

Vol. 11. No.4. 2022.

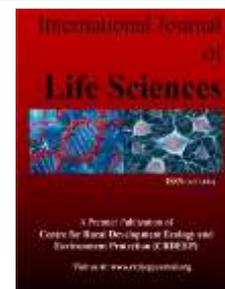
©Copyright by CRDEEP Journals. All Rights Reserved.

DOI: 10.13140/RG.2.2.21081.60008

Contents available at:

<http://www.crdeepjournal.org>

International Journal of Life Sciences (ISSN: 2277-193x) CIF: 5.411; SJIF: 6.431
A Peer Reviewed Journal

Full Length Research Paper

A Prevalence Study of Cardiac Risk Assessment of Female Construction Workers of Bengal, India: A Meta-Analysis

¹Subhashree Sana, ²Dr. Sugata Das (Kumar), ³Dr. Anandi Bagchi and ^{4*}Dr. Subrata Ghosh

¹Research Scholar Department of Physiology, Hooghly Mohsin College, University of Burdwan, Hooghly-712101, West Bengal, India

²Research Associate, Defence Institute of Physiology and Allied Sciences, DRDO, New Delhi-110054

³Assistant Professor, Department of Physiology, P R Thakur Govt College Thakurnagar Gaighata, North 24 Pgs West Bengal 743287

⁴Associate Professor, Department of Physiology, Hooghly Mohsin College, University of Burdwan, Hooghly-712101, West Bengal, India¹

ARTICLE INFORMATION

Corresponding Author:
Subrata Ghosh

Article history:

Received: 26-12-2022

Revised: 29--12-2022

Accepted: 03-01-2023

Published: 04-01-2023

Key words:

Construction female workers,
Cardiovascular risk factor, serum lipoprotein(a), Vitamin B12, C-Reactive Protein.

ABSTRACT

Construction workers are exposed to a variety of chemical and physical hazards while working. In the majority of third-world nations, including India, cardiovascular disease (CVD) and other non-communicable diseases (NCDs) are starting to get the most attention for workers of unorganized sector. This study aims to find out different primary health problems amongst workers working in the construction industry, to find out socio-demographic condition associated with cardio-risk factors and to estimate the risk factors of cardiac condition of female construction workers with respect to their occupational hazards. This cross-sectional study was conducted among 99 female construction site workers (age range of 18-47 years) & divided into two group: Brick and cement sack carriers and only cement moulders. Physical & cardiovascular markers (Serum Lp(a), C-reactive protein, LDL, HDL, Triglyceride, Cortisol and Vitamin B12) parameters were measured by standardised procedure. The paired t-test, correlation coefficient was applied to analyze the qualitative data by Minitab 20. The carrier's group had more prevalence to cardiovascular disease (CVD) risk than moulders group. Despite of that, moulder group also had abnormal level of CVD risk. Both groups had age range 30-35 years, onset of CVD risk and there is linear positive and negative (Vitamin B12) correlation found amongst CVD markers. It was concluded that 75-84% of construction female worker belongs to 30-35 years are more prevalent to CVD risk. The carrier's group had more prevalence CVD risk than moulders group as they are doing heavy and strenuous job irrespective of time and limit. Immediate ways are need to apply on them for speedy recovery.

Introduction

India's construction sector is one of the growing industries with a stable and expanding economy. Essentially, it is a labor-intensive sector. A large section of the population is employed by it. Because they typically come from lower socioeconomic classes, construction workers lack access to basic necessities. In addition to this, the majority of the construction sites or projects where these laborers are engaged are unorganized. As a result, the legislation designed to protect the workers' health and welfare frequently does not apply to these locations (Investing in India's Construction Industry, 2022). Contact with wet cement still happens, especially in small tasks, despite the growing automation of construction and the more frequent use of pre-cast concrete parts. The task is physically demanding and frequently performed in inclement weather, such as extreme heat or cold. It involves a wide range of operations, and the workers in this business are susceptible to many occupational illnesses and psychological pressures (Shah, Kartik R., & Rajnarayan R. Tiwari, 2010). In comparison to men, women who work as unskilled labour in the construction sector have a number of different challenges. Women in the field have challenging working conditions owing to sexual harassment, gender

