Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/ryq4sz34

IMPACT OF POLYETHYLENE ON CARDIORESPIRATORY HEALTH IN PLASTIC RECYCLE FACTORY WORKERS

Navjot kaur sidhu[1], Dr. Shahiduzzafar PhD[2*]

[1]Researcher Scholar, Galgotias University
[2*]Assistant Professor Dept of Physiotherapy, Galgotias University, Greater Noida, U.P India

***Corresponding Author:-**Shahidazafar
* Assistant Professor Dept of Physiotherapy, Galgotias University, Greater Noida, U.P India
Email:-Shahiduz.zafar@galgotiasuniversity.edu.in

ABSTRACT

Background and Purpose: Not many studies have been conducted on Plastic factory workers compared to those who work in recycling plastic factories and to those in Normal factories but do not recycle the plastic. Therefore, the purpose of this study is to evaluate the Impact of Polyethylene on Cardiorespiratory Fitness in Plastic Recycle Factory Workers.
Materials & Methods: A total of 100 participants was collected from plastic recycle factory. The participants were included as per the inclusion and exclusion. The participants were divided into two groups on basis of their work as: GROUP A -PLASTIC RECYCLE FACTORY WORKERS.GROUP B –NON-PLASTIC RECYCLE **FACTORY WORKERS**. Both groups were assessed for their Cardiorespiratory fitness by the treadmill stress testing. The Astrand Treadmill Test was done for the VO2max check.VO2 max = (Time × 1.444) + 14.99 is used for calculation VO2max level. Data was collected and analyzed with the help of SPSS 21 and MS Excel.
Results: The results are quite apparent and reveal that there is an influence on the Plastic Recycle Factory Workers lung health since the VO2 max is lower than it should be. (35-45 ml/kg/min>27.47±1.0381) Vo2max vs Age has a negative correlation of -.206 (Negative correlation), meaning that as age increases, the Vo2 max level decreases, and Vo2 max vs BMI has a negative correlation of -.148 (Negative correlation), meaning that as BMI rises, the Vo2 max level decreases.
Conclusion: According to the findings of this study, we are able to make the conclusion that there are stronger impacts of the cardiorespiratory fitness in factory workers who recycle plastic as compared to factory workers who operate in other types of materials. This demonstrates that working in a factory that recycles plastic can have significant negative impacts on one's health.

Keywords- CARDIORESPIRATORY FITNESS, POLYETHYLENE, RECYCLE FACTORY

INTRODUCTION

Cardiorespiratory fitness (CRF) refers to the capacity of a person's circulatory and respiratory systems to deliver oxygen to working muscles over a prolonged length of time(1). The maximum oxygen consumption rate (VO2 max) is the gold standard for assessing CRF. The C-reactive protein (CRP) was designated as a clinical vital sign and should be routinely assessed as part of clinical practise by the American Heart Association in a 2016 scientific statement(2).

By increasing the number of small arteries in trained skeletal muscles, which deliver more blood to working muscles, and by increasing the size of the heart muscle, regular exercise improves the effectiveness of these systems(3). Exercise benefits not only the respiratory system but also the heart by increasing the amount of oxygen inhaled and subsequently delivered to body tissues. According to a 2005 Cochrane review, physical activity programmes can improve heart health(4).

Cardiorespiratory fitness has multiple benefits. Heart disease, lung cancer, type 2 diabetes, and stroke are a few of the illnesses it can avoid. Improving cardiorespiratory fitness is a fantastic strategy to improve health and happiness(5). According to accumulating studies, CRF may be a more reliable predictor of mortality than well-known risk factors such as smoking, hypertension, high cholesterol, and type 2 diabetes. In the past few years, a new study has linked higher CRF levels to mortality rates in individuals younger than 65. As the Baby Boomer and Generation X populations age in the United States, low CRF may emerge as a new risk factor for prematurity. Addition of CRF to these more conventional risk indicators has the potential to considerably boost the reliability of risk projections(6).

Aerobic exercise, which is defined as maintaining a heart rate between 65 and 85 percent of maximum heart rate, should be conducted three to five times per week for 30 to 60 minutes at a moderate intensity(7).

