

## Cardiovascular risk factors among Bangladeshi ready-made garment workers

Kaniz Fatema,<sup>1,2</sup> Khurshid Natasha,<sup>3</sup> Liaquat Ali<sup>4</sup>

<sup>1</sup>Department of Epidemiology, Bangladesh, University of Health Sciences, Mirpur, Dhaka, Bangladesh;

<sup>2</sup>School of Public Health and Community Medicine, University of New South Wales, Australia;

<sup>3</sup>Department of Health Education & Health Promotion, Bangladesh, University of Health Sciences, Mirpur, Dhaka, Bangladesh;

<sup>4</sup>Department of Biochemistry & Cell Biology, Bangladesh, University of Health Sciences, Mirpur, Dhaka, Bangladesh

### Abstract

To estimate the prevalence and identify correlates of anthropometry and clinical risk factors for cardiovascular diseases (CVDs) among ready-made garment (RMG) of workers, majority are females, come from low-socioeconomics conditions. Population-based cross-sectional study with 614 individuals aged  $\geq 18$  years were recruited from six different RMG factories. In total, of 313 male (46%) and 301 of female (56%) workers had body mass index (BMI) in the overweight and obese range as per Asian cut off values with corresponding reflection in waist hip ratio (WHR). High proportion of male 84% (95% confidence interval 81-87) had smoking habits. The prevalence of hypertension (HTN), dyslipidemia were 24% vs 15%; 56% vs 43% among males and females respectively. Prevalence of diabetes was 7.3% (5.3-9.4) and pre-diabetes was 10.6% (8.2-13) and it showed female preponderance (4.5% male vs 10.3% female). In multivariable logistic regression HTN showed significant association with age, gender, BMI; glycemic status with age, gender and WHR; dyslipidemia with BMI and WHR. A substantial proportion of RMG workers are at an increased risk of CVDs which need focused attention to reduce smoking (among males) and body-weight and central obesity, particularly in females.

### Introduction

The epidemics of non-communicable diseases (NCDs) that include cardiovascular diseases (CVDs), along with hypertension, type 2 diabetic mellitus, overweight, and obesity are

getting enormous load specially due to globalization and urbanization.<sup>1</sup> The burden of NCDs, especially CVDs in developing countries, like Bangladesh, is expected to double in the next two decades, making it the single largest cause of death and the second largest cause of disability by 2020.<sup>2</sup> Although developed countries have been facing this problem for some years, mortality due to CVDs is now expanding exponentially even in developing countries. As nutritional, demographic, epidemiological and socioeconomic transitions are occurring in many developing countries, from public-health point of view, it is largely due to changes in lifestyle, which include changes in dietary habits and lack of exercise, leading to obesity, and smoking. In 2001, approximately 80% of all deaths due to CVDs worldwide occurred in developing countries, and countries with lower middle income, while these countries also accounted for 86% of the total global burden of CVDs.<sup>3</sup>

Data from several cross-sectional studies confirm the severity of CVDs and high prevalence of their risk factors, such as smoking, type 2 diabetes, high blood pressure, dyslipidemia, and obesity in urban areas.<sup>4,5</sup> Despite this high burden, there is poor awareness among the people of developing countries, in addition to low detection and control rates.<sup>6,7</sup> The reasons for this include low literacy, lack of access to healthcare, and competing priorities, such as infectious and nutritional diseases.

Ready-made garment (RMG) industry is currently the main industry of Bangladesh for its economic viability. Before liberation, there was only one garment factory in 1970 in Bangladesh. In 1977, the number of garment factories was only eight, During 1978-2011, the sector progressed rapidly. The number of garment industries is now about 3300. Since the early 1980s, the export-oriented garment industries have mushroomed in Bangladesh, with female workers constituting a significant proportion of its wage labor force. The number of RMG workers in Bangladesh is 1.6 million, and they work on shifting duty.<sup>8</sup> Seventy-six percent of the total export of Bangladesh is garment-oriented, and She exports approximately 124 items of garment products. So, at present, it is the main industry in Bangladesh and is also the main source of income for the illiterate people. This large number of RMG workers has actually migrated from rural to urban areas. As a consequence, their lifestyle and dietary habits have also changed over the years.

