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Congestive Heart Failure (CHF) by Petrochemicals among Fuel Attendants

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Abstract. *Introduction:* Petroleum also known as crude oil is a naturally occurring yellowish-black liquid found in geological formations beneath the Earth's surface. It is commonly refined into various types of fuels. Congestive heart failure has been defined as global pandemic, since it affects around 26 million people worldwide. Fuel attendants engaged in these environments are continuously exposed to petrol and diesel fumes which results in hazards of the human system such as the heart, liver and kidney. The purpose of this study is to determine the congestive heart failure by petrochemicals among fuel attendants. *Methods:* The total sample size for this study was 200 samples. Of them, 100 were included as case group. They were fuel attendants who work at the various filling stations visited in the LGA. Their main direct sources of exposure were inhalation, accidental ingestion, and skin contact, among others. These samples were collected from people who are within the age range of 15-50 years. *Result:* This study shows that cardiac enzymes Troponin I has a mean value of 16.83 in fuel attendants compared to the mean value of 7.12 in non-fuel attendants in Oluyole Area, Ibadan. This is statistically significant ($p < 0.01$) with 133%. Troponin C has a mean value of 16.69 in fuel attendants compared to the mean value of 7.31 among non-fuel attendants in Oluyole Area, Ibadan. This is statistically significant ($p < 0.01$) with 114%. Troponin T has a mean value of 16.94 in fuel attendants compared to the mean value of 7.56 in non-fuel attendants in Oluyole Area, Ibadan. This is statistically significant ($p < 0.01$) with 112%. *Conclusion:* This study shows that exposure to petrochemicals can cause biochemical changes in the heart leading to the release of enzymes into the blood stream which serve as biomarker tools for the diagnosis of the risk of cardiovascular diseases such as congestive heart failure. Other petrochemical effect includes elevated blood pressure. Fuel attendants should be screened for heart related diagnosis before employed, this will reduce the risk of employing attendants with heart related disease leading to heart failure. Timely, regular medical checkup should be done while working as a fuel attendant and it is also achievable to create time in having physical exercise which reduces the risk of being above the BMI which consistently reduces the risk of heart related disease.

Keywords: Congestive Heart Failure, Petrochemical, Fuel, Attendants, Heart

Introduction

Petroleum also known as crude oil is a naturally occurring yellowish-black liquid found in geological formations beneath the Earth's surface. The word *petroleum* comes from Medieval Latin petroleum (literally 'rock oil'), which comes from Latin petra 'rock' (from Greek *pétra* πέτρα) and oleum 'oil' (from Greek *élaion* ἔλαιον) (Houghton, 2020). It is commonly refined into various types of fuels. Components of petroleum are separated using a technique called fractional distillation, i.e., separation of a liquid mixture into fractions differing in boiling point by means of distillation, typically using a fractionating column. (Adams, 2016). It consists of naturally occurring hydrocarbons of various molecular weights and may contain miscellaneous organic compounds The name *petroleum* covers both naturally occurring unprocessed crude oil and petroleum products that are made up of refined crude oil. A fossil fuel, petroleum is formed when large quantities of dead organisms, mostly zooplankton and algae, are buried underneath sedimentary rock and subjected to both intense heat and pressure. Petroleum is a naturally occurring material in the earth composed predominantly of chemical compounds of carbon and hydrogen with and without other nonmetallic elements such as sulfur, nitrogen, and oxygen. Petroleum has mostly been recovered by oil drilling. Drilling is carried out after studies of structural geology, sedimentary basin analysis, and reservoir characterization. Recent developments in technologies have also led to exploitation of other unconventional reserves such as oil sands and oil shale. Once extracted, oil is refined and separated, most easily by distillation, into numerous products for direct use or use in manufacturing, such as gasoline (petrol), diesel and kerosene to asphalt and chemical reagents used to make plastics, pesticides and pharmaceuticals. Petroleum is used in manufacturing a wide variety of materials and it is estimated that the world consumes about 100 million barrels (16 million cubic metres) each day (Tom & Warren, 2021).

Petroleum exploitation has significant negative environmental and social consequences. Most significantly, extraction, refining and burning of petroleum fuels all release large quantities of greenhouse gases, so petroleum is one of the major contributors to climate change. Environmental effects of petroleum includes the environmental impacts of exploration and exploitation of petroleum reserves, such as oil spills, and air and water pollution at the sites of utilization. All of these environmental impacts have direct health consequences for humans. Additionally, oil has also been a source of conflict leading to both state-led-wars and other kinds of conflicts (for example, oil revenue funded the Islamic State). Production of petroleum is expected to reach peak oil before 2035 (Tom & Warren, 2021), as global economies reduce dependencies on petroleum as part of climate change mitigation and a transition towards renewable energy and electrification (Houghton, 2020). This is expected to have significant economic impacts that stakeholders argue need to be anticipated by a just transition and addressing the stranded assets of the petroleum industry.