In response to alterations in the body's needs, the cardiovascular system modifies cardiac output, blood flow, and blood pressure. The volume of blood pumped per minute by the heart is measured by cardiac output, which is the product of heart rate and stroke volume. During physical exertion, the heart rate and stroke volume both rise, resulting in a greater cardiac output(8). Early on, the cardiovascular adaptations to exercise are rapid: "In less than a second following muscle contraction, the heart's vagal outflow is stopped, and sympathetic activation increases. To ensure that the amount of blood flowing to the muscle is proportional to its metabolic needs, the heart 3 must pump more forcefully ". There is a direct association between intensity of exercise and changes in heart rate and stroke volume, and both respond positively to frequent training(9).

Polyethylene, sometimes known as polythene, is the most frequently made plastic. It is a polymer used mostly for packaging (plastic bags, plastic films, geomembranes and containers including bottles, etc). (Plastic bags, plastic films, geomembranes, as well as bottles and other containers) In 2017, polyethylene resins made about 34% of the worldwide plastics market, with annual output reaching 100 million metric tonnes(10).

Polyethylene is composed of nonpolar hydrocarbons with high molecular weight. As a consequence, it shares similar chemical properties with paraffin. There are no chemical bonds between the macromolecules. Their symmetric molecular structure favourscrystallisation, therefore polyethylene is only partially amorphous. With increased crystallinity, density, mechanical and chemical stability are all enhanced(11).

Every day, around 25,940 metric tonnes of plastic waste are created in India, for an annual total of 9,46 million metric tonnes. Sixty percent of the plastic waste (15,384 tonnes) is collected and recycled, while the remainder is allowed to decompose in the environment(12).

Plastic is also known chemically as polyethylene and is primarily composed of styrene. PVC is a rigid, durable polymer with excellent UV resistance, electrical properties, and surface hardness and scratch resistance. Styrene is a white liquid that occurs naturally in the environment as a byproduct of petroleum and natural gas. Polymers derived from styrene are essential to our health and well-being since they are extremely durable, flexible, and lightweight(6).

PVC is a carcinogen that is inhaled, swallowed, and absorbed via the skin by plastics industry workers. Inhaling vinyl chloride may cause a variety of unpleasant health effects, such as coughing, wheezing, dyspnea, headaches, ataxia, drowsiness, and even coma(13).

As well as hematemesis, vinyl chloride may cause nausea, vomiting, diarrhoea, and abdominal pain. There is currently no conclusive answer to the question of how harmful PVC and styrene exposure is. 4 PVC and styrene are two of the most prevalent airborne particles in plastic manufacture, and they can have severe, long-term effects on workers, such as occupational hearing loss and lung function impairment and disease.

Compared to those who work in factories that recycle plastic and those who work in normal factories that do not recycle plastic, fewer studies have been conducted on plastic industry workers. The purpose of this study is to determine the effect of polyethylene on the cardiorespiratory fitness of factory workers who recycle plastic.

STATEMENT QUESTION

- Is there any impact of plactic on cardio respiratory fitness by the treadmill stress testing in plastic factory workers?

AIMS AND OBJECTIVES OF THE STUDY

- To find the impact of plactic on cardio respiratory fitness by the treadmill stress testing in plastic factory workers

HYPOTHESIS

Null hypothesis

- There is no significant effect of polyethylene on cardiorespiratory health of plastic recycle factory workers

Research hypothesis

- Impact of plactic on cardio respiratory fitness by the treadmill stress testing in plastic factory workers

METHODOLOGY

Type of study: EXPERIMENTAL STUDY
Sampling: Convenience sampling
Area of Project: Guwahati
Sampling Method:

- No of Sample: 100

Inclusion Criteria:

- AGE OF WORKERS (18-45 Years)
- MINIMUM 6 HOUR OF WORKING HOURS
- FREQUENCY - 6 DAYS A WEEK OF WORKING
- HAVE A HISTORY OF MINIMUM 1 YEAR WORKING IN THE FACTORY

Exclusion Criteria:

- HISTORY OF LUNG DISEASE
- ANY RECENT SURGERY
- ANY CARDIOVASCULAR DISEASE
- ANY NEUROLOGICAL IMPAIRAMENT

TOOLS USED

- STOPWATCH
- TREADMILL
- SPHYGMOMANOMETER
- PULSOXIMETER

PROCEDURE

GROUP A - PLASTIC RECYCLE FACTORY WORKERS. (N-50)
GROUP B – NON-PLASTIC RECYCLE FACTORY WORKERS(N-50)
A total of 100 participants was collected from plastic recycle factory. The participants were included as per the inclusion and exclusion. The participants were divided into two groups on basis

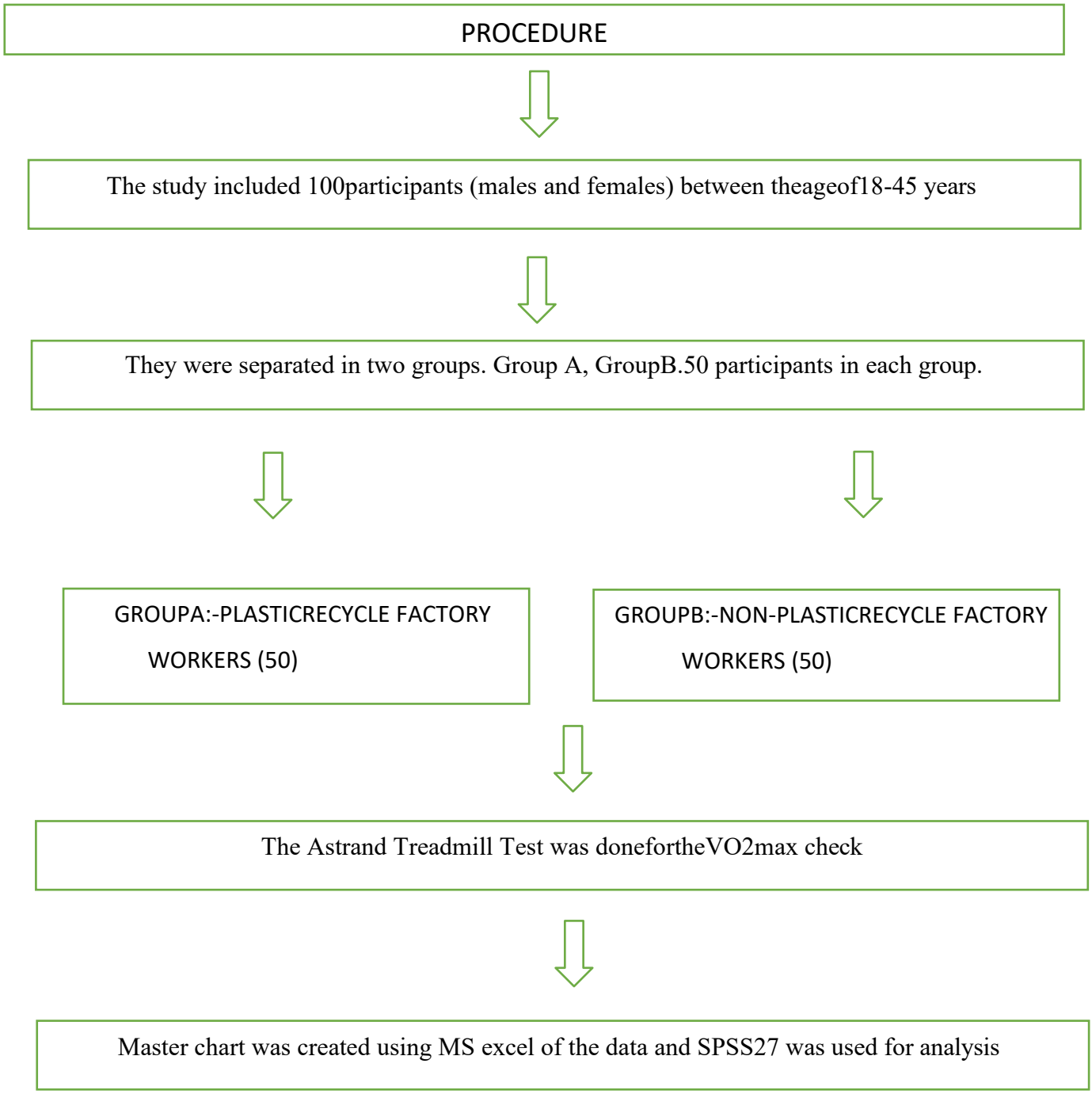
of their work as: GROUP A -PLASTIC RECYCLE FACTORY WORKERS.GROUP B –NON-PLASTIC RECYCLE FACTORY WORKERS. Both groups were assessed for their Cardiorespiratory fitness by the treadmill stress testing. The Astrand Treadmill Test was done for the VO2max check.VO2 max = (Time × 1.444) + 14.99 is used for calculation VO2max level. Data was collected and analyzed with the help of SPSS 21 and MS Excel.