Although the garment workers are the most productive section of Bangladesh, their health status has largely been ignored. We hardly found any research paper or investigation about their health status or the risk of NCDs among RMG worker, especially in urban areas

Correspondence: Kaniz Fatema, School of Public Health and Community Medicine, University of New South Wales (UNSW), Australia.  
Mobile: +61.0470505515 (Australia); +8801716502930 (Bangladesh).  
E-mail: kaniz\_dina@yahoo.com; k.fatema@student.unsw.edu.au

Key words: ready-made garments, cardiovascular diseases, hypertension, type 2 diabetes, obesity.

Acknowledgments: special thanks to the important contribution of the EPZ-savar authority for their kind support. We acknowledge the important contribution of the laboratory staff, volunteers from EPZ to make this work possible. We are grateful to all the subjects who participated in the study.

Contributions: KF, idea development, project design, statistical analysis, data interpretation, paper preparing and submission; KN, collection of data, data interpretation and paper preparing; LA, supervised and monitored all aspects of this study from conception of the idea to submission of the paper. The three authors contributed equally to the final version of the paper.

Conflict of interests: the authors declare that they have no competing interests.

Funding: the authors received financial support from Biomedical Research Group, BIRDEM.

Received for publication: 17 October 2013.

Revision received: 28 July 2014.

Accepted for publication: 4 October 2014.

This work is licensed under a Creative Commons Attribution NonCommercial 3.0 License (CC BY-NC 3.0).

©Copyright K. Fatema et al., 2014

Licensee PAGEPress, Italy

Journal of Public Health in Africa 2014; 5:373

doi:10.4081/jphia.2014.373

where these industries are situated. The sedentary nature of the work schedule of the garment workers coupled with indiscriminate dietary habits makes it important to investigate this population.

The present study was, therefore, designed to explore the prevalence of anthropometric and clinical risk factors for CVDs among the Bangladeshi RMG workers in an urban setting (Dhaka city).

### Materials and Methods

#### Study subjects and settings

This special population-based cross-sectional study was conducted at the export process-

ing zone (EPZ) in Savar under Dhaka district, which is about 35 km from central Dhaka, the capital of Bangladesh. Six garments factories were randomly selected from the EPZ area first and then the study participants were recruited following the simple random-sampling procedure and also aged  $\geq 18$  years from those six garments. To determine the required sample-size, the formula:  $n=PQ/d^2$  was used, where P indicates the prevalence (of different risk factors of CVDs) from a previous study.<sup>9</sup> Thus, we got different sample-sizes for different risk factors, such as hypertension, diabetes, pre-diabetes, dyslipidemia), and the maximum sample-size was taken ( $n=625$ ). 650 individuals (325 male and 325 female) of those 6 garments were invited to participate in this study by following simple random procedure from the record of national identification number; among them 614 (98%) individuals agreed (313 male and 301 female) to participate and were investigated. This epidemiological study was conducted through screening in the medical service centre of EPZ area. Six centers were visited in six different places of EPZ Savar area within 15 days (follow-up was done within 30 days where necessary).

### Ethical approval

The protocol was approved by the ethical and research review committee of Diabetic Association of Bangladesh [in bangla acronym Bangladesh Diabetic Samity (BADAS)].

### Data collection procedures

Four field assistants were assigned as voluntary workers to participate in the field work (including sample selection, organization of visits, collection of data by reviewing the questionnaire, and delivering the results to the participants). They collected the list of all adult RMG workers aged  $\geq 18$  years from six randomly-selected garment factories and identified the required number of subjects following the computerized simple random-sampling procedure. Pregnant women and physically disable persons were excluded from the study. The field assistants approached the potential participants with an information letter and a response document. Participants were informed about the purpose and the procedure of the study and were requested to attend the screening places in the morning on a pre-arranged date after an overnight fasting of at least 8-10 h. With proper aseptic precaution, venous blood sample (8 mL) was collected from each participant. All subjects other than those with known diabetes ( $n=4$ ) were given a 75-g oral glucose solution (75-g oral glucose in 500 mL of water) to drink. Another 3 mL of venous blood was collected after two hours to determine 2-h post-oral glucose tolerance test. After that, samples were centrifuged on site within three hours, and the plasma samples