Congestive heart failure has been defined as global pandemic, since it affects around 26 million people worldwide (Ponikowski *et al.*, 2014). Currently 5.7 million people in the US have congestive heart failure, but the projections are worrisome since it is expected that by 2030 more than 8 million people will have this condition, accounting for a 46 % increase in prevalence (Mozaffarian & Benjamin, 2016). According to WHO (2018), heart related diseases is estimated to cause about 5.60% death in Nigeria, that’s approximately 108,587 total number of deaths in the year (WHO, 2018). In the recent past there has been an increased concern about exposure to potentially harmful substances in Petrochemicals (Bourke, 2013).

Fuel attendants engaged in these environments are continuously exposed to petrol and diesel fumes which results in hazards of the human system such as the heart, liver and Kidney (Uzma *et al.*, 2008). Petrol pump workers are vulnerable to petroleum hydrocarbons through intake of contaminated dermal exposure or inhalation of vapor (Azeez *et al.*, 2012). The

purpose of this study is to determine the Congestive heart failure by petrochemicals among fuel attendants.

Materials and Methods

This study is a community based cross-sectional analytical study designed to establish the effect of petrochemicals in the heart of fuel attendants in Oluyole area of Ibadan.

Population of study: The target population include fuel attendants sampled across Oluyole local area in Ibadan Oyo State. The target number of respondents from the surveyed questionnaire is estimated to be 200 copies. However, to give room for loss of questionnaire or non-compliance, additional 10 copies (10%) was added, making a total of 210 questionnaires produced for sampling purpose.

Sample size determination: The total sample size for this study was 200 samples. Of them, 100 were included as case group. They were fuel attendants who work at the various filling stations visited in the LGA. Their main direct sources of exposure were inhalation, accidental ingestion, and skin contact, among others. The control group, 100 people, did trade neither gasoline nor work in the oil industry. The inclusion criteria were no past medical history of chronic diseases, including diabetes, hepatitis, renal failure, and blood disorders, no using a specific medicine, no smoker, and no alcohol consumptions. These samples were collected from people who are within the age range of 15-50 years.

Study variables: Demographic data, including gender, age, location, job duration (year) and working time (hour/day) were collected through a physical assessment.

Sample analysis: Five ml venous blood was taken for the laboratory tests in the mornings, and the levels of following parameters were tested after spinning and separation of the samples; Troponin C, Troponin I and Troponin T. These analytes were tested using kits. In order to confirm the reliability of the tests, some of the samples were double-checked in another laboratory.

Ethical approval: The ethical approval was obtained from the Ethics Committee at Lead City University, Ibadan. The purpose of the study was explained to the participants and an oral and written consent was achieved before data and sample collection.

Data management and Analysis: Information was extracted using a data collection sheet designed for the purpose. The data were coded and analysed using statistical package for social sciences (SPSS) version 21.0. This consisted of initial univariate and bivariates analyses, and then multivariate logistics regression analysis to identify the independent determinant of abnormal semen parameters in male infertility. Test of statistical significance was based on 95% confidence interval and $p<0.05$ using chi square test with fisher exact correction where applicable.

Results

Analysis and Presentation of Data

Table 1 shows a descriptive variable of Descriptive Variables=ConT1, Contronc, Controponint, Conbmi, Troponini1, Troponinic, Troponint, BMI

Table 1: Descriptive variable of Descriptive Variables

Descriptive Statistics			
	N	Mean	Std. Deviation
CONT1	100	7.1200	2.94145
CONTRONC	100	7.3100	3.02747
CONTROPONINT	100	7.5600	2.65269
CONBMI	100	28.7040	2.46191

TROPONINI1	100	16.8300	3.07829
TROPONINIC	100	16.6900	2.55325
TROPONINT	100	16.9400	2.39030
BMI	100	27.3530	2.99702
Valid N (listwise)	100		

Table 2: Mean, Std Deviation, Std Error Mean of Troponin I, Troponin C Troponin T and BMI

Group Statistics

	STATUS	N	Mean	Std. Deviation	Std. Error Mean
Troponin I	Non-Fuel Attendants	100	7.1200	2.94145	.29414
	Fuel Attendants	100	16.8300	3.07829	.30783
Troponin C	Non-Fuel Attendants	100	7.3100	3.02747	.30275
	Fuel Attendants	100	16.6900	2.55325	.25533
Troponin T	Non-Fuel Attendants	100	7.5600	2.65269	.26527
	Fuel Attendants	100	16.9400	2.39030	.23903
BMI	Non-Fuel Attendants	100	28.7040	2.46191	.24619
	Fuel Attendants	100	27.3530	2.99702	.29970

Table 3: Levene's Test for Equality of Variances, t-test for Equality of Means Troponin I, Troponin C, Troponin T and BMI

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
Troponin I	Equal variances assumed	.293	.589	-22.806	198
	Equal variances not assumed			-22.806	197.592
Troponin C	Equal variances assumed	2.831	.094	-23.685	198
	Equal variances not assumed			-23.685	192.519
Troponin T	Equal variances assumed	1.047	.307	-26.269	198
	Equal variances not assumed			-26.269	195.890
BMI	Equal variances assumed	8.238	.005	3.483	198
	Equal variances not assumed			3.483	190.805

