Hypertension, diabetes mellitus, overweight and obesity in employees under health transition at the railways company in Congo-Brazzaville

Bertrand Fikahem Ellenga Mbolla[1,2*], Thierry Raoul Alexis Gombet[2], Henri Germain Monabeka[2], Paul Macaire Ossou-Nguiet[2], Solange Flore Mongo-Ngamami[1], Christian Michel Kouala Landa[1], Suzy-Gisèle Kimbally-Kaky[1,2], Benjamin Longo-Mbenza[3]

[1]Department of Cardiology, University Hospital of Brazzaville, Brazzaville, Congo
[2]Department of Medicine, Faculty of Health Sciences, Marien Ngouabi University, Brazzaville, Congo
[3]Faculty of Health Sciences, Walter Sisulu University, Mthatha, South Africa
Email: [*]ellenga_bertrand@hotmail.com

ABSTRACT

Background and Aim: Cardiovascular risk (CVR) factors, namely hypertension (HT), diabetes mellitus and obesity, are a public health problem in sub-Saharan Africa because of health transition. The additional effect of the social gradient within the railway companies in Congo-Brazzaville on high CVR is not yet established. The aim of this study was to determine the extent of hypertension, diabetes mellitus, overweight, and obesity and to identify the contributing factors of fatness and hypertension. **Methods:** This was a cross-sectional study conducted in April 2013. A simple random sample of 255 out of all 2550 workers from the railway companies of Congo was examined for epidemiological, clinical and biological variables. **Results:** Out of the study sample, 231 (90.6%), 79 (31%), and 52 (20.4%) were men, rural dwellers, and senior executives, respectively. The mean age was 45 ± 13 years (range 19 to 63 years). The rates of overweight, hypertension, obesity, and diabetes mellitus were 40.3% (n = 103), 29.4% (n = 75), 7.5% (n = 19), and 3.5% (n = 9), respectively. In univariate analysis, female sex (OR 2.7, 95% CI 1.13 - 6.45, p = 0.01), senior executive (OR 2.4; 95% CI: 1.3 - 4.5; p = 0.003) and physical inactivity (OR 2.5; 95% CI: 1.5 - 4.2; p < 0.001) were significantly associated with overweight. Female sex (OR 7.5, 95% CI: 2.6 - 21; p < 0.001) and senior executive (OR 3.17; 95% CI: 1.2 - 8.3) were also significantly associated with obesity. In logistic regression, overweight (OR = 4.8, 95% CI 2.8 - 11, p < 0.0001), and obesity (OR = 6.8, 95%CI 2.1 - 22, p = 0.01) were identified as the most important and independent determinants of hypertension. **Conclusions:** Fatness is emerging and it is the most contributing factor of hypertension among workers at the Congolese railway companies. There is also a significant interaction between non-modifiable factors (genetic: females and family history) and modifiable factors (inactivity, fatness) for higher risk of hypertension. Health promotion should be emphasized by physical activity programs.

KEYWORDS

1. INTRODUCTION

The cardiovascular risk factors (CVRF), namely hypertension, diabetes mellitus and fatness (overweight/obesity) are a public health problem because of the high morbidity and mortality worldwide and in the developing countries, including sub-Saharan Africa (SSA) [1,2]. People are facing health (demographic, epidemiologic, and nutrition) transitions which may explain an important cardiovascular disease (CVD)-associated mortality [2]. Globally, diabetes mellitus has contributed to 6% of all deaths in 2010 [3], while hypertension is considered as the

[*]Corresponding author.

leading cause of the disease burden [4]. The prevalence of hypertension in SSA varies from 13.7% in rural areas to 20.7% in urban areas [5], and that of diabetes mellitus varies between 3% and 14.5% [3]. Moreover, the incidence of CVRF will increase with high rates of mortality in the upcoming decades [1,2,5,6]. Therefore, World Health Organization (WHO) has recommended active primary prevention and control of CVRF and CVD in countries with limited resources [7]. This prevention includes hypertension, smoking, physical inactivity and obesity [7,8]. The lack of primordial prevention of CVRF has already been a concern among general and inactive working pompulations from Congo Brazzaville [9-12]. Indeed, according to Kimbally-kaky *et al.*, the prevalence was 32% for hypertension, 7.1% for diabetes and 12% for obesity in urban population from Brazzaville [9]. Higher frequencies were reported by Levisse *et al.*, 45% for hypertension, 12% for diabetes and 25% for obesity during a second screening in the community of Congo [10]. Gombet *et al.* highlighted the importance of the cardiometabolic risk among Bank sedentary employees from Brazzaville [11,12]. The additional effect of social gradient within the railway companies in Congo Brazzaville on high CVR is not yet established. The aim of this study was to determine the extent of hypertension, diabetes mellitus, overweight, and obesity and to identify the contributing factors of fatness and hypertension.