were then refrigerated and stored at  $-20^\circ\text{C}$  until laboratory assays were done. During the 2 h waiting period the participants were interviewed for some general information; like the demographic and socioeconomic information, including name, sex, age, education, and economic status through the pretested questionnaire. Anthropometric parameters and blood pressure were also recorded. Serum glucose (fasting and 2 h after glucose) was measured by glucose oxidase method. Total cholesterol (TC) and triglyceride (TG) were analyzed by enzymatic-colorimetric method. The written results of medical examination were distributed and explained to the participants through medical service centre of EPZ. Participants with high blood pressure (BP) ( $>140/90$ ) were followed up. It was done at the EPZ medical centre for 2 more office visit within next 30 days after first measurement by the data collector. The suspected cases for hypertension were referred to the EPZ medical centre for future follow up and treatment. Diabetes cases were referred to the Savar Swasthasheba Hospital for free diabetes diagnosis and consultancy only.

### Anthropometrical measurement

Anthropometric measurement (height, weight, waist-circumference, and hip-circumference) were collected. Asian body mass index (BMI) criteria were used for identifying overweight and obese in this population.<sup>10</sup> Abdominal obesity was evaluated by waist/hip ratio (WHR), with android and gynecoid cut-off points taken at 0.8 and 0.9 for females and males respectively.<sup>11</sup>

### Blood pressure measurement

Blood pressure was measured following 3 standard measurements. First measurement was done by auscultatory method on the day of interview. Participants who were found with raised BP were identified and referred to the EPZ medical centre for follow up. The 2<sup>nd</sup> and 3<sup>rd</sup> measurement were done on two different office visits of the subjects with at least one week interval within 30 days of the first measurement. Prior to the measurement, 10 min rest was assured and using standard cuffs for adults fitted with mercury sphygmomanometer minimized variation in measurement. Hypertension was defined as a systolic BP of  $\geq 140$  mmHg and/or diastolic BP of  $\geq 90$  mmHg.<sup>9</sup>

### Diagnosis criteria for diabetes

The participants were classified into non-diabetes, diabetes, impaired fasting glucose (IFG), and impaired glucose tolerance (IGT) according to the recommendation of the World Health Organization Expert Committee.<sup>12</sup>

### Criteria for other variables

According to the recommendation of American Diabetic Association<sup>13</sup> the cut-off value of other variables, such as total cholesterol and triglyceride, were used to analyze data. Tobacco use *was* defined by consumption of any form of tobacco in the past six months. The types of tobacco consumption considered smoked (cigarettes, beedis, and cigars), orally took (tobacco chewed, pan masala etc.), and inhaled forms (snuff).

The written results of laboratory examinations were distributed and explained to the participants through the Health Care Centre, EPZ, Savar. The identified cases of hypertension, dyslipidemia, and diabetes were referred to the Health Care Centre for follow-up and further treatment.

### Data analysis

The statistical analysis was performed using the SPSS software (version 16). Continuous data were summarized as mean and standard deviation and categorical data as proportions. The prevalence and the odds ratio (OR) for CVD risk indicators (*i.e.* hypertension, dyslipidemia, diabetes, BMI, and WHR) were determined by simple percentages with 95% confidence interval (CI). Risk indicators were calculated assuming the least prevalence of clinically-relevant criteria as a reference value. Multiple logistic regression was performed to quantify the individual effect of the predictor variables and to adjust for the potential confounding factors. All P values presented are two-tailed. The statistical tests were considered significant at a level of  $\leq 0.05$ .

## Results

### Overall characteristics of the study participants

The socio-demographic characteristics of the participants were presented in Table 1. Of the 614 individuals, 51% were male and 49% were female. Their mean age was 29 years. The male subjects were comparatively older than the females. The majority (54%) of the participants were in the middle age-group (26-35 years). About 45.3% of the participants had primary education, and in some cases, they can sign only. About 30% had up to secondary-level education, and 24.3% had at least higher secondary-level education. Table 1 also shows the mean value of various clinical, biochemical and anthropometric measurements. The male and female participants had mean BMI of 22.5  $\text{kg}/\text{m}^2$  and 23.4  $\text{kg}/\text{m}^2$  and the WHR of 0.86 and 0.81 respectively. The mean BMI and WHR raised with the increase of age in both male and female. In Table 1, the behavioral indicators show that most study subjects had their

meals 3 times (94.8%) a day and the staple food was only rice (95.9%). Most (86.2%) of the respondents had smoking habit.