Table 4: Frequency Table of Troponin I

TROPONIN I

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	3	3.0	3.0	3.0
	3.00	8	8.0	8.0	11.0
	4.00	13	13.0	13.0	24.0
	5.00	8	8.0	8.0	32.0
	6.00	12	12.0	12.0	44.0
	7.00	12	12.0	12.0	56.0
	8.00	12	12.0	12.0	68.0
	9.00	11	11.0	11.0	79.0
	10.00	8	8.0	8.0	87.0

	11.00	3	3.0	3.0	90.0
	12.00	5	5.0	5.0	95.0
	13.00	4	4.0	4.0	99.0
	14.00	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

Table 5: Frequency Table of Troponin C

TROPONIN C					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	3	3.0	3.0	3.0
	3.00	7	7.0	7.0	10.0
	4.00	15	15.0	15.0	25.0
	5.00	6	6.0	6.0	31.0
	6.00	9	9.0	9.0	40.0
	7.00	15	15.0	15.0	55.0
	8.00	10	10.0	10.0	65.0
	9.00	8	8.0	8.0	73.0
	10.00	9	9.0	9.0	82.0
	11.00	9	9.0	9.0	91.0
	12.00	5	5.0	5.0	96.0
	13.00	2	2.0	2.0	98.0
	14.00	2	2.0	2.0	100.0
	Total	100	100.0	100.0	

Table 6: Frequency Table of Troponin T

TROPONIN T					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	2	2.0	2.0	2.0
	3.00	4	4.0	4.0	6.0
	4.00	5	5.0	5.0	11.0
	5.00	10	10.0	10.0	21.0
	6.00	18	18.0	18.0	39.0
	7.00	14	14.0	14.0	53.0
	8.00	13	13.0	13.0	66.0
	9.00	7	7.0	7.0	73.0
	10.00	13	13.0	13.0	86.0
	11.00	5	5.0	5.0	91.0
	12.00	7	7.0	7.0	98.0
	14.00	2	2.0	2.0	100.0
	Total	100	100.0	100.0	

Table 7: Frequency Table of BMI

BMI					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	13.80	1	1.0	1.0	1.0
	22.00	1	1.0	1.0	2.0
	25.00	4	4.0	4.0	6.0
	25.70	1	1.0	1.0	7.0
	26.00	2	2.0	2.0	9.0
	26.20	1	1.0	1.0	10.0

26.80	1	1.0	1.0	11.0
27.00	9	9.0	9.0	20.0
27.10	1	1.0	1.0	21.0
28.00	21	21.0	21.0	42.0
28.10	1	1.0	1.0	43.0
28.30	2	2.0	2.0	45.0
28.80	1	1.0	1.0	46.0
28.90	1	1.0	1.0	47.0
29.00	15	15.0	15.0	62.0
29.30	1	1.0	1.0	63.0
30.00	19	19.0	19.0	82.0
30.70	1	1.0	1.0	83.0
31.00	9	9.0	9.0	92.0
31.40	1	1.0	1.0	93.0
32.00	5	5.0	5.0	98.0
33.00	1	1.0	1.0	99.0
35.00	1	1.0	1.0	100.0
Total	100	100.0	100.0	

Table 8: Frequency Table of BP

BP					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	115/78	1	1.0	1.0	1.0
	115/79	2	2.0	2.0	3.0
	115/80	3	3.0	3.0	6.0
	118/80	3	3.0	3.0	9.0
	119/78	1	1.0	1.0	10.0
	119/79	1	1.0	1.0	11.0
	119/80	1	1.0	1.0	12.0
	120/78	1	1.0	1.0	13.0
	120/80	18	18.0	18.0	31.0
	120/81	5	5.0	5.0	36.0
	121/75	1	1.0	1.0	37.0
	121/78	2	2.0	2.0	39.0
	121/79	2	2.0	2.0	41.0
	121/80	2	2.0	2.0	43.0
	121/81	3	3.0	3.0	46.0
	121/82	1	1.0	1.0	47.0
	121/83	3	3.0	3.0	50.0
	122/80	3	3.0	3.0	53.0
	122/82	2	2.0	2.0	55.0
	122/83	5	5.0	5.0	60.0
	122/85	1	1.0	1.0	61.0
	123/80	4	4.0	4.0	65.0
	123/84	2	2.0	2.0	67.0
	124/80	1	1.0	1.0	68.0
	124/81	2	2.0	2.0	70.0
	124/82	1	1.0	1.0	71.0
	125/80	8	8.0	8.0	79.0

125/82	4	4.0	4.0	83.0
125/85	2	2.0	2.0	85.0
126/82	2	2.0	2.0	87.0
126/83	2	2.0	2.0	89.0
128/84	1	1.0	1.0	90.0
129/86	1	1.0	1.0	91.0
130/80	2	2.0	2.0	93.0
130/84	1	1.0	1.0	94.0
130/85	3	3.0	3.0	97.0
130/90	2	2.0	2.0	99.0
135/83	1	1.0	1.0	100.0
Total	100	100.0	100.0	