bias, wage discrimination, poor work relationships, and lower compensation, and their skill levels stay unchanged even after working for a short period of time. In India, women make up around one-fifth of the labour force in terms of total economic activity (Sultana Nahid *et al* 2014). According to Oxford Economics' Global Construction 2020 study, India's construction market was the ninth largest in the world and represented 3.3% of the overall market. India is anticipated to develop at an estimated compound annual growth rate (CAGR) of 8.9 percent from 2014 to 2020, making it the second-largest market. Workers in the construction business make about half of the world's population, or about 14.1% of the total, according to a bureau of labour statistics poll. Around 75 percent of the 180 million construction workers in the globe work in developing nations (Gopalakrishnan, S., 2020).

A recent International Labour Organization survey found that 165 out of every 1000 workers get work-related injuries as a result of a lack of expertise. There is no way to residential circumstances better than the working ones. Most of the time, building businesses doesn't even offer appropriate sanitation or power. The majority of employees and residents continue to experience substantial occupational health issues, as well as general health issues such high mortality rates, birth control, accidents, infectious and non-communicable illnesses, hunger, and insufficient medical treatment (Devi, K. & Kiran, U.V., 2013). Construction activity is extremely difficult since employees are constantly exposed to unfavorable conditions including fumes, dust, heat, and dampness. Among these personnel, musculoskeletal and cardiovascular illnesses are two of the leading reasons of early deployment. Construction employees have a higher risk of having a poor cardiovascular health than those in other professions (Chung, J.W.Y *et al*, 2018).

Construction workers are exposed to a variety of chemical and physical hazards while working, in addition to the front-line dangers on a workplace. Acute and chronic illnesses, diseases, malignancies, and/or problems might result from these dangers. Chemical risks can be inhaled, ingested, or absorbed and come in a variety of forms, such as dusts, mists, vapors, and gases. These dangers occasionally assault the body at the place of entrance, but many enter the bloodstream or gastrointestinal tract and target other organs instead, notably the heart, lungs, liver, kidney, blood, and neurological system (Yi, W. & Chan, A., 2016). In the majority of third-world nations, including India, cardiovascular disease (CVD) and other non-communicable diseases (NCDs) are starting to get the most attention. In India, the unorganized sector employs around 340 million people (92 percent), with the construction industry accounting for almost half of them. Workers are exposed to unhealthy occupational health risks and poor working circumstances, according to the National Commission for Enterprises in the Unorganized Sector. They are mostly migrants from outlying areas in India who are frequently less educated and unwary of various preventative measures, making them more vulnerable (Parashar, M., & Dwivedi *et al*, 2017)

Female workers never recognize of their institutional work, in decision making and always reinforced by social, cultural, political and religious practices and beliefs. This study discussed about the prevalence of cardiovascular health of migrant female construction workers of Bengal.

Objectives

Under these circumstances, this study aims

- To find out different primary health problems amongst workers working in the construction industry.
- To find out socio-demographic condition associated with cardio-risk factors.
- To estimate the risk factors of cardiac condition of female construction workers with respect to their occupational hazards.

Materials and methods

Study design and study population

A cross-sectional study was conducted amongst construction site of two districts of West Bengal; viz Hooghly and Bardhaman. 125 female labors will randomly be chosen from same districts with an age range of 18 to 47 years as subjects. 99 subjects gave consent and selected for final experiment.

An age matched comparative study was carried out whereby the subjects were divided into five groups study: 18-23, 24-29, 30-35, 36-41, 42-47 years experimental vs. comparative groups from same field but different job status. Subjects who are brick and cement carrier were assigned for experimental group and who are only cement moulders were assigned for comparative group. Subjects were involved construction field for more than 5 years un-interrupted were chosen for this study. They will be debarred from taking any medicine 1 month before and during the study. The entire study was performed with the permission of the relevant local authority and all the subjects were explained about the objective and probable impact of the work.