### Prevalence of cardiovascular diseases risk factors

Only 19.4% of the study population was free from any risk factors, such as hypertension, diabetes, dyslipidemia, and obesity. Most (80.6%) study subjects had at least one of these risk factors, about 46.7% had at least 2 co-existing risk factors, and 4.2% had all types of risk factors (Table 2).

Moreover, the prevalences of various risk factors of CVD, such as overweight 23% (95% CI 19.7-26.3) and obesity 27.9% (95% CI 25.3-30.5), central obesity (WHR) 10.1% (95% CI 7.7-12.5), hypertension 14.5% (95% CI 11.7-17.3), pre-hypertension 19.5% (95% CI 16.4-22.1), smoking 86.2% (95% CI 83.5-88.9), diabetes 7.3% (95% CI 5.2-9.3), impaired glucose regulation (including IGT and/or IFG) 10.6% (95% CI 8.1-13.0), cholesterol 9.1% (95% CI 6.8-11.4), and triglyceride 19.7% (95% CI 16.8-22.8) were a little higher than assumed (Table 3). Additionally female participants had high (99.7%) tobacco-chewing habit. The prevalence of these risk factors differed significantly between male and female groups in the case of obesity, WHR, hypertension, smoking, diabetes, and TG (Table 3).

Hypertension, diabetes, hypercholesterolemia, hypertriglyceridemia, overweight and obesity, WHR, and the presence of multiple risk factors showed rising trends with age. However, smoking was highly prevalent in the youngest age-group, and it decreased with age. The risk of developing obesity-associated risk factors started to rise much below the defined thresholds for western populations (BMI $\geq$ 23.0 kg/m<sup>2</sup> and WHR<0.95 male, <0.80 female) (Table 4).

Hypertension had a significant association with age, gender, and BMI. Moreover, glycemic status had also a significant association with age, gender, and WHR, and dyslipidemia with BMI and WHR and on logistic regression analysis (P<0.05 and P<0.001; Table 5).

seven of every 10 deaths in developing countries. Many non-communicable diseases can be prevented by tackling associated risk factors. In our study on the cardiovascular risk profile in an industrial workplace setting in Dhaka, Bangladesh, among a relatively-young "floating" urban population, we found the prevalence of traditional risk factors surprisingly high among this hard-working population of low socio economic status. Of this group of population aged 36-45 years, two-thirds were overweight and obese, almost one-third had abnormal glucose tolerance, one-third had high blood pressure, two-third had dyslipidemia, and 72%

had smoking habit (Table 4). Above all we considered overweight and obesity, waist circumference, hypertension, glycemic status, dyslipidemia and smoking as major risk factors for CVD and we found that, almost half of the participants had at least two of those risk factors currently exist (Table 2).

This high prevalence of risk factors among this vulnerable group of population may lead to develop adverse risk profile of CVDs in the future. However, in the past few decades, various studies have documented the issue of high and increasing prevalence of CVDs among South-East Asian population but studies on

**Table 1. General characteristics of the study population (n=614).**

Variables	No. (%)
<b>General characteristics</b>	
Sex	Male 313 (51.0) Female 301 (49.0)
Age	18-25 193 (31.4) 26-35 332 (54.1) 36-45 89 (14.5)
Education	Primary 278 (45.3) <SSC 183 (29.8) >SSC 149 (24.3)
<b>Behavioural characteristics</b>	
Major food	Rice 589 (95.9) Bread/chapati 25 (4.1)
Food intake habit	3 times 582 (94.8) 4 times 23 (3.7)
Smoking pattern	$\geq$ 5 times 9 (1.5) Non-smoker 85 (13.8) Smoker 529 (86.2)
<b>Anthropometric, clinical, laboratory and measurements</b>	
Mean age (years)	29.2 $\pm$ 5.7
Body mass index (kg/m <sup>2</sup> )	22.9 $\pm$ 3.4
Waist-hip ratio	0.84 $\pm$ 0.07
Systolic blood pressure (mmHg)	118.9 $\pm$ 15.2
Diastolic blood pressure (mmHg)	75.2 $\pm$ 12.2
Fasting blood glucose (mg/dL)	5.4 $\pm$ 1.8
2 h after 75 gm glucose (mg/dL)	6.4 $\pm$ 3.6
Total blood cholesterol (mg/dL)	189.0 $\pm$ 40.8
Serum fasting triglycerides (mg/dL)	148.1 $\pm$ 91.8

Values expressed as numbers and percentages in parentheses or mean $\pm$ SD, as appropriate; SD, standard deviation; yrs, years.