Table 9: Frequency Table of Troponin I (In Non-Fuel Attendants and Fuel Attendants)

	Non-Fuel Attendants		Fuel Attendants	
	Frequency	**Percent**	**Frequency**	**Percent**
2.00	3	3.0		
3.00	8	8.0		
4.00	13	13.0		
5.00	8	8.0		
6.00	12	12.0		
7.00	12	12.0		
8.00	12	12.0		
9.00	11	11.0		
10.00	8	8.0	3	3.0
11.00	3	3.0	1	1.0
12.00	5	5.0	3	3.0
13.00	4	4.0	9	9.0
14.00	1	1.0	9	9.0
15.00			9	9.0
16.00			12	12.0
17.00			11	11.0
18.00			8	8.0
19.00			13	13.0
20.00			10	10.0
21.00			10	10.0
23.00			1	1.0
25.00			1	1.0
Total	100	100.0		

Table 10: Frequency Table of Troponin C (In Non-Fuel Attendants and Fuel Attendants)

	Non-Fuel Attendants		**Fuel Attendants**	
	Frequency	**Percent**	**Frequency**	**Percent**
2.00	3	3.0		
3.00	7	7.0		
4.00	15	15.0		
5.00	6	6.0		
6.00	9	9.0		

7.00	15	15.0		
8.00	10	10.0		
9.00	8	8.0		
10.00	9	9.0		
11.00	9	9.0		
12.00	5	5.0	2	2.0
13.00	2	2.0	10	10.0
14.00	2	2.0	13	13.0
15.00			11	11.0
16.00			12	12.0
17.00			13	13.0
18.00			13	13.0
19.00			9	9.0
20.00			7	7.0
21.00			10	10.0
Total	**100**	**100.0**	**100**	**100.0**

Table 11: Frequency Table of Troponin T (In Non-Fuel Attendants and Fuel Attendants)

	Non-Fuel Attendants		Fuel Attendants	
	Frequency	**Percent**	**Frequency**	**Percent**
2.00	2	2.0		
3.00	4	4.0		
4.00	5	5.0		
5.00	10	10.0		
6.00	18	18.0		
7.00	14	14.0		
8.00	13	13.0		
9.00	7	7.0		
10.00	13	13.0		
11.00	5	5.0		
12.00	7	7.0		
13.0			9	9.0
14.00	2	2.0	8	8.0
15.00			14	14.0
16.00			13	13.0
17.00			13	13.0
18.00			16	16.0
19.00			11	11.0
20.00			11	11.0
21.00			3	3.0
22.00			1	1.0
24.00			1	1.0
Total	100	100.0	100	100.0

Table 12: Frequency Table and percent of BMI (In Non-Fuel Attendants and Fuel Attendants)

	Non-Fuel Attendants		Fuel Attendants	
	Frequency	Percent	Frequency	Percent
13.80	1	1.0		
18.00			1	1.0
19.00			1	1.0
20.00			1	1.0
22.00	1	1.0	1	1.0
23.00			6	6.0
24.00			6	6.0
25.00	4	4.0	11	11.0
25.50			1	1.0
25.70	1	1.0		
26.00	2	2.0	7	7.0
26.20	1	1.0		
26.80	1	1.0		
27.00	9	9.0	15	15.0
27.10	1	1.0		
28.00	21	21.0	9	9.0
28.10	1	1.0		
28.30	2	2.0		
28.80	1	1.0		
28.90	1	1.0		
29.00	15	15.0	18	18.0
29.30	1	1.0		
30.00	19	19.0	11	11.0
30.70	1	1.0		
30.80			1	1.0
31.00	9	9.0	4	4.0
31.40	1	1.0	2	2.0
32.00	5	5.0	4	4.0
33.00	1	1.0	2	2.0
34.00			1	1.0
35.00	1	1.0		
Total	100	100.0	100	100.0

Table 13: Frequency Table of BP (In Non-Fuel Attendants and Fuel Attendants)

	Fuel Attendants			Non-Fuel Attendants	
	Frequency	Percent		Frequency	Percent
115/78	1	1.0	115/75	1	1.0
115/79	2	2.0	118/76	1	1.0
115/80	3	3.0	118/78	3	3.0
118/80	3	3.0	118/79	1	1.0
119/78	1	1.0	118/80	2	2.0
119/79	1	1.0	119/78	1	1.0
119/80	1	1.0	119/79	1	1.0
120/78	1	1.0	119/80	2	2.0
120/80	18	18.0	120/80	17	17.0
120/81	5	5.0	120/81	5	5.0