2. MATERIALS AND METHODS

This was a cross-sectional survey conducted from 1st to 22 April 2013 at the occupational medicine centers of the railways company in urban and rural areas of Brazzaville (capital) and Pointe-Noire (port), cities separated by 510 km of railways, on the occasion of the annual systematic review recommended by law.

Study population: A simple random sample of 255 out of all 2550 workers from the railways company of Congo was examined for epidemiological, clinical and biological variables. The criteria of exclusion were fever, infections, chronic diseases, pregnancy, and refusal for participation to the study. Data were collected on a pre-coded structured and standardized questionnaire using self-reported languages such as French, Lingala and Kituba. The consent of the management and staff was obtained. The approval of the Ethics Committee of the Faculty of Health Sciences, Brazzaville, Congo, was granted. Thus, the study was carried out according to the Helsinki Declaration.

Data collection: Epidemiological data comprised of sex, age, geographic area (rural or urban), occupational status (senior executive or no), family history of diabetes and hypertension, addictions (alcohol and tobacco), physical inactivity (yes or no), and regular consumption of fruits and vegetables. Clinical examination recorded weight

(kg) using a mechanical scale (GIMA, Milano, Italy) with an accuracy of 0.1 kg, and height (m) with a standard stadiometer. Body mass index (BMI) was weight in kg divided by (height) $\times$ (height). Blood pressure was taken after a rest of at least 15 minutes, by averaging 3 shots. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured using automatic and validated OMRON M6 Comfort device (HEM-7221-E OMRON Healthcare Co., Ltd.., Kyoto, Japan). The fasting plasma glucose (g/L) was assayed after venipuncture and overnight 8 to 12 hours using an autoanalyzer and Biomerieux kits (Biomerieux, Mercy l'Etoile, France).

Definitions: Obesity was defined by BMI ≥ 30 kg/m^2 and overweight by BMI between 25 and 29.9 kg/m^2. Hypertension was defined by SBP ≥ 140 mm Hg and DBP ≥ 90 mmHg or long-term antihypertensive medication. Diabetes was defined by fasting glucose ≥ 1.26 g/L or long-term medication for diabetes. Physical inactivity, current smoking and excessive alcohol intake (EAI) were defined according to the criteria used by Gombet *et al.* [11]. Regular consumption of fruit and vegetables (ReFrVe) was reported by recall of the previous week of this survey.

Statistical analysis: Data were expressed in proportions for categorical variables and mean $\pm$ standard deviation for continuous variables. In univariate analysis, Student t-test, Chi-square test, and Odds ratio (OR with 95% Confidence Interval or CI) were used for comparisons of means and proportions, and associations, respectively. In multivariate analysis, after adjusting for confounding factors, logistic regression model identified independent determinants of hypertension, overweight and obesity. The criterion for statistical significance was p-value < 0.05. All analyses were performed using SPSS software version 10.0 for Windows (SPSS Inc, Chicago, IL, USA).

3. RESULTS

There were 231 men (90.6%) and 24 women (9.4%). The mean age was 45 ± 13 years (range 19 and 63 years). Among them, 79 lived in rural areas (31%) and 52 were senior executives (20.4%). Other epidemiological characteristics are reported in **Table 1**. **Table 2** presents the characteristics of the clinical variables in this population. The prevalence of overweight was 40.3% (n = 103). The univariate factors associated with overweight were female sex, and being senior executive (**Table 3**). Obesity was noted in 19 cases (7.5%). The female sex, urban residence and executive position were significantly associated with obesity (**Table 3**). The frequency of diabetes was 3.5% (95% CI 1.6 - 6.6) or 9 cases. The frequency of hypertension was 29.4% (95% CI 23.9 - 35.4) or 75 cases. In univariate analysis, family history of hypertension, senior position, overweight, obesity, and diabetes

Table 1. General characteristics of all participants.

	n (%)
Female sex	24 (9.4)
Senior executive	52 (20.4)
Rural area	79 (31)
Excessive alcohol intake	177 (69.7)
Current smoking	43 (16.9)
Diabetes in parents	26 (10.2)
Hypertension in parents	41 (16.1)
ReFrVe[*]	192 (75.3)
Physical inactivity	100 (39.2)

[*]ReFrVe: Regular consumption of fruit and vegetables.