## Discussion and Conclusions

The epidemic of CVDs is a major public-health problem worldwide. By the dawn of the third millennium, non-communicable diseases are sweeping the entire globe, with an increasing trend in developing countries where the transition has imposed more constraints to deal with the double burden of infective and non-infective diseases in a poor environment characterized by ill-health systems. By 2020, it is predicted that these diseases will be causing

**Table 2. Cardiovascular diseases status according to the presence of intermediate risk factors among the study population.**

No. of intermediate risk factors	No. (%)	Male	Female
Subjects with 1 intermediate risk factor	208 (33.9)	99 (31.6)	109 (36.2)
Subjects with 2 intermediate risk factor	183 (29.8)	96 (30.7)	87 (28.9)
Subjects with 3 intermediate risk factor	78 (12.7)	42 (13.4)	36 (12.0)
Subjects with 4 intermediate risk factor	26 (4.2)	14 (4.5)	12 (4.0)
Subjects with 2 intermediate risk factors	287 (46.7)	152 (48.6)	135 (44.9)

Values expressed as numbers and percentages. Hypertension, diabetes mellitus, dyslipidemia and obesity (calculating BMI) were considered as intermediate risk factors.



**Table 3. Proportion of cardiovascular diseases risk factors among the study population by gender (n=614).**

Variables	Total (95% CI)	Male (n=313)	Female (n=301)
BMI	Normal (18.51-23.0)	38.6 (34.8-42.4)	102 (33.9)
	Underweight (<18.5)	10.6 (8.1-13.0)	31 (10.3)
	Overweight (23.01-25.0)	23.0 (19.7-26.3)	65 (24.3)
	Obese (>25.01)	27.9 (25.3-30.5)	103 (21.7)
WHR	Normal (<0.95 M, <0.80 F)	70.8 (67.2-74.4)	151 (50.2)
	Moderate (0.96-1.0 M, 0.81-0.85 F)	19.1 (16.0-22.2)	92 (30.6)
	High risk (>1.0 M, >0.85 F)	10.1 (7.7-12.5)	58 (19.3)
Hypertension	Normotensive	80.5 (77.3-83.6)	256 (85.0)
	Pre-hypertensive	14.5 (11.7-17.3)	43 (14.3)
	Hypertensive	19.5 (16.4-22.1)	45 (15.0)
Smoking Pattern	Non-smoker	13.8 (11.1-16.5)	300 (99.7)
	Smoker	86.2 (83.5-88.9)	1 (0.3)
Glycemic status	Non diabetic	82 (79.0-85.1)	238 (79.1)
	Pre diabetic	10.6 (8.1-13.0)	32 (10.6)
	Diabetic	7.3 (5.2-9.3)	31 (10.3)
Cholesterol (mg/dL)	<200 normal	68.1 (64.4-71.7)	209 (69.4)
	200.01-240 border line high risk	22.8 (19.5-26.1)	59 (19.6)
	>240.01 high risk	9.1 (6.8-11.4)	33 (11.0)
Triglyceride (mg/dL)	<150 normal	64.2 (60.4-68)	224 (74.4)
	150.01-200 border line high risk	16.1 (13.2-19)	44 (14.6)
	>200.01 high risk	19.7 (16.8-22.8)	33 (11.0)

BMI, body mass index; WHR, waist hip ratio. Data are presented as mean±SD; independent *t*-test was done as a test of significance. Data were coded with reference value separately for male and female and then analyzed together.