121/75	1	1.0	120/83	1	1.0
121/78	2	2.0	121/80	5	5.0
121/79	2	2.0	121/81	2	2.0
121/80	2	2.0	121/82	3	3.0
121/81	3	3.0	121/83	1	1.0
121/82	1	1.0	122/80	6	6.0
121/83	3	3.0	122/81	1	1.0
122/80	3	3.0	122/82	2	2.0
122/82	2	2.0	122/83	2	2.0
122/83	5	5.0	123/80	9	9.0
122/85	1	1.0	123/81	1	1.0
123/80	4	4.0	123/82	1	1.0
123/84	2	2.0	123/84	4	4.0
124/80	1	1.0	123/85	1	1.0
124/81	2	2.0	124/81	2	2.0
124/82	1	1.0	124/83	2	2.0
125/80	8	8.0	124/84	2	2.0
125/82	4	4.0	125/80	3	3.0
125/85	2	2.0	125/82	2	2.0
126/82	2	2.0	125/83	1	1.0
126/83	2	2.0	125/84	1	1.0
128/84	1	1.0	125/85	2	2.0
129/86	1	1.0	126/82	1	1.0
130/80	2	2.0	127/81	1	1.0
130/84	1	1.0	129/81	1	1.0
130/85	3	3.0	129/83	1	1.0
130/90	2	2.0	129/84	1	1.0
135/83	1	1.0	130/83	1	1.0
Total	100	100.0	130/84	4	4.0
			131/85	1	1.0
			138/87	1	1.0
			Total	100	100.0

Table 14: Anova Table of Troponin (I, C, T) & BMI (In Non-Fuel Attendants and Fuel Attendants)

	Status	Mean	Std. Deviation	Std. Error Mean	t	Df	Prob.
Troponin I	Non-Fuel Attendants	7.1200	2.94145	.29414	-22.80***	198	.000
	Fuel Attendants	16.8300	3.07829	.30783			
Troponin C	Non-Fuel Attendants	7.3100	3.02747	.30275	-23.685***	198	.000
	Fuel Attendants	16.6900	2.55325	.25533			
Troponin T	Non-Fuel Attendants	7.5600	2.65269	.26527	-26.269***	198	.000
	Fuel Attendants	16.9400	2.39030	.23903			
BMI	Non-Fuel Attendants	28.7040	2.46191	.24619	3.483***	198	.001
	Fuel Attendants	27.3530	2.99702	.29970			

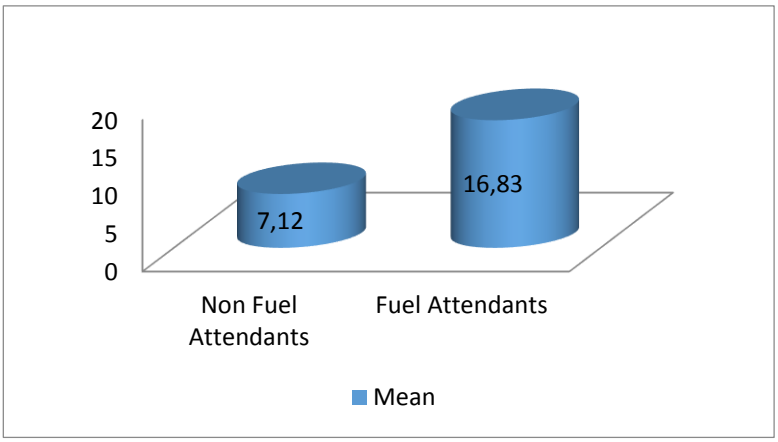

Figure 1: Effects of petrochemicals on Troponin I in Non-Fuel Attendants and Fuel Attendants

Result represented as Mean (SEM): 16.83 ± 3.07. p <0.01 when compared with the subject of Fuel attendants.

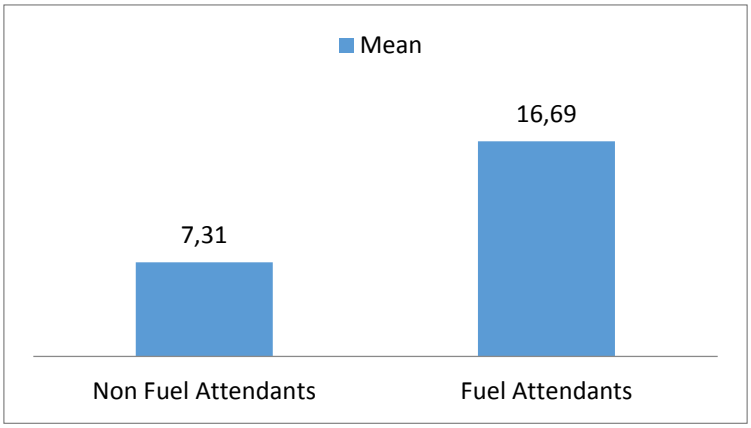

Figure 2: Effects of petrochemicals on Troponin C in Non-Fuel Attendants and Fuel Attendants

Result represented as (SEM): 16.69 ± 2.55. p <0.01 when compared with the subjects of Fuel attendants.

