Global Journal of Medical Research: K
Interdisciplinary
Volume 19 Issue 6 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

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Abstract- Welding is a blending process that involves the joining together of metals or thermoplastics. This study was aimed at assessing the status of selected biochemical parameters and hormonal profile in plasma of some roadside welders within the age range of 35-45 years who had welded with ≥20 welding rods/day for a duration of≤10 years (experimental group one) and≥11years (experimental group two) respectively. Five ml blood specimen was withdrawn from each of the ninety apparently healthy recruited volunteers who were categorized as control group (n=30), experimental group one (n=30) and experimental group two (n=30). The plasma obtained was used for the quantitative measurement of alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, C- reactive protein, urea, creatinine, luteinizing hormone, follicle stimulating hormone, prolactin and testosterone. The results showed no significant alterations in the mean values (p≥0.05) of all the measured biochemical and hormonal profile status in experimental group one volunteers as against that of the control group.

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GJMR-K Classification: *NLMC Code: QU 35*

Strictly as per the compliance and regulations of:

Studies on Selected Biochemical and Hormonal Profile Status in Plasma of Some Roadside Welders in Ajegunle, Nigeria

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Abstract- Welding is a blending process that involves the joining together of metals or thermoplastics. This study was aimed at assessing the status of selected biochemical parameters and hormonal profile in plasma of some roadside welders within the age range of 35-45 years who had welded with ≥20 welding rods/day for a duration of ≤10 years (experimental group one) and ≥11years (experimental group two) respectively. Five ml blood specimen was withdrawn from each of the ninety apparently healthy recruited volunteers who were categorized as control group (n=30), experimental group one (n=30) and experimental group two (n=30). The plasma obtained was used for the quantitative measurement of alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, C- reactive protein, urea, creatinine, luteinizing hormone, follicle stimulating hormone, prolactin and testosterone. The results showed no significant alterations in the mean values (p≥0.05) of all the measured biochemical and hormonal profile status in experimental group one volunteers as against that of the control group. However, in experimental group two volunteers only alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, C-reactive protein, urea, creatinine and testosterone were significantly altered (p ≤0.05) against that of the control group while other parameters were not altered. In conclusion, welding with ≥20 welding rods/day for ≥11 years duration may pose danger to roadside welders in the studied community. Gross neglect of safety precautions may be contributory to this danger. It is therefore recommended that roadside welders should comply with safety precautions and go for regular medical check- up.

Keywords: roadside welders, biochemical parameters, hormonal profile status, ajegunle, nigeria.

I. Introduction

Welding is an old profession which applies the joining of metals or thermoplastics through construction process, thus resulting into blending. As reported by an ancient Greek historian Herodotus, this profession which was invented by Glaucus of Chios has been in practice for so many millennia dated back with the use of bronze and iron as earliest examples in Europe and Middle East (1), followed by the emergence of "short pulse" electrical arc welding by Sir Humphry Davy in 1800, (2, 3, 4), which was later followed by the emergence of continuous electric arc welding in 1802 by a Russian Scientist, Vasily Petrov (4,5).

Apart from being indecent, welding is a very dangerous occupation that requires strict compliance to the necessary precautions so as to prevent its harmful effects. Exposure to gases such as ozone, carbon dioxide and fumes that contain heavy metals may pose danger to the health status of welders that are inexperienced. For example exposure to manganese fumes generated from welding even at levels as low as < 0.2mg/m^3 may cause health problems such as neurological and/or damage to liver, kidneys, central nervous system and the lungs in particular where nano particles are easily trapped in the alveolar macrophages thus inducing pulmonary fibrosis (6,7).

This study which is aimed at assessing the alterations of selected plasma biochemical parameters and hormonal profile status in some roadside welders in Ajegunle, Nigeria who had welded with ≥20 welding rods/day for a duration of ≤10 years and ≥11 respectively was embarked upon taking into consideration the danger posed by exposure to gases and fumes generated from welding rods as well as the gross non compliance to safety precautions by most of these roadside welders.