**Table 4. Overall and age-stratified prevalence (%) of risk factors (n=614).**

Variables	Total (95% CI)	Age groups in years			
		18-25	26-35	36-45	
Hypertension	Normotensive	80.5 (77.3-83.6)	77.2	64.5	48.3
	Pre-hypertensive	14.5 (11.7-17.3)	14.5	13.0	20.2
	Hypertensive	19.5 (16.4-22.1)	8.3	22.6	31.5
Glycemic status	Non Diabetic	82 (79.0-85.1)	87.0	82.5	69.7
	Pre Diabetic	10.6 (8.0-13.0)	9.3	9.6	16.9
	Diabetic	7.3 (5.2-9.3)	3.6	7.8	13.5
Cholesterol (mg/dL)	<200 normal	62.1 (64.4-71.7)	79.3	64.5	57.3
	200.01-240 border line high risk	22.8 (19.5-26.1)	15.0	26.8	24.7
	>240.01 high risk	9.1 (6.8-11.4)	5.7	8.7	18.0
Triglyceride (mg/dL)	<150 normal	64.2 (60.4-68.0)	75.1	59.3	58.4
	150.01-200 border line high risk	16.1 (13.2-19.0)	16.6	17.2	11.2
	>200.01 high risk	19.7 (16.8-22.8)	8.3	23.5	30.3
Dyslipidemia	No	49.7 (45.8-53.6)	65.3	44.3	36.0
	Yes	50.3 (46.4-54.2)	34.7	55.7	64.0
BMI	Normal (18.51-23.0)	38.6 (34.8-42.4)	50.3	34.9	27.0
	Underweight (<18.5)	10.6 (8.1-13.0)	17.1	8.1	5.6
	Overweight (23.01-25.0)	23.0 (19.7-26.3)	16.1	25.6	28.1
	Obese (>25.01)	27.9 (25.3-30.5)	16.6	31.3	39.3
Waist hip ratio	Normal (<0.95 male, <0.80 female)	70.8 (67.2-74.4)	80.8	68.1	59.6
	Moderate (0.96-1.0 male, 0.81-0.85 female)	19.1 (16.0-22.2)	15.0	21.4	19.1
	High risk (>1.0 male, >0.85 female)	10.1 (7.7-12.5)	4.1	10.5	21.3
Smoking pattern	Non-smoker	13.8 (11.1-16.5)	6.2	14.5	28.1
	Smoker	86.2 (83.5-88.9)	93.8	85.5	71.9

BMI, body mass index.

**Table 5. Multiple regression analysis of hypertension, dyslipidemia and glycemic status as dependent variable with other variables of the study population.**

Variables	Hypertension		Dyslipidemia		Glycemic status	
	$\beta$ -value	P-value	$\beta$ -value	P-value	$\beta$ -value	P-value
Age (years)	0.14	0.002	0.06	0.19	-0.14	0.003
Sex	-0.11	0.02	0.08	0.09-0.12	0.01	
BMI (kg/m <sup>2</sup> )	0.21	0.001	0.25	0.00	-0.03	0.48
WHR	0.01	0.83	0.17	0.007	-0.11	0.03
Smoking	0.04	0.36	-0.05	0.24	-0.05	0.22

BMI, body mass index; WHR, waist hip ratio.

evaluation of CVD risk factors among comparatively hard-working younger population are very few.<sup>9,14-21</sup> Specific strategies and focused attention are, thus, needed for screening and management of these risk factors among this vulnerable group of population.

Of the commonly-used anthropometric indices, BMI and WHR showed a good predictors for diabetes, hypertension, dyslipidemia, and CVDs in a sample of industrial workers in Dhaka city, Bangladesh. In our study, BMI and WHR were significantly associated with hypertension. However, results of similar studies showed that, instead of WHR, BMI and waist circumference (WC) had a strong correlation with systolic and diastolic blood pressure.<sup>9,22,23</sup>

WHR, an index of central obesity and BMI, consistently emerged as one of the best predictors for CVD risk indicator in our study (Table 5). Moreover, the findings of our study supported the fact that high prevalence of type 2 diabetes and insulin resistance among South Asians are associated with central obesity.<sup>24-27</sup>

All the four major anthropometric indices (*i.e.*, BMI, WHR, WC and waist height stature) of a population from an industrial area, were compared in a study in Delhi.<sup>19</sup> Comparing with that study our results differed at one point, that not only WHR but also BMI were the best predictors for hypertension, dyslipidemia, and diabetes. As it was difficult to identify the true differences between various anthropometric indices in their ability to identify individuals who are at risk of CVDs, we need to explore different techniques to classify anthropometric indices.