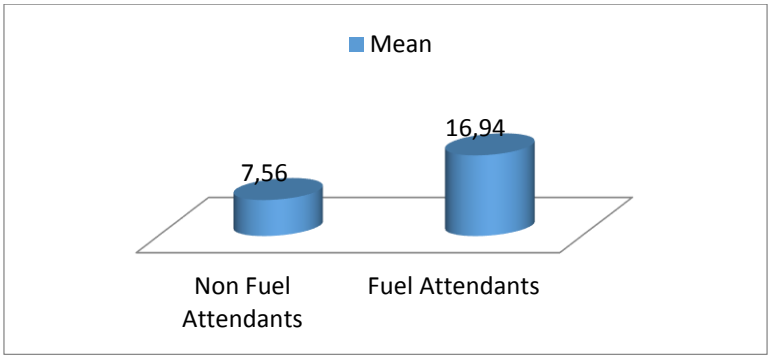

Figure 3: Effects of petrochemicals on Troponin T in Non-Fuel Attendants and Fuel Attendants

Result represented as (SEM): 16.94 ± 2.39. p <0.01 when compared with the subjects of Fuel attendants.

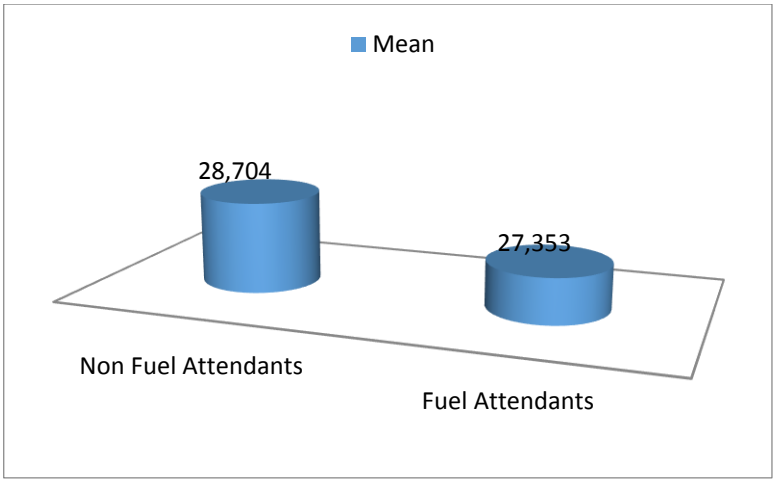

Figure 4: Effects of petrochemicals on BMI in Non-Fuel Attendants and Fuel Attendants

Result represented as (SEM): 27.35 ± 2.99. p <0.05 when compared with the BMI of both subjects.

Table 15: Effects of petrochemicals in the Blood pressure of Fuel attendants and non-Fuel attendants. The cumulative percent is 100%

	Fuel Attendants			Non-Fuel Attendants	
	Frequency	Percent		Frequency	Percent
115/78	1	1.0	115/75	1	1.0
115/79	2	2.0	118/76	1	1.0
115/80	3	3.0	118/78	3	3.0
118/80	3	3.0	118/79	1	1.0
119/78	1	1.0	118/80	2	2.0
119/79	1	1.0	119/78	1	1.0
119/80	1	1.0	119/79	1	1.0
120/78	1	1.0	119/80	2	2.0
120/80	18	18.0	120/80	17	17.0
120/81	5	5.0	120/81	5	5.0
121/75	1	1.0	120/83	1	1.0
121/78	2	2.0	121/80	5	5.0
121/79	2	2.0	121/81	2	2.0
121/80	2	2.0	121/82	3	3.0
121/81	3	3.0	121/83	1	1.0
121/82	1	1.0	122/80	6	6.0
121/83	3	3.0	122/81	1	1.0
122/80	3	3.0	122/82	2	2.0
122/82	2	2.0	122/83	2	2.0
122/83	5	5.0	123/80	9	9.0
122/85	1	1.0	123/81	1	1.0
123/80	4	4.0	123/82	1	1.0
123/84	2	2.0	123/84	4	4.0
124/80	1	1.0	123/85	1	1.0
124/81	2	2.0	124/81	2	2.0
124/82	1	1.0	124/83	2	2.0
125/80	8	8.0	124/84	2	2.0

125/82	4	4.0	125/80	3	3.0
125/85	2	2.0	125/82	2	2.0
126/82	2	2.0	125/83	1	1.0
126/83	2	2.0	125/84	1	1.0
128/84	1	1.0	125/85	2	2.0
129/86	1	1.0	126/82	1	1.0
130/80	2	2.0	127/81	1	1.0
130/84	1	1.0	129/81	1	1.0
130/85	3	3.0	129/83	1	1.0
130/90	2	2.0	129/84	1	1.0
135/83	1	1.0	130/83	1	1.0
Total	100	100.0	130/84	4	4.0
			131/85	1	1.0
			138/87	1	1.0
			Total	100	100.0

Table 16 shows effects of petrochemicals in the Blood pressure of Fuel attendants. The cumulative percent is 100%. Blood pressure from 115/75 – 122/80 systolic and diastolic respectively is 31% while the valid Blood pressure between 122/81-135/83 systolic and diastolic respectively is 69% of the cumulative percent among the fuel attendants. This is statistically significant.