The Astrand Treadmill Test

The person begins the treadmill test at a gradient (incline) of 0% and walks up to a speed of 8.05 km/h (5 mph). The timer should be set for three minutes after they reach this speed. Then, after 3 minutes, reduce the grade to 2.5 percent and work for another 2 minutes. After that, the client's grade will increase by 5% every two minutes until they are unable to continue the exam.

Results: From the total running time an estimate of your clients VO2 max can be calculated by using the following formula;

VO2 max = (Time × 1.444) + 14.99



DATA ANALYSIS

The data analysis was conducted using version 26.0 of Social Science Packaging Software (S.P.S.S.). Independent T-tests and Chi-Square tests were used to assess the data. Microsoft Word 2016-made graphical representation.

RESULTS

The results are quite apparent and reveal that there is an influence on the Plastic Recycle Factory Workers lung health since the VO2 max is lower than it should be. (35-45 ml/kg/min>27.47±1.0381) Vo2max vs Age has a negative correlation of -.206 (Negative correlation), meaning that as age increases, the Vo2 max level decreases, and Vo2 max vs BMI has a negative correlation of -.148 (Negative correlation), meaning that as BMI rises, the Vo2 max level decreases.

TABLE 1 SHOWS THE DEMOGRAPHIC DETAILS.
TABLE 4 GENDER RATIO
TABLE 3 VO2 MAX(KG/ML/MIN) STATISTICS (T TEST)
TABLE 4 CORRELATION OF AGE VS VO2 MAX AND BMI. 24

LIST OF TABLES:

Table No.1 Demographic Descriptive Statistics (Weight,Height,Age)

	AGE	HEIGHT(cm)	WEIGHT	BMI
Mean	23.13	164.4434	65.05	23.874
N	100	100	100	100
Std. Deviation	1.812	10.52960	13.325	3.2038

TableNo.2 Age wise gender ratio

Group Statistics					
	Sex	N	Mean	Std. Deviation	Std. Error Mean
Age	MALE	67	26.52	4.168	.509
	FEMALE	33	27.18	5.329	.928