Our data demonstrated that the abnormality of lipids profile (triglyceride and cholesterol) was higher among this population. However, females had a lower level of triglyceride and cholesterol compared to male. The cause of different level of TG among the gender is not clear but calorie intake, composition of diet and lifestyle seem to have some effect.<sup>15,28</sup>

We explored the causes for the high prevalence of the CVDs risk factors among our study population and found overweight and central obesity to be the major correlates of these risk markers (Table 5), as the pattern of garment work is quite sedentary in nature and the dietary habit is also indiscriminate. The

indices of obesity (increased BMI and WHR) and hyperlipidemia (increased triglyceride and cholesterol) may at least in part explain the rising trend of diabetes mellitus among the population in Bangladesh.<sup>29</sup> We believe that the high prevalence of risk markers, such as impaired glucose tolerance, dyslipidemia, and high blood pressure, all of which are influenced by body fat, is a reflection of the current urbanization and adaptation of a western lifestyle among the population in Bangladesh that was also revealed in the WHO fact sheet.<sup>30</sup>

While such a high prevalence of risk factors is a cause for concern, A EPZ based garments industry where high quality all kind of environmental facilities has been insured by the international labor organization in Bangladesh, its provide a unique opportunity for carrying out a non communicable diseases related prevention programs. It is estimated that there are nearly 1.6 million people working in such large organized sector industries in Bangladesh. While most of these industries have their own primary healthcare facilities, their employees and their dependents can also get healthcare in higher medical institutions when required. With the rising burden of CVDs, the expenditure on such healthcare programmes of industries is likely to increase enormously. Thus, there is a lot of scope for and benefit in initiating comprehensive, low-cost CVD prevention programmes at the workplace for employees and their dependants. Such onsite programmes have been found to be modestly successful in some places in India through increased awareness, health education, and risk-reduction interventions.<sup>9</sup> Modified models could easily be adapted to Bangladeshi settings. This is likely to lead to a healthier workforce and a decrease in expenditure by the industry on treatment costs and increased absenteeism in the workplace. We hope that our study will provide the stimulus for initiating such surveillance and preventive activities.

The main limitation of this study is that it was a cross sectional rather than a follow up study. It is also understood that persons, who participate in this programme, tend to be those who are developing little awareness regarding their health and had little education. Instead of detail lipid profile we only had done two (*i.e.*

cholesterol and triglyceride) which may not enough to draw conclusion regarding dyslipidemia status. This study did not address the specific cause of CVDs observing only a single exposure as over or underestimate might occurred and its needs further follow up.

In summary, a substantial number of urban adult RMG workers in Dhaka are unaware of the existence of CVDs. The rates of prevalence that we have reported are based on mostly western cut-offs, and we require a longitudinal evaluation of CVD-related morbidity and mortality among our study population to fully understand the implications of the findings of our study. To address the above issues, we need a large-scale prospectus study to identify the determinants of CVDs and to reduce the burden of the classical risk factors of these disorders.

## References

1. World Health Organization. Non-communicable diseases and mental health news. Newsletter 2010;1:13.
2. Ballantyne C, Arroll B, Shepherd J. Lipids and CVD management: towards a global consensus. *Eur Heart J* 2005;26:2224-31.
3. Hobbs FDR, Hoes AW, Cowie MR. The epidemiology of cardiovascular disease. In: Hobbs R, Arroll B, eds. *Cardiovascular risk management*. Chichester: Wiley-Blackwell; 2008.
4. Mohan V, Deepa R, Rani SS, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). *J Am Coll Cardiol* 2001;38:682-7.
5. Chadha SL, Radhakrishnan S, Ramachandran K, et al. Prevalence, awareness and treatment status of hypertension in urban population of Delhi. *Indian J Med Res* 1997;92:233-40.
6. Qiao Q, Hu G, Tuomilehto J, et al. Age- and sex-specific prevalence of diabetes and impaired glucose regulation in 11 Asian cohorts. *Diabetes Care* 2003;26:1770-80.
7. Zachariah MG, Thankappan KR, Alex SC,