Sampling Method and sample calculation

The sample size calculation was determined by 'Sample Size Formula'.

- **Formula 1:** Sample size for infinite population

$S = Z^2 \times P \times (1-P) / M^2$ [S = sample size for infinite population, Z = Z score, P = population proportion (Assumed as 50% or 0.5), M = Margin of error

$S = Z^2 \times P \times (1-P) / M^2$

$S = (1.960)^2 \times 0.5 \times (1-0.5) / 0.05^2$

$$= 3.8416 \times 0.25 / 0.0025$$

$$S = 384.16$$

- **Formula 2:** Adjusted sample size

$$\text{Adjusted Sample Size} = (S)/1+(S-1)/\text{Population}$$

$$384.16/1+(384.16-1)/125$$

$$384.16/ (508.16/125)$$

$$384.16 \times 125/508.16$$

$$=94.49$$

~ 95 [At least 95 sample had to choose for statistical analysis]

In this study 99 sample was chosen for final experiments.

Inclusion criteria

- Age range was 18-47 years.
- Healthy and gave consent to participate throughout experiment.
- Uninterrupted work experience minimum 5 years.
- Not taking any type of regular medicine.

Exclusion Criteria

- Subjects had prior health problems.
- Subjects who were not willing to give blood for diagnosis.

Ethical consideration

This study was performed following the ethical guidelines for biomedical research on human participants as directed by ICMR, Govt. of India and due permission took from the Institutional Ethical Committee (IEC) for research on human participant – of University of Burdwan, Hooghly Mohsin College.

Methodology

Data were collected by using following standard testing methods:

Table 1: Study of Physical parameters

Serial no	Parameter Assessed	Testing method
1.	Age (years)	Questionnaire Method
2.	Height(cm)	Anthropometry
3.	Weight(kg)	Weighing Machine
4.	BMI (kg/sq. m)	Calculator
5.	Blood Pressure (mmHg)	Sphygmomanometer

Table 2: Study of cardiac health

S.no	Parameter Assessed	Testing method
1.	Serum Lipoprotein(a)	Human Lipoprotein A ELISA Kit (ab212165) (Bartoli <i>et al</i> , 2022)
2.	Serum C-reactive protein	Human C Reactive Protein ELISA Kit (CRP) (ab99995) (Ferguson <i>et al</i> , 2022)
3.	Lipid profile (LDL, HDL, Triglyceride)	HPLC method (Melis <i>et al</i> , 2021)
4.	Vitamin B12	CLIA method (Gulvady <i>et al</i> , 2007)
5.	Cortisol	Cortisol ELISA Kit (ab108665) (Sanghavi <i>et al</i> , 2016)

Statistical analysis

The data were analysed in Minitab, version 20.4 (2021) statistical software. Paired t-test were applied to analyze the qualitative data. Mean values of continuous variables were calculated. Quantitative variables were expressed as mean \pm SD. Paired t-tests were performed to evaluate the overall cumulative cardiac stress factors' significance. The Pearson correlation coefficient was measured to evaluate the strength of the linear relationship between mentioned variables. p-values < 0.05 were considered to be significant.

Results

Total 99 female construction workers were participated in this study. Age range was 18 years to 47 years. Workers were categorized as per following table 3. Mainly, 30-35 years female workers who were involved in exclusively brick and cement carrier activities had cardiovascular risk at higher percentage compared to previous age range group. But maximum brick and cement carrier female workers of cardiovascular risk were found at 42-47 years age range. It was clearly found that maximum female brick and cement carrier workers had prevalence of cardiovascular risk compared to only moulders group.