Table 2. Clinicals and biologicals variables of population.

	Means ± standard deviation (range)
Age (years)	45 ± 13 (19 - 63)
weight (Kg)	74.2 ± 9.6 (56 - 114)
Height (cm)	172.5 ± 5 (158 - 195)
BMI (Kg/m^2)	24.8 ± 3 (19 - 38)
SBP (mm Hg)	133.3 ± 22.2 (90 - 213)
DBP (mm Hg)	84.7 ± 12.4 (61 - 127)
Glycaemia (g/dL)	104.3 ± 22.4 (75 - 218)

BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure.

Table 3. Univariates Odds of overweight and obesity.

	Overweight (n = 103)				Obesity (n = 19)			
	n (%)	OR	IC 95%	p-value	n (%)	OR	IC 95%	p-value
Female sex	15 (14.6)	2.7	1.13 - 6.45	0.018	7 (36.8)	7.5	2.6 - 21.5	<0.001
EAI	68 (66)	0.7	0.4 - 1.2	0.18	14 (73.7)	1.23	0.42 - 3.56	0.45
Current smoking	18 (17.5)	1.07	0.5 - 2.1	0.47	4 (21.1)	1.34	0.42 - 4.27	0.30
Diabetes in parents	13 (12.6)	1.54	0.68 - 3.48	0.19	2 (10.5)	1.03	0.22 - 4.77	0.45
HTIP	20 (19.4)	1.5	0.76 - 2.94	0.15	6 (31.6)	2.65	0.94 - 7.42	0.06
Senior executive	30 (29.1)	2.42	1.3 - 4.51	0.003	8 (42.1)	3.17	1.2 - 8.3	0.02
ReFrVe	75 (72.8)	0.8	0.45 - 1.42	0.27	19 (100)	-	-	0.001
Rural area	19 (25.3)	0.6	0.3 - 1.2	0.13	2 (10.5)	0.24	0.03 - 0.94	0.02
Physical inactivity	54 (52.4)	2.5	1.51 - 4.26	<0.001	10 (52.6)	1.8	0.7 - 4.6	0.15
Diabetes	6 (5.8)	3	0.75 - 12.5	0.09	1 (5.3)	1.53	0.18 - 13.3	0.32

EAI: excessive alcohol intake; HTIP: hypertension in parents; ReFrVe: Regular consumption of fruit and vegetables.

mellitus were significantly associated with hypertension (**Table 4**). In logistic regression, the independent determinants of hypertension were overweight and obesity (**Table 5**).

4. DISCUSSION

This study allowed us to determine the CVRF in workers from the railways company of Congo. The magnitude of overweight and hypertension and the emerging of diabetes and obesity with significant interrelations between CVRF were demonstrated among these Congolese workers.

Epidemiological aspects: There was a male predominance (90.6%) as heavy working is not suitable in the railways Company. In fact, women are often underrepresented in most studies of CVRF at SSA workplace [11-14]. We found a high rate of addiction among railway workers, with 16.9% for smoking and 69.7% for excessive alcohol consumption. Other authors in SSA report discrepancies about addiction rates: 73% for excessive alcohol consumption, 23% of smoking in Cameroon [14], 12.3% of smoking in Senegal [15], 33.6% of excessive alcohol consumption and 3 2% of smoking in Congo. [11] These differences appear to be related to the type of work performed, cultural beliefs such as religion (Muslim and protestant), Bantu taboos and traditions in developing countries, and the environment influence (degree of urbanization, globalization and social inequalities). However, the frequency of physical inactivity that

we found (39.2%) is less than that of Gombet *et al.* (70%) in the workplace in Brazzaville [11], and Mbaye *et al.* (68%) among postal workers in Senegal [15]. Indeed, this difference appears to be related to the working conditions of each other. The bank and post office men then appear more sedentary than the railroad workers. It is recognized that physical inactivity is among major causes of obesity and glucose disorders in black Africans [16].