- et al. Prevalence, correlates, awareness, treatment, and control of hypertension in a middle-aged urban population in Kerala. *Indian Heart J* 2003;55:245-51.
8. Bangladesh National Garments Worker Federation, Activity Report: 1999-2004, Available from: <http://www.agp.org> Accessed: 14/11/2008.
  9. Prabhakaran D, Shah P, Chaturvedi V, et al. Cardiovascular risk factor prevalence among men in a large industry of northern India. *Natl Med J India* 2005;18:2:59-65.
  10. WHO expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet* 2004;363:157-63.
  11. Tybor DJ, Lichtenstein AH, Dallal GE, et al. Independent effects of age-related changes in waist circumference and BMI z scores in predicting cardiovascular disease risk factors in a prospective cohort of adolescent females. *Am J Clin Nutr* 2011;93:2:392-40.
  12. World Health Organization. Definition, diagnosis and classification of diabetes mellitus and its complications. Report of a WHO consultation. Geneva: World Health Organization; 1999.
  13. American Diabetes Association Guidelines; 2005. Available from: [http://www.utm.edu/gim/smalltalks/diabetes\\_guidelines.pdf](http://www.utm.edu/gim/smalltalks/diabetes_guidelines.pdf) Accessed: 10/06/12.
  14. Gupta R, Gupta VP, Sarna M, et al. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. *Indian Heart J* 2002;54:59-66.
  15. Mohan V, Shanthirani CS, Deepa R. Glucose intolerance (diabetes and IGT) in a selected South Indian population with special reference to family history, obesity and lifestyle factors - The Chennai Urban Population Study (CUPS 14). *J Assoc Physicians India* 2003;51:771-7.
  16. Lee J, Heng D, Chia KS, et al. Risk factors and incident coronary heart disease in Chinese, Malay and Asian Indian males: the Singapore Cardiovascular Cohort Study. *Int J Epidemiol* 2001;30:983-8.
  17. Enas EA, Garg A, Davidson MA, et al. Coronary heart disease and its risk factors in first-generation immigrant Asian Indians to the United States of America. *Indian Heart J* 1996;48:343-53.
  18. Anand SS, Yusuf S, Vuksan V, et al. Differences in risk factors, atherosclerosis and cardiovascular disease between ethnic groups in Canada: The study of health assessment and risk in ethnic groups (SHARE). *Indian Heart J* 2000;52:S35-43.
  19. Kaur P, Ezhil R, Suresh S, et al. A comparison of anthropometric indices for predicting hypertension and Type 2 diabetes in a male industrial population of Chennai, South India. *Ethnicity Dis* 2008;18:31-6.
  20. Bhatnagar D, Anand IS, Durrington PN, et al. Coronary risk factors in people from the Indian subcontinent living in west London and their siblings in India. *Lancet* 1995;345:405-9.
  21. Reddy KS, Prabhakaran D, Shah P, Shah B. Differences in body mass index and waist:hip ratios in North Indian rural and urban populations. *Obes Rev* 2002;3:197-202.
  22. Vasan RS, Larson MG, Leip EP, et al. Impact of high-normal blood pressure on the risk of cardiovascular disease. *N Engl J Med* 2001;345:1291-7.
  23. Phadnis, VK Sharma. Association of anthropometric indices of obesity with diabetes, hypertension and dyslipidemia: a study from central India. *Indian J Med Spec* 2012;3:6-11.
  24. Chandie Shaw PK, Berger SP, Mallat M, et al. Central obesity is an independent risk factor for albuminuria in nondiabetic South Asian subjects. *Diabetes Care* July 2007;30:1840-4.
  25. Misra A, Pandey RM, Devi JR, et al. High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in northern India. *Int J Obes Relat Metab Disord* 2001;25:1722-9.
  26. Pandit K, Goswami S, Ghosh S, et al. Metabolic syndrome in South Asians. *Indian J Endocrinol Metab* 2012;16:44-55.
  27. Nahar N, Dubey S, Josh A, et al. Association of anthropometric indices of obesity with diabetes, hypertension and dyslipidemia: a study from central India. *Indian J Med Special* 2012;3:6-11.
  28. Johansson S, Wilhelmsen L, Lappas G, Rosengren A. High lipid levels and coronary disease in women in Goteborg - outcome and secular trends: a prospective 19 year follow up in the BEDA study. *Eur Heart J* 2003;24:704-16.
  29. Akhter A, Fatema K, Afroz A, et al. Prevalence of diabetes mellitus and its associated risk indicators in a rural Bangladeshi population. *Open Diabet J* 2011;4:6-13.
  30. World Health Organization. Fact sheet N°317. Cardiovascular diseases (CVDs); September 2012. Available from: <http://www.who.int/mediacentre/factsheets/fs317/en/index.html> Accessed: 09/01/13.