Table No3.GenderRatio

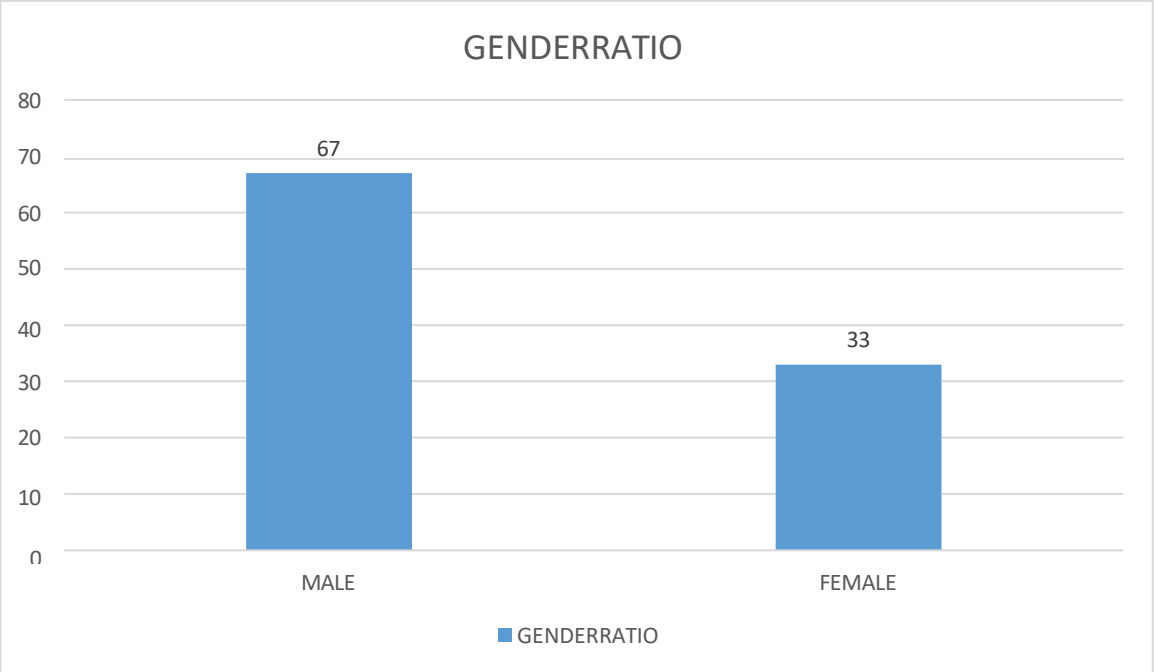
Gender Ratio					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	67	67.0	67.0	67.0
	FEMALE	33	33.0	33.0	100.0
	Total	100	100.0	100.0	

Table No.4 T-Test results of The Astrand Treadmill Test

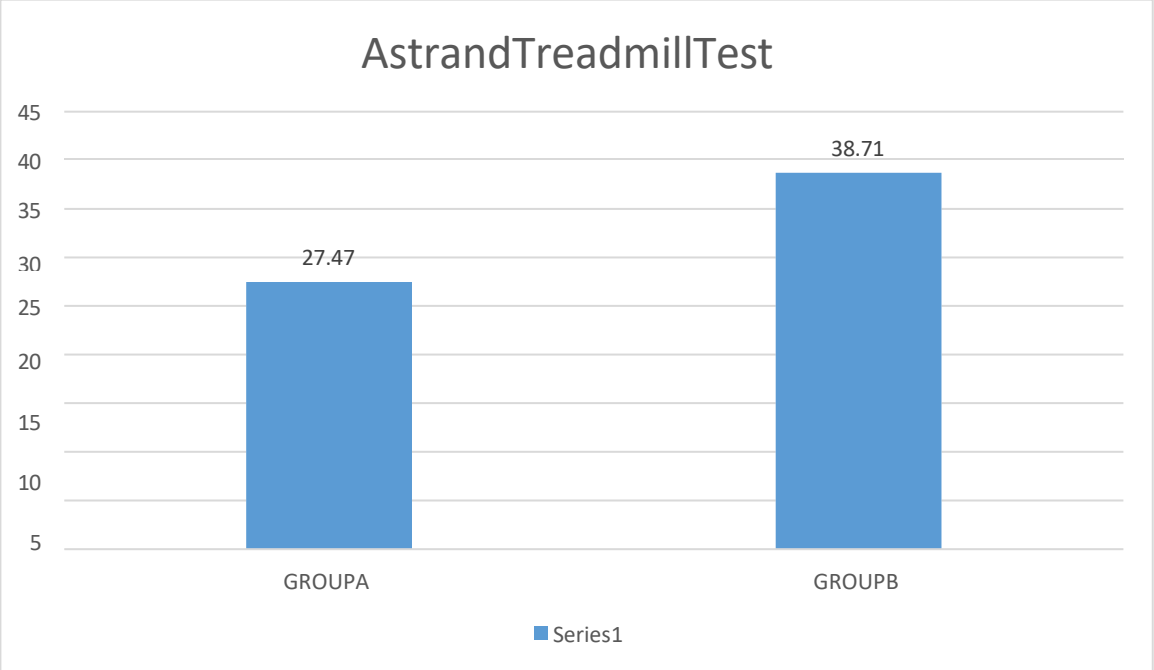
	MEAN±SD	T-TEST	P-VALUE
vo2max(kg/ml/min) GROUP A	27.472±1.0381	206.684	P<0.005
vo2max(kg/ml/min) GROUP B	38.711±1.838	176.83	