Table 16: Effects of Petrochemicals in the Blood pressure of Fuel attendants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	115/78	1	1.0	1.0	1.0
	115/79	2	2.0	2.0	3.0
	115/80	3	3.0	3.0	6.0
	118/80	3	3.0	3.0	9.0
	119/78	1	1.0	1.0	10.0
	119/79	1	1.0	1.0	11.0
	119/80	1	1.0	1.0	12.0
	120/78	1	1.0	1.0	13.0
	120/80	18	18.0	18.0	31.0
	120/81	5	5.0	5.0	36.0
	121/75	1	1.0	1.0	37.0
	121/78	2	2.0	2.0	39.0
	121/79	2	2.0	2.0	41.0
	121/80	2	2.0	2.0	43.0
	121/81	3	3.0	3.0	46.0
	121/82	1	1.0	1.0	47.0
	121/83	3	3.0	3.0	50.0
	122/80	3	3.0	3.0	53.0
	122/82	2	2.0	2.0	55.0
	122/83	5	5.0	5.0	60.0
	122/85	1	1.0	1.0	61.0
	123/80	4	4.0	4.0	65.0
	123/84	2	2.0	2.0	67.0
	124/80	1	1.0	1.0	68.0
	124/81	2	2.0	2.0	70.0
	124/82	1	1.0	1.0	71.0

125/80	8	8.0	8.0	79.0
125/82	4	4.0	4.0	83.0
125/85	2	2.0	2.0	85.0
126/82	2	2.0	2.0	87.0
126/83	2	2.0	2.0	89.0
128/84	1	1.0	1.0	90.0
129/86	1	1.0	1.0	91.0
130/80	2	2.0	2.0	93.0
130/84	1	1.0	1.0	94.0
130/85	3	3.0	3.0	97.0
130/90	2	2.0	2.0	99.0
135/83	1	1.0	1.0	100.0
Total	100	100.0	100.0	

Discussion

Petrochemical products remain necessary environmental hazards. Their uses cannot be overemphasized; however, exposure to their hydrocarbon constituents poses significant threats to human health. This study documents the effect and possible mechanism of petroleum hydrocarbons on the Cardiac Enzymes Troponin (I, C, T). This Study shows that Cardiac enzymes Troponin I has a Mean Value of 16.83 in Fuel attendants compared to the Mean Value of 7.12 in non-fuel attendants in Oluyole Area, Ibadan. This is statistically significant ($p < 0.01$) with 133%. Several studies have shown associations between levels of cardiac troponin I measured with high-sensitivity assays and the incidence of cardiovascular death, because individuals in these studies are free of acute cardiovascular symptoms as reflected in the completed questionnaire. Therefore, the result of this subject's cardiac troponin I elevation is thought to be reflective of myocardial injury and structural alterations of the myocardium caused by petrochemicals. This is in an agreement with a previous study done by (Magnus *et al*., 2016) who observe the striking elevation of Cardiac troponin I concentration as a result of carbon monoxide

This study shows that Cardiac enzymes Troponin C has a Mean Value of 16.69 in fuel attendants compared to the Mean Value of 7.31 among Non-fuel attendants in Oluyole Area, Ibadan. This is statistically significant ($p < 0.01$) with 114%. The results of this study show elevation of Troponin C among fuel attendants which is observed to be caused by Myocardial damage which involve the activation of petrochemicals by inducing the tissue with Carbon monoxide, hypoxia of nitrogen oxide-mediated cardiomyocyte apoptosis then occur, Moreover, CO-hemoglobin may have a direct toxic effect on the mitochondria, rapidly reducing myocardial oxygen reserve. These impairments in energy metabolism may induce myocardial fiber necrosis and release components of the contractile apparatus, such as Troponin C. Moreover, Toponin C concentrations has excellent diagnostic abilities to detect Risk of Congestive Heart Failure. This is in correlation with a previous study done by (June *et al.*, 2020) who observed the sensitivity of Cardiac Biomarkers in the screening of Myocardial Injury by Carbon monoxide poisoning.

This Study also shows that Cardiac enzymes Troponin T has a Mean Value of 16.94 in fuel attendants to compare the Mean Value of 7.56 in non-fuel attendants in Oluyole Area, Ibadan. This is statistically significant ($p < 0.01$) with 112%. High-sensitivity Troponin T are recognized as diagnostic and prognostic circulating biomarkers of cardiac dysfunction, troponin T increases as a consequence of cardiomyocyte injury and/or necrosis. The results of this studies show elevation of troponin T among fuel attendants which is thoughts to be a reflection of replacement of oxygen by petrochemicals poisoning.

In petrochemicals intoxications, carbon monoxide competes with oxygen and forms carboxy hemoglobin (COHb) with 200 times greater affinity than oxygen. Displacement of oxygen reduces oxygen-carrying capacity. CO also stabilizes the Hb quaternary state and reduces oxygen release and delivery to tissues. However, the toxic effects of CO cannot be explained by this event alone. Due to the increase in the binding of CO to enzymes and proteins (cytochrome P-450 and myoglobin) at the cellular level, the resultant effect is a cellular damage caused by the reduction of energy production in the mitochondria of the cells mainly due to the binding of cytochrome aa3. With these effects occurring in the myocardium, myocardial damage occurs and clinical complications are observed. This is in agreement with a previously study done by (Yusuf, 2021) who observe the Cardiac Biomarker for myocardial damage in acute carbon monoxide poisoning.