Overweight and obesity: Overweight was reported in 47.8% vs. 7.5% for obesity in this study. In the general population in Brazzaville, the prevalence of obesity is 8.6% vs. 18.5% of overweight according to Kimbally-kaky *et al* [9]. Levisse *et al*. Report higher prevalence of obesity and estimated 20% using a screening in a Congolese community [10]. This difference is related to study designs [10]. However, Gombet *et al*. were found among bank employees in Brazzaville a BMI ≥ 25 in 65.1% of cases. Indeed, it is for most office workers, so physical inactivity. Furthermore, the epidemic proportion of 65.1% of overweight among Bank employees in Brazzaville [11] explained by the strong link between physical inactivity and obesity in the literature [16]. This study confirmed positive associations between overweight and physical inactivity. Globally, obesity affects more women [7], and its prevalence in SSA is up to 60% in some African regions [17]. It should be noted that obesity rates currently found in SSA, are comparable to those found in developed countries [18,19]. Similarly, the role

Table 4. Univariate Odds of hypertension.

	Hypertension (n = 75)			
	n (%)	OR	95% IC	p-value
Female sex	10 (13.3)	1.82	0.7 - 4.3	0.12
Excessive alcohol intake	51 (68)	0.89	0.49 - 1.59	0.4
Current smoking	15 (20)	1.35	0.67 - 2.71	0.24
HTIP	19 (25.9)	2.43	1.2 - 4.8	0.009
Diabetes in parents	8 (10.7)	1.1	0.44 - 2.6	0.51
Senior executive	27 (36)	3.48	1.8 - 6.5	0.0001
ReFrVe	61 (81.3)	1.62	0.83 - 3.1	0.09
Rural area	19 (25.3)	0.67	0.37 - 1.24	0.13
Overweight	48 (64)	4	2.2 - 7.1	<0.00001
Obesity	11 (14.7)	3.7	1.4 - 9.6	0.006
Physical inactivity	35 (46.7)	1.54	0.89 - 2.6	0.07
Diabetes mellitus	6 (8)	5.1	1.2 - 21	0.01

HTIP: hypertension in parents; ReFrVe: Regular consumption of fruit and vegetables.

Table 5. Independants determinants of overweight, obesity and hypertension by logistic regression.

	Independant determinants	β coefficient	Standard error	χ^2	OR(95% CI)	p-value
Overweight	**Hypertension** (yes vs no)	1.315	0.317	4.147	3.72 (2 - 6.93)	**<0.0001**
	Physical inactivity (yes vs no)	0.736	0.312	2.354	2.08 (1.13 - 3.85)	**0.018**
Obesity	**Sexe** (male vs female)	−2.816	0.91	−3.091	0.05 (0.01 - 0.35)	**0.002**
Hypertension	**Obesity** (yes vs no)	1.929	0.604	3.189	6.88 (2.1 - 22.5)	**0.001**
	Overweight (yes vs no)	1.738	0.356	4.874	5.69 (2.82 - 11.4)	**<0.0001**

of overweight and obesity on the increase in cardiovascular risk, with a significant impact on morbidity and mortality is well established [4,7].

Diabetes: The present prevalence of diabetes (3.5%) among both rural and urban workers was lower than those observed in urban areas by Kimbally-kaky *et al.* (7%) [9] and Levisse *et al.* (13%) [10] in the general population, and Gombet *et al.* (7.9%) in a Bank setting [11]. Overall, these trends meet the range of diabetes prevalence in SSA according to Mbanya *et al.* [3]. In the African environment, Mbanya *et al.* showed that lack of exercise is the most important origin of overweight and diabetes [3].

Hypertension: Hypertension was the second CVRF (29.4%) in our study, after overweight. Associated factors in univariate analysis were family history of hypertension, high socio-professional status, overweight and diabetes. The independent determinants of hypertension were only overweight and obesity. This prevalence is comparable to those reported in the general population in Brazzaville [9], or in other SSA countries [5,17,20]. The prevalence of hypertension in rural areas is lower than in SSA cities [3,5,8,17]. At the workplace, the prevalence of hypertension varies from 29.7% among officials in Abidjan (Ivory Coast) [13] to 43.7% among postal workers in Saint-Louis (Senegal) [15]. These differences can be explained by the environment, lifestyle, metabolic disorders and genetic characteristics [7,8,11].