LIST OF GRAPHS:

GRAPH NO1: Gender Ratio



GRAPH NO2: T-Test results of The Astrand Treadmill Test



DISCUSSION

The objective of this study was to compare the incidence Plastic factory workers and non-plastic factory works Cardio health The results are quite apparent and reveal that there is an influence on the Plastic Recycle Factory Workers lung health since the VO2 max is lower than it should be. (35-45 ml/kg/min>27.47±1.0381) Vo2max vs Age has a negative correlation of -.206 (Negative correlation), meaning that as age increases, the Vo2 max level decreases, and Vo2 max vs BMI has a negative correlation of -.148 (Negative correlation), meaning that as BMI rises, the Vo2 max level decreases. In a related study, Mohamed F. A. Elagib et al. 2020 Exposure to cement dust has been linked to declines in periodontal health in Sudanese workers in the cement industry. In addition to the 100 workers from the Rabak Cement Factory and Algablain Quarry who had been exposed to the harmful substances, 84 employees of the Kosti River Transport Corporation were also evaluated. Quantitative and qualitative data on demographics and way of life were gathered with the use of a precoded and pretested questionnaire. Tooth wear, calculus, plaque index, gingival index, probing depth, and gingival relapse were all evaluated (GR). There were large differences in TW and CAL between the exposed and control groups. The quantities were significantly higher in those who had been exposed to TW and CAL. None of the four metrics showed significant movement (PI, GIS, PPD, and GR). Somewhere between 16.8 and 29.5% of those in the exposed group took measures to lower their risk. Consequently, there were substantial differences in clinical indicators between those who used preventative measures and those who did not.
Authors Abbas Norouzian Baghania, et al This study aimed to quantify the amount of pollution caused by a fungal bioaerosol in paper and cardboard recycling facilities, as well as the extent of any potential non-cancerous effects that might arise from such pollution. In a pioneering study, Iranian researchers looked intowhether or not bioaerosols pose a threat to workers' health. The information shed light on the seasonal variation in fungal concentrations across the WPCRF's various processing units. The findings were disconcerting, to say the least. Based on the findings, the air in the WPCRF included a sizeable quantity of bioaerosols. Massive amounts of bioaerosols were generated by the conveyor belt and the hand separation on route one. Air samples from the WPCRF's working units revealed the presence of numerous fungi, including Penicillium, Cladosporium, and Aspergillus, prompting concerns for the health of WPCRF employees who spent extended periods of time there. 29

Future scope of study

- More study can be done with higher sample size in the study for Both male and females' gender for correlation.

Conflict of interest: -None

Limitation of study

- Less sample sizes
- Limited activates performed
- Limited Geographic region covered

CONCLUSION

According to the findings of this study, we are able to make the conclusion that there are stronger impacts of the cardiorespiratory fitness in factory workers who recycle plastic as compared to factory workers who operate in other types of materials. This demonstrates that working in a factory that recycles plastic can have significant negative impacts on one's health.

