupational Groups and Families". Workforce Compensation and Performance Service, Washington, pp. 4.
28. WHO (2006). "Guidelines for the prevention, management and care of diabetes mellitus /Edited by Khatib M.N.O". EMRO Technical Publications Series 32:13-27.
29. WHO (2007). "Steps to health: a European framework to promote physical activity for health". WHO regional office for Europe. Publication no EUR/06/5062700/10. http://www.euro.who.int/.
30. Yamamoto, A., Temba, H., Horibe, H., Mabuchi, H., Saito, Y., Matsuzawa, Y., kita, T. and Nakamura, H. on behalf of the Research Group on Serum Lipid Survey 1990 in Japan (2003). "Life style and cardiovascular risk factors in the Japanese population- from an epidemiological survey on serum lipid levels in Japan 1990/ part 1: influence of life style and excess body weight on HDL-cholesterol and other lipid parameters in Men". J. Atheroscler. Thromb. 10(3): 165-75.