Table 3: Representation of cardiovascular risk percentage of female construction workers (Carrier and Moulders)

Age range (Years)	N (%) = A+B* (percentages)	CVD Risk* N= A+B (%)
18-23 years	06+03 (6.06+3.03)	01+0 (16.66+0)
24-29 years	12+7 (12.12+7.07)	02+01 (16.66+14.29)
30-35 years	16+13 (16.16 +13.13)	12+11 (75+84.61)
36-41 years	12+13 (12.12+13.13)	10+9 (76.92+75)
42-47 years	10+7 (10.1+7.07)	9+5 (90+71.42)

*CVD = cardiovascular disease A= Brick + Cement Carriers, B= Only cement moulders

Table 4: Representation of cardiovascular risk parameters of female construction workers

Parameters	Carriers Group# (mean ± SD)	Moulders Group! (mean ± SD)	p-values (>0.05)
Height (cm)	151.05±5.62	150.90±5.96	0.846
Weight (kg)	49.40±4.47	49.05±4.87	0.551
BMI (kg/m ²)	20.57±4.87	21.68±4.62	0.869
SBP (mmHg)	112±14.60	122±5.81	0.009*
DBP (mmHg)	72±12.97	84±5.17	0.003*
Serum Lp (a) (mg/dL)	38.2±7.98	29±6.97	0.002*
Serum C-RP (mg/L)	15.92±1.11	11.61±0.96	0.021*
Serum LDL (mg/dL)	153.09±6.16	112.13±20.34	0.001*
Serum HDL (mg/dL)	34.40±2.35	54.21±8.82	0.002*
Serum Triglyceride (mg/dL)	143.01±2.35	132.8±3.6	0.002*
Serum Vitamin B12 (pg/ml)	89.3±11.9	110.2±9.37	0.025*
Serum Cortisol (microgram/dL)	15.2±3.08	7.16±2.46	0.001*

#Carriers Group= Female Brick & Cement sack carriers

! Moulders Group= Only do cement moulding work

*= values >0.05 significant

BMI= Body Mass Index, SBP= Systolic Blood Pressure, DBP= Diastolic Blood Pressure Lp (a)= Lipoprotein (a), C-RP= C-Reactive Protein, LDL=Low Density Lipoprotein, HDL=High Density Lipoprotein

Table 5: Representation of Correlation of Cardiac risk factors of carriers group

	Lp (a) (mg/L)	Cortisol(microgram/dl)	HDL (mg/dl)	LDL (mg/dl)
Cortisol(microgram/dl) E	0.984	--	--	--
HDL (mg/dl) E	-0.260	-0.251	--	--
LDL (mg/dl) E	0.095	0.947	-0.282	--
Triglyceride(mg/dl) E	0.705	0.553	0.635	-0.348
Vit - B12 pg/ml E	-0.812	-0.688	0.071	-0.584
CRP (mg/l) E	-0.160	0.002	-0.288	0.099
	Triglyceride(mg/dl)		Vit - B12 pg/ml	
Cortisol(microgram/dl) E	--		--	
HDL (mg/dl) E	--		--	
LDL (mg/dl) E	--		--	
Triglyceride(mg/dl) E	--		--	
Vit - B12 pg/ml E	-0.604			
CRP (mg/l) E	0.124		-0.068	

The correlation coefficient can range in value from -1 to +1. The larger the absolute value of the coefficient, the stronger the relationship between the variables. Negative means inversely proportional.

Discussion

This study has been carried out to find the prevalence of cardiac risk assessment of construction female workers. The construction industry is recognized as one of the most dangerous industries. Numerous efforts have been devoted to reduce safety hazards; however, less attention has been given to occupational health issues. According to Wen Yi & Albert Chan, 2016; a Pilot Medical Examination Scheme for Construction Workers (PMES) was launched to help identify the health profile of construction workers. Based on the medical examinations and questionnaire survey, it was found that 39.8% and 38.4% of the participants exceeded threshold for cholesterol level and blood pressure, correspondingly; and 39.2% of the participants suffered musculoskeletal pain. 2014 research on health issues affecting