REFERENCES

1. DeFina LF, Haskell WL, Willis BL, Barlow CE, Finley CE, Levine BD, et al. Physical Activity Versus Cardiorespiratory Fitness: Two (Partly) Distinct Components of Cardiovascular Health? Prog Cardiovasc Dis. 2015 Jan 1;57(4):324–9.
2. Després JP. Physical Activity, Sedentary Behaviours, and Cardiovascular Health: When Will Cardiorespiratory Fitness Become a Vital Sign? Canadian Journal of Cardiology. 2016;32(4):505–13.
3. Lang JJ, Tremblay MS, Ortega FB, Ruiz JR, Tomkinson GR. Review of criterion-referenced standards for cardiorespiratory fitness: what percentage of 1 142 026 international children and youth are apparently healthy? Br J Sports Med. 2019;53(15):953–8.
4. Raghuveer G, Hartz J, Lubans DR, Takken T, Wiltz JL, Mietus-Snyder M, et al. Cardiorespiratory Fitness in Youth: An Important Marker of Health: A Scientific Statement from the American Heart Association. Circulation. 2020;E101–18.
5. Bachmann JM, DeFina LF, Franzini L, Gao A, Leonard DS, Cooper KH, et al. Cardiorespiratory Fitness in Middle Age and Health Care Costs in Later Life. J Am Coll Cardiol. 2015;66(17):1876–85.
6. Christensen JR, Kongstad MB, Sjogaard G, Sogaard K. Sickness presenteeism among health care workers and the effect of BMI, cardiorespiratory fitness, and muscle strength. J Occup Environ Med. 2015;57(12):e146–52.
7. Koubaa A, Triki M, Trabelsi H, Masmoudi L, Zeghal KN, Sahnoun Z, et al. Effect of low-intensity continuous training on lung function and cardiorespiratory fitness in both cigarette and hookah smokers. Afr Health Sci. 2015;15(4):1170–81.
8. Baur DM, Christophi CA, Tsismenakis AJ, Cook EF, Kales SN. Cardiorespiratory fitness predicts cardiovascular risk profiles in career firefighters. J Occup Environ Med. 2011;53(10):1155–60.
9. Gill JMR. Physical activity, cardiorespiratory fitness and insulin resistance: A short update. Curr OpinLipidol. 2007;18(1):47–52.
10. Borghols EAM, Dresen MHW, Hollander AP. Influence of heavy weight carrying on the cardiorespiratory system during exercise. Eur J Appl PhysiolOccup Physiol. 1978;38(3):161–9.
11. Dankner R, Geulayov G, Farber N, Novikov I, Segev S, Sela BA. Cardiorespiratory fitness and plasma homocysteine levels in adult males and females. Israel Medical Association Journal. 2009;11(2):78–82.
12. Barba-Moreno L, Cupeiro R, Romero-Parra N, Janse De Jonge XAK, Peinado AB. Cardiorespiratory Responses to Endurance Exercise Over the Menstrual Cycle and With Oral Contraceptive Use.
13. Oliver M, Macdonald J, Rajwani M. The use of botulinum neurotoxin type A (Botox) for headaches: a case review. Vol. 50, J Can Chiropr Assoc. 2006. 34
14. Demirtaş H, Saygun M, Bayar Muluk N. Is there a relationship between occupational noise and hearing levels, sleep quality, and QoL of the factory workers? Neurological Sciences. 2022 Feb 1;43(2):1015–23.
15. Elagib MFA, Ghandour IA, Abdel Rahman ME, Baldo SMH, Idris AM. Influence of cement dust exposure on periodontal health of occupational workers. Toxin Rev. 2021;40(4):1496–504.
16. Norouzian Baghani A, Sorooshian A, Delikhoon M, Nabizadeh R, Nazmara S, Bakhtiari R. Pollution characteristics and noncarcinogenic risk assessment of fungal bioaerosol in different processing units of waste paper and cardboard recycling factory. Toxin Rev. 2021;40(4):752–63.
17. Mo PKH, Cheng Y, Lau JTF. Work-related factors on mental health among migrant factory workers in china: Application of the Demand-Control and Effort-Reward Imbalance Model. Health Soc Care Community. 2022 Feb 1;30(2):656–67.