The increase in all these Cardiac Troponin among fuel attendants' values corroborates with our previous research on the implication of petrochemical on cardiac enzymes of the heart, the myocardium responds to any injury caused by petrochemicals that causes disruption of its sarcolemmal membrane by releasing cytoplasmic pool of biomarkers such as TROPONINS, myoglobin and creatine kinase (Frantz & Ertl, 2005). These markers are released rapidly, so that blood levels rise above cut off points quickly. This is confirmed to a similar work conducted by Azeez *et al*. (2012) explaining troponin as a biomarker in cardiac injury. Troponin found in blood may not be due to cell death only, it may also result from reversible myocardial injury (Lawal, 2011). Mechanistic studies have shown that necrosis is not essential for cardiac troponin release and that even preload and integrin stimulation both have shown to cause proteolysis and cardiac troponin release (Babuin & Jaffe, 2005).

Body Mass Index constitutes one of the most important independent cardiovascular risk factors, and positive relationships between cardiovascular mortality and BMI has been shown in many large-scale studies. Ideal BMI is in the range of 18.5-24.9 range. Below this range is underweight range, while between 25-29.9 is overweight range and between 30-39 is obesity. At the end of this study, it was observed that both the fuel attendants and the non-fuel attendants falls in normal ideal BMI range (18.5-24-9), mean value for the Fuel attendants is 27.35 compared to Non –fuel attendants which is 28.70 in Oluyole Area, Ibadan. This is statistically significant ($p<0.05$). This finding showed that petrochemicals is positively associated with BMI, with fuel attendants presenting a much higher likelihood of obesity and a lower likelihood of being within a healthy weight range than non-fuel attendants. One plausible explanation for this increasing trend in obesity rates in fuel attendants may be the fact that the fuel attendants lack physical activity. This is because they work almost throughout the day, and get stressed and retired at night. On a very consistent basis, body weight increase seems to be an aftereffect of physical inactivity, indicating that public health efforts to prevent obesity should pay attention to the enhancement of physical exercise and a more active lifestyle among adults. There is significant of petrochemical effect in body mass index (BMI). In this regard, people that are above the BMI and are constantly expose to the petrochemicals are at risk of congestive heart failure especially with elevated blood pressure. BMI is significantly associated to increased risk of hypertension; the risk becomes more increased when exposed to petrochemicals

Blood pressure from 115/75 – 122/80 systolic and diastolic respectively is 31% while the valid Blood pressure between 122/81-135/83 systolic and diastolic respectively is 69% of the cumulative percent among the fuel attendants. These results showed that Petrochemical exposure is significantly correlated with elevated blood pressure. It was reported that systolic and diastolic BP is higher in older people who are fuels attendants. Another study showed that the prevalence of hypertension increases with increasing age even in non-fuel attendants. This study showed that inhalation of petroleum products led to significant rise in arterial blood pressure. This is consistent with a study by Azeez *et al.* (2012) and coroborates previous studies

that documented the pressor effect of petroleum hydrocarbon (Mills, 2005). This is due to the ability of petroleum hydrocarbon to enhance the sensitization of myocardium to catecholamines, impair vagal activity (Mills, 2005), and increased baroreceptor activity with resultant vasoconstriction and increased arterial blood pressure (Azeez *et al.*, 2012).

The exact mechanisms by which chemicals produce cardiotoxicity are poorly understood, but there are two possible mechanisms of action that could explain the cardiotoxic effects of chemicals (Greaves, 2000). The first is vasospasm, similar to the effect of catecholamines, that compromise myocardial perfusion leading to localized ischemia with degeneration and necrosis of the downstream myocardium. Chemicals having vasoactive properties could led to increased responsiveness to norepinephrine, predisposition of coronary arteries to thrombus formation, and production of coronary artery vasospasm, each of which could impair blood flow leading to localized ischemia (Greaves, 2000). The second mechanism which causes direct cardiomyocyte damage, such as that caused by anthracyclines (e.g., doxorubicin), by damaging cardiomyocyte cellular components. This may result in disruption of mitochondrial oxidative phosphorylation, alteration of cell and organelle membranes, disruption of ion homeostasis, or disruption of critical biological molecules or pathways either directly or through formation of toxic metabolites or free radicals, and disruption of normal intracellular ion levels (Jokinen *et al.*, 2011).

Conclusion

This study shows that exposure to petrochemicals can cause biochemical changes in the heart leading to the release of enzymes into the blood stream which serve as biomarker tools for the diagnosis of the risk of cardiovascular diseases such as congestive heart failure. Other petrochemical effect includes elevated blood pressure. Fuel attendants should be screened for heart related diagnosis before employed, this will reduce the risk of employing an attendant with heart related disease leading to heart failure. Timely, regular medical checkup should be done while working as a fuel attendant and it is also achievable to create time in having physical exercise which reduces the risk of being above the BMI which consistently reduces the risk of heart related disease.

Conflict of Interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and the writing of the paper.

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Authors' Contributions

The entire study procedure was conducted with the involvement of all authors.

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