female building construction workers by Nahid Sultana and this cross-sectional research was undertaken at the Dhaka National Medical College among 134 female construction employees. Among the 134 respondents, it was found that the majority of the women who worked in construction (71.6%) were brick breakers, and 28.3% were weight carriers. 58.2 percent of all respondents report having backaches, and among them, complete micturition, uterine prolapse, low backache, and respiratory issues were also discovered that may require particular treatment (Banu, S.R., 2016). Research was conducted in 2014 by Sarika Manhas to evaluate the physical health of female construction workers in Jammu and Kashmir's Kathua District. 120 female construction workers in the age groups of 20 to 30 and 30 to 40 made up the study's core sample. The majority of the female employees, according to the results, had mild health issues with their eyes, musculoskeletal system, skin, and urinary tract. Nevertheless, had less severe issues with the brain system, digestive tract, cardio vascular system, and breathing. Breathing issues and chest congestion were quite typical, as were redness, discomfort, irritability, and watery eyes. Overall, the results highlight the poor health condition of female construction workers. But now in 2022, the entire scenario has changed. From this study it was found that 30-35 years of female construction workers have prevalence of cardiac health issues for both group of workers either brick and cement sack carriers or cement moulder group. Surprisingly, it was also found that mostly the female brick and cement carrier workers who are uninterruptedly do their work more than 5 years had more prone to cardiovascular risk than compared to those female construction workers who are mainly do cement moulding work. This result may be due to heavy loading job as compared to cement moulding. The recommended limit of load to carry on head by NIOSH is only 23.1 kgs (51 pound) (Middlesworth, M. (2012), but in reality, female construction workers carried 5 times more compared to recommended limit. Extra load might be affecting their cardiac health that elevate their risk factors level. For evaluating cardiac health, this study measured some cardiac health markers and obviously it was found abnormal results but belongs to same socioeconomic status, both groups had insignificant values of height, weight and BMI level. According to Kuppuswamy socioeconomic scale, both groups' subjects were mostly belonging to upper-lower class (Saleem, S.M. & Jan, S.S., 2019)

Female construction workers did tremendous stressful work for uninterrupted 10 hours. Due to this heavy stressful work, subjects had significantly elevated level of cortisol level. It is already established, since lipids are often processed to produce energy and serum cortisol shares a fundamental structural similarity with steroids and lipids—cyclopentanoperhydrophenanthrene rings, there is a chance that assessment stress might have an impact on the body's lipid profile. Any change in the subject's plasma lipids that causes a rise in cardiac risk factors may eventually put them at danger (Maduka, I.C *et al*, 2015). This study showed that increment of cortisol support LDL and triglyceride increment along with decrease level of HDL level. These results might be due to over stressed and leads to cardiovascular risk in very near future.

The plasma lipoprotein known as lipoprotein(a) is made up of one LDL particle high in cholesterol, one molecule of apolipoprotein B100, and an extra protein known as apolipoprotein(a), which are connected by a disulphide link. Apolipoprotein(a) shares structural similarities with plasminogen and plasmin but does not have fibrinolytic activity, so elevated Lp(a) levels could potentially increase the risk of CVD (i) through prothrombotic/anti-fibrinolytic effects, (ii) via accelerated atherogenesis as a result of Lp(a) cholesterol being deposited in the intima, or both cardiovascular risk in the very near future (Nordestgaard, B.G *et al*, 2010). This reflects in this study results. Increment of lipoprotein (a) level association with elevated level of LDL and triglyceride leads a higher risk for cardiovascular disease for female construction workers mainly who are carried over weight throughout 10 hours a day.