18. Côté D, Durant S, MacEachen E, Majowicz S, Meyer S, Huynh AT, et al. A rapid scoping review of COVID-19 and vulnerable workers: Intersecting occupational and public health issues. Vol. 64, American Journal of Industrial Medicine. John Wiley and Sons Inc; 2021. p. 551–66.
19. Darboe B, Kao MY, Tsai D. Respiratory symptoms among municipal waste workers in the Gambia: Types of solid waste and working conditions. Int J Health Promot Educ. 2015 Jan 2;53(1):17–27.
20. Mahmood S. Female Garment Workers' Understandings of HIV in Bangladesh. Article in American Journal of Public Health Research [Internet]. 2021;9(2):81–9. Available from: http://pubs.sciepub.com/ajphr/9/2/6
21. Gladding T, Thorn J, Stott D. Organic dust exposure and work-related effects among recycling workers. Am J Ind Med. 2003 Jun 1;43(6):584–91.
22. Gottesfeld P, Pokhrel AK. Review: Lead exposure in battery manufacturing and recycling in developing countries and among children in nearby communities. Vol. 8, Journal of Occupational and Environmental Hygiene. 2011. p. 520–32.
23. Hsu YT, Su TY, Chen CY, Liao HY, Kuo YC, Wu W te, et al. Exposure profiles of workers from indium tin oxide target manufacturing and recycling factories in Taiwan. Int J Hyg Environ Health. 2021 Apr 1;233.
24. Wang YL, Lee YH, Chiu IJ, Lin YF, Chiu HW. Potent impact of plastic nanomaterials and micromaterials on the food chain and human health. Vol. 21, International Journal of Molecular Sciences. MDPI AG; 2020.
25. al Sayem Khan MA, Ahmad MH. EFFECT OF INDOOR CONDITION OF BANGLADESH FACTORY TO WORKERS HEALTH AND BEHAVIOR. Journal of Tourism, Hospitality and Environment Management. 2022 Mar 8;7(27):405–16.
26. Kaifie A, Schettgen T, Bertram J, Löhndorf K, Waldschmidt S, Felten MK, et al. Informal e-waste recycling and plasma levels of non-dioxin-like polychlorinated biphenyls (NDL-35
27. Kandasamy SP, Akolkar AB, Manoharan A, Paranji S. Municipal solid waste management at Chennai in southern India - An occupational health perspective. Int J Health Promot Educ. 2013 Jan;51(1):50–61.
28. Fishwick D, Sen D, Barber C, Bradshaw L, Robinson E, Sumner J, et al. Occupational chronic obstructive pulmonary disease: A standard of care. Vol. 65, Occupational Medicine. Oxford University Press; 2015. p. 270–82.
29. Leung AOW, Duzgoren-Aydin NS, Cheung KC, Wong MH. Heavy metals concentrations of surface dust from e-waste recycling and its human health implications in southeast China. Environ Sci Technol. 2008 Apr 1;42(7):2674–80.
30. Abdel-Rasoul G, Abu-Salem M, elShazly H, Allam H, Salem E, Ahmed A. Respiratory and auditory health disorders among workers in a plastic factory (industrial zone, Queisna City, Menoufia Governorate). Menoufia Medical Journal. 2016;29(3):757.
31. Paudyal P, Semple S, Niven R, Tavernier G, Ayres JG. Exposure to dust and endotoxin in textile processing workers. Annals of Occupational Hygiene. 2011 May;55(4):403–9.
32. Unwin J, Coldwell MR, Keen C, McAlinden JJ. Airborne emissions of carcinogens and respiratory sensitizers during thermal processing of plastics. Annals of Occupational Hygiene. 2013 Apr;57(3):399–406.
33. Mwaiselage J, Moen B, Bråtveit M. Acute respiratory health effects among cement factory workers in Tanzania: An evaluation of a simple health surveillance tool. Int Arch Occup Environ Health. 2006 Jan;79(1):49–56.
34. Khaliq F, Vaney N. Pulmonary functions in plastic factory workers: A preliminary study [Internet]. Article in Indian Journal of Physiology and Pharmacology. 2011. Available from: https://www.researchgate.net/publication/221815927
35. Rafey A, Siddiqui FZ. A review of plastic waste management in India–challenges and opportunities. Int J Environ Anal Chem. 2021;

36. Angaw Y, Kumie A, Tefera Y, Wakuma S, Nega A, Hidru HD, et al. Temporary hearing loss and associated factors among aykaaddis textile factory workers in Oromia region, Ethiopia: A cross-sectional study. Risk Manag Healthc Policy. 2021;14:719–28.
37. Shin SH, Kim HO, Rim KT. Worker Safety in the Rare Earth Elements Recycling Process From the Review of Toxicity and Issues. Vol. 10, Safety and Health at Work. Elsevier Science B.V.; 2019. p. 409–19.
38. Wang Y, Hu J, Lin W, Wang N, Li C, Luo P, et al. Health risk assessment of migrant workers' exposure to polychlorinated biphenyls in air and dust in an e-waste recycling area in China: Indication for a new wealth gap in environmental rights. Environ Int. 2016 Feb 1;87:33–41.