The link between family history of hypertension, stress and hypertension at workplace is known [21]. In addition, the increase of body weight is well correlated with the increase of blood pressure [17]. With the obesity pandemic worldwide and in SSA in particular [7,19], effective prevention and control of contributing factors and metabolic consequences are urgently needed among these railway men [18,22-24].

5. CONCLUSION

Fatness is emerging and it is the most contributing factor of hypertension among these Congolese workers at the railway companies. There is also a significant interaction between non-modifiable factors (genetic: females and family history) and modifiable factors (inactivity, fatness) for higher risk of hypertension. Physical activity programs should emphasize health promotion.

REFERENCES

[1] Araújo, F., Gouvinhas, C., Fontes, F., La Vecchia, C., Azevedo, A. and Lunet, N. (2013) Trends in cardiovascular diseases and cancer mortality in 45 countries from five continents (1980-2010). *European Journal of Preventive Cardiology*.
http://dx.doi.org/10.1177/2047487313497864

[2] Rapport sur la Santé dans le Monde 2013. (2013) La recherche pour la couverture sanitaire universelle. OMS, 79.
http//apps.who.int/iris/bitstream/10665/85764/1/9789240

691193_fre.pdf

[3] Mbanya, J.C., Motala, A.A., Sobngwi, E., Assah, F.K. and Enoru, S.T. (2010) Diabetes in sub-Saharan Africa. *Lancet*, **375**, 2254-2266.
http://dx.doi.org/10.1016/S0140-6736(10)60550-8

[4] Lim, S.S., Vos, T., Flaxman, A.D., Danaei, G., Shibuya K., Adair-Rohani, H., AlMazroa, M.A., Amann, M., Ross Anderson, H., Andrews, K.G., Aryee, M., Atkinson, C., *et al.* (2012) A comparative risk assessment to 67 risk factors and risk factor clusters in 21 regions, 1999-2010: A systematic analysis for the Global Burden of Disease Study. *Lancet*, **380**, 2224-2260.
http://dx.doi.org/10.1016/S0140-6736(12)61766-8

[5] Twagirumukiza, M., De Backar, C., Kips, J.G., de Backer, G., Vander Stichele, R. and Van Bortel L.M. (2011) Current and projected prevalence of arterial hypertension in sub-Saharan africa by sex, age and habitat: An estimate from population studies. *Journal of Hypertension*, **29**, 1243-1252.
http://dx.doi.org/10.1097/HJH.0b013e328346995d

[6] Danaei, G., Finucane, M.M., Lu, Y., Singh, G.M., Cowan, M.J., Paciorek, C.J., Lin, J.K.,, Farzadfar, F., *et al.* (2011) National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: Sytematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet*, **378**, 31-40.
http://dx.doi.org/10.1016/S0140-6736(11)60679-X

[7] Rapport sur la Situation Mondiale des Maladies Non Transmissibles en 2010 (2011) Résumé d'Orientation. OMS 2011, ISBN 978 92 4 156422 9, 38-45.
www.who.int/nmh/publications/ncd_report-summary_fr.pdf

[8] Ibrahim, M.M. and Damasceno, A. (2012) Hypertension in developing countries. *Lancet*, **380**, 611-619.
http://dx.doi.org/10.1016/S0140-6736(12)60861-7

[9] Kimbally-Kaky, G. (2004) Hypertension artérielle et les autres facteurs de risque cardiovasculaires à Brazzaville. Ministère de la santé et de la population—OMS. Rapport d'enquête. Brazzaville.
http//www.who.int/entity/chp/steps/STEPS_Congo_Data.pdf

[10] Levisse, P., Mughnetsyan, V. and Kessy, G.S. (2009) Epidemiological study based on mass screening for diabetes, hypertension and android obesity in Brazzaville (Congo), 2008. *Médecine et Maladies Métaboliques*, **3**, 438-441.
http://dx.doi.org/10.1016/S1957-2557(09)72413-7

[11] Gombet, T., Longo-Mbenza, B., Ellenga Mbolla, B., Ikama, M.S., Mokondjimobe, E. and Nkoua, J.L. (2012) Aging, female sex, migration, elevated HDL-C and inflammation are associated with prevalence of metabolic syndrome among African bank employees. *International Journal of General Medicine*, **5**, 495-503.