C-reactive protein (CRP) levels may be a sign of impending cardiovascular issues. This is due to the fact that inflammation inside the blood vessel walls is linked to the development of atherosclerosis, which is the depositing of cholesterol inside the blood vessel walls. The levels of CRP are comparable to those of total cholesterol and systolic blood pressure. CRP has been suggested to have a causative role in coronary heart disease because it binds to LDL and is found in atherosclerotic plaques. When patients in the top third (mean 24 mg/L) and bottom third (10 mg/L) of the CRP distribution were compared, the relative risk for coronary heart disease was 16 (95% [CI] 1.5-1.7), according to a literature-based meta-analysis of 22 prospective studies (Emerging Risk Factors Collaboration, 2010). From this study it was found that there is significant difference between increment of c-reactive protein associated with other cardiovascular risk factors compared to those subjects who are doing more strenuous job.

The generation of red blood cells, or oxygen-carrying blood cells, as well as the maintenance of the neurological system's proper operation both require vitamin B-12, commonly known as cobalamin. Lack of vitamin B-12 indirectly raises heart rate by decreasing the blood's ability to transport oxygen, as vitamin B-12 is also involved in the chemical activities of the cell. A range of atherogenic processes, including hyperhomocysteinemia brought on by vitamin B12 insufficiency but not solely, are linked to this vitamin's inadequacy. In addition to deadly and non-fatal coronary disease, myocardial infarction, stroke, and other circulatory health issues, macrocytosis linked to vitamin B12 deficiency is also linked to these conditions (Pawlak, R., 2015).

The correlation coefficient results of only carriers group showed a positive linear relationship between cardiovascular risk factor amongst cortisol, LDL, lipoprotein (a), C-reactive protein and triglyceride, that means if one is increase that leads to other element to be increased and also negative relation with HDL and Vitamin B12 that depicts if one is increase that leads to other to be decreased. From the entire study it was found that there is very high chance to occurrence

of cardiovascular disease to female construction female workers. The moulders group have comparatively low values than carrier group but they are also prone to occurrence of cardiovascular disease.

Limitations

There could be certain limitations even if the survey offers trustworthy information about the underprivileged people. The study's sample size is limited and its findings cannot be extrapolated to other populations because it only included female employees at two construction sites in two districts of Bengal. There must be more cardiovascular risk factors there; for convincing proof, it should be examined in the future. Despite these drawbacks, the study suggests that due to their hormonal status, this demographic group is susceptible to cardiovascular disease.