[12] Gombet, Th., Kimbally-Kaky, G., Ikama, M.S. and Ellenga Mbolla, B.F. (2007) Hypertension artérielle et autres facteurs de risque cardiovasculaires en milieu professionnel Brazzavillois. *Médecine d'Afrique Noire*, **54,** 545-548.

[13] Koffi, N.M., Sally, S.J., Kouame, P., Silue, K. and Nama,

A.J. (2001) Facies de l'hypertension artérielle en milieu professionnel à Abidjan. *Médecine d'Afrique Noire*, **48**, 257-260.

[14] Bita Fouda, A.A., Lemogoum, D., Owona Manga, J., Dissongo, J., Tobbit, R., Ngounou Moyo, D.F., Etapelong Sume, G. and Kollo, B. (2012) Epidemiologie de l'obésité en milieu du travail à Douala, Cameroun. *Revue Médicale de Bruxelles*, **33**, 131-137

[15] Mbaye, A., Ndiaye, M.B., Kane, A.D., Ndoume, F., Diop, S., Yaméogo, N.V. and Kane, A. (2011) Screening of cardiovascular risk factors among workers of a private telecommunication company in Senegal. *Archives de Maladies Professionnelles et de l'Environnement*, **72**, 96-99.
http://dx.doi.org/10.1016/j.admp.2010.10.001

[16] Assah, F.K., Ekelund, U., Brage, S., Mbanya, J.C. and Wareham, N.J. (2011) Urbanization, physical activity, and metabolic health in sub-Saharan Africa. *Diabetes Care*, **34**, 491-496. http://dx.doi.org/10.2337/dc10-0990

[17] Cappuccio, F.P., Kerry, S.M., Adeyemo, A., Luke, A., Amoah, A.G., Bovet, P., Connor, M.D., Forrester, T., Gervasoni, J.P., Kimbally Kaki, G, Plange-Rhule, J., Thorogood, M. and Cooper, R.S. (2008) Body size and blood pressure. An analysis of Africans and the African diaspora. *Epidemiology*, **19**. 38-46.
http://dx.doi.org/10.1097/EDE.0b013e31815c4d2c

[18] Mina, R. and Casolin, A. (2007) National standard for health assessment of rail workers: The first year. *Medical Journal of Australia*, **187**, 394-397.

[19] Finucane, M.M., Stevens, G.A., Cowan, M.J., Danaie, G., Lin, J.K., Paciorek, C., Sing, G.M., *et al*. (2011) National, regional, and global trends in body-mass index since 1980: Systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 milion participants. *Lancet*, **377**, 557-567.
http://dx.doi.org/10.1016/S0140-6736(10)62037-5

[20] Yayehd, K., Damorou, F., Akakpo, R., Tchérou, T., N'da, N.W., Pessinaba, S., Belle, L. and Johnson, A. (2013) Prevalence and determinants of hypertension in Lomé (Togo): Results of a screening in May 2011. *Annales de Cardiologie et d'Angeiologie*, **62**, 43-50.
http://dx.doi.org/10.1016/j.ancard.2012.09.006

[21] Harada, K., Karube, Y., Saruhara, H., Takeda, K. and Kuwajima, I. (2006) Workplace hypertension is associated with obesity and family history of hypertension. *Hypertension Research*, **29**, 969-976.
http://dx.doi.org/10.1291/hypres.29.969

[22] Mina, R. and Casolin, A. (2012) The australian standard for rail workers five years on. *Occupationnal Medecine*, **62**, 642-647. http://dx.doi.org/10.1093/occmed/kqs170

[23] Ng, K.L., Quinn, S., Gill, T.K., Hill, C. and Shanahan, E.M. (2013) Impact of the new national health standard for rail safety workers on ischaemic heart disease risk factors in train drivers. *Internal Medicine Journal*, **43**, 650-655.
http://dx.doi.org/10.1111/j.1445-5994.2012.02923.x

[24] Ghiasvand, M., Heshmat, R., Golpira, R., Haghpanah, V., Soleimani, A., Shoushtarizadeh, P., Tavangar, S.M. and Larijani, B. (2006) Shift working and risk of lipid disorders: A cross-sectional study. *Lipids Health Diseases*, **5**, 9. http://dx.doi.org/10.1186/1476-511X-5-9