Conclusion

The payoff from investments in construction, development, extension and education comes in the form of sustained increase in productivity. Women must be able to recognize the wage differential, understand the legal context, and organize within institutions or create new ones to negotiate equal wages and engage with employers, and employers must also comply with legislation. In the context of construction workers, ensuring social protection refers mainly to medical, improving health and safety, unhygienic reproductive environment and unhygienic lifestyle. Health concerns for women include cardiac risk, reproductive hormonal disturbance as well as occupational safety issues surrounding, for example, accidents and exposure to unsafe conditions, chemicals, and substances. The present study established a linear relationship of cardiovascular risk factor of female construction workers. They have high prevalence of cardiovascular risk as they are doing more strenuous job irrespective of time and limit. Therefore, it is also necessary to re-evaluate health policies that emphasize behavior modification and communication to encourage employees, particularly those at unorganized construction sites, to adopt healthy diets and lifestyles.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Banu, S.R., 2016. Health issues of women construction workers: An evidence from Trichirappalli, Tamilnadu. *International journal*.
- Bartoli-Leonard, F., Turner, M.E., Zimmer, J., Chapurlat, R., Pham, T., Aikawa, M., Pradhan, A.D., Szulc, P. and Aikawa, E., 2022. Elevated lipoprotein (a) as a predictor for coronary events in older men. *Journal of Lipid Research*, 63(8).
- Chung, J.W.Y., Wong, B.Y.M., Yan, V.C.M., Chung, L.M.Y., So, H.C.F. and Chan, A., 2018. Cardiovascular health of construction workers in Hong Kong: A cross-sectional study. *International journal of environmental research and public health*, 15(6), p.1251.
- Devi, K. and Kiran, U.V., 2013. Status of female workers in construction industry in India: A review. *IOSR J Humanit Soc Sci*, 14, pp.27-30.
- Emerging Risk Factors Collaboration, 2010. C-reactive protein concentration and risk of coronary heart disease, stroke, and mortality: an individual participant meta-analysis. *The Lancet*, 375(9709), pp.132-140.
- Ferguson, D.P., Leszczynski, E.C., Horton, T.H., Pfeiffer, K.A., Gardiner, J. and Pearson, A.L., 2022. C-reactive protein and telomerase reverse transcriptase (TERT) associate with chronic disease markers in a sample from low-income neighborhoods in Detroit, Michigan. *Sports Medicine and Health Science*.
- Gopalakrishnan, S., 2020. Risk factors of morbidity among construction workers: A review. *Int. J. Community Med. Public Health*, 7, p.4664.
- Gulvady, C., Pingle, S. and Shanbhag, S., 2007. Incidence of vitamin B12/D3 deficiency among company executives. *Indian J Occup Environ Med*, 11(2), pp.83-85.
- Investing in India's construction industry* (2022). Available at: <https://www.international-construction.com/news/investing-in-india-s-construction-industry/8019238.article>
- Maduka, I.C., Neboh, E.E. and Ufelle, S.A., 2015. The relationship between serum cortisol, adrenaline, blood glucose and lipid profile of undergraduate students under examination stress. *African health sciences*, 15(1), pp.131-136.
- Manhas, S., 2014. Assessment of physical health status of female construction workers of Kathau district, J and K. *International Organization of Scientific Research-Journal of Humanities and Social Sciences*, 19, pp.19-24.
- Melis, S., Foubert, I. and Delcour, J.A., 2021. Normal-phase HPLC-ELSD to compare lipid profiles of different wheat flours. *Foods*, 10(2), p.428.
- Middlesworth, M. (2012) *A Step-by-Step Guide to Using the NIOSH Lifting Equation for Single Tasks*, ErgoPlus. Available at: <https://ergo-plus.com/niosh-lifting-equation-single-task/>.
- Nordestgaard, B.G., Chapman, M.J., Ray, K., Borén, J., Andreotti, F., Watts, G.F., Ginsberg, H., Amarengo, P., Catapano, A., Descamps, O.S. and Fisher, E., 2010. Lipoprotein (a) as a cardiovascular risk factor: current status. *European heart journal*, 31(23), pp.2844-2853.
- Parashar, M., Dwivedi, S., Agarwalla, R., Kishore, J. and Shaikh, Z., 2017. Risk factors for cardiovascular diseases among male workers of building construction site in Delhi. *Journal of Clinical and Preventive Cardiology*, 6(3), p.99.

- Pawlak, R., 2015. Is vitamin B12 deficiency a risk factor for cardiovascular disease in vegetarians? *American journal of preventive medicine*, 48(6), pp.e11-e26.
- Saleem, S.M. and Jan, S.S., 2019. Modified Kuppuswamy socioeconomic scale updated for the year 2019. *Indian J Forensic Community Med*, 6(1), pp.1-3.
- Sanghavi, B.J., Moore, J.A., Chávez, J.L., Hagen, J.A., Kelley-Loughnane, N., Chou, C.F. and Swami, N.S., 2016. Aptamer-functionalized nanoparticles for surface immobilization-free electrochemical detection of cortisol in a microfluidic device. *Biosensors and Bioelectronics*, 78, pp.244-252.
- Shah, K.R. and Tiwari, R.R., 2010. Occupational skin problems in construction workers. *Indian Journal of Dermatology*, 55(4), p.348.
- Sultana, N., Ferdousi, J. and Shahidullah, M., 2014. Health problems among women building construction workers. *Journal of Bangladesh Society of Physiologist*, 9(1), pp.31-36.
- Yi, W. and Chan, A., 2016. Health profile of construction workers in Hong Kong. *International journal of environmental research and public health*, 13(12), p.1232.
- Yi, W. and Chan, A., 2016. Health profile of construction workers in Hong Kong. *International journal of environmental research and public health*, 13(12), p.1232.