II. Materials and Methods

Ninety apparently healthy male subjects categorized into three (3) groups as shown were randomly recruited for this research work: Control group: This group consisted of thirty (30) apparently healthy male volunteers within the age range of 35-45 years who by virtue of their profession are white collar workers. Experimental group one: This group consisted of thirty (30) apparently healthy male volunteers who are roadside welders and by virtue of their profession had welded with ≥20 welding rods/day for a duration of ≤10 years and are within the age range of 35-45 years. Experimental group two: This group consisted of thirty (30) apparently healthy male volunteers who are

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roadside welders and by virtue of their profession had welded with ≥20 welding rods/day for a duration of ≥11 years and are within the age range of 35-45 years. As at the time of carrying out this research work all the recruited volunteers in both the control and experimental groups were free from any ailment(s), Besides, they were not addicted to cigarette smoking, snuffing, drugs and coffee abuse thus ruling out the likely effects of these lifestyle variables on the obtained results. All the collected data from the recruited volunteers were through well structured questionnaire.

The procedure used for this research was strictly in compliance with the principles of Helsinki declaration of 1975 as revised in 2008. Approval was obtained from all the recruited volunteers who were informed and made to know the reason for which their blood specimens were being collected. Furthermore, permission was obtained from employers of the recruited volunteers in the experimental groups: Oluwafemi Welding and Construction Industry, Oluwasegun Welding and Construction Industry and Adegoke Welding and Construction Industry all in Ajegunle, Lagos State, Nigeria before their blood specimens were collected.

After this process, five ml blood specimen was withdrawn from each of the recruited volunteers (control and experimental groups) via a standard venipuncture technique and dispensed into lithium heparinized anticoagulated bottles respectively. The specimen in each bottle was mixed carefully so as to ensure homogenicity and prevention of blood clot, and thereafter spun for 10minutes at 1,500 revolution/minute using Gulfex Medical and Scientific macro centrifuge model 800D England.

The obtained plasma was subsequently used for the quantitative measurement of biochemical parameters and hormonal profile status. The absorbance of the following biochemical parameters were quantitatively measured with S23A13192 model spectrophotometer: alanine aminotransferase (ALT) as described in the manual of 11th February, 2009 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County, Antrim, BT294QY, United Kingdom in accordance with the colorimetric method of (8,9), aspartate aminotransferase (AST) as described in the manual of 5th January, 2007 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County, Antrim, BT294QY, United Kingdom in accordance with the colorimetric method of (10,11), alkaline phosphatase (ALP) as described in the manual of September, 2001, A506 edition of Teco Diagnostics, 1268N, Lakeview Avenue, Anaheim, CA92807, 1-800-222-9880 in accordance with the colorimetric endpoint method of (12), C-reactive protein (Crp) as described in the manual of Spin-react Diagnostic, Spain in accordance with the latex turbidimetry method of (13,14), urea, as described in the manual of 7th January, 2011 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County, Antrim, BT294QY, United Kingdom in accordance with the urease Berthelot method of (15-18) and creatinine, as previously described by Jaffe in 1886 and revised on the 15th September, 2010 by Randox Laboratories Limited, 55, Diamond Road, Crumlin, County, Antrim, BT294QY, United Kingdom in accordance with the Jaffe reaction method of (19, 20). The absorbance of the following hormonal profile status were quantitatively measured with plate reader MR DYNEX Technologies Inc 14340 Sullyfield Circle, Chantilly, VA , 20151-1621 USA with serial number IMRA-2676 using the specified methods: luteinizing hormone, as described in the manual of May, 2008 revised edition of Diagnostic Automation Inc Microwell enzyme immunoassay test kit catalog No 4225 in accordance with the colorimetric method of (21), follicle stimulating hormone, as described in the manual of 4th February, 2003, revised edition of enzyme immunoassay test kit catalog No BC-1029, Biocheck Inc, 323, Vintage Park, Dr Foster City, USA, CA 94404 in accordance with the colorimetric method of (22), prolactin, as described in the manual of 27th June, 2003 revised edition of enzyme immunoassay test kit catalog No: PROL-96 in accordance with the colorimetric method of (23), and testosterone, as described in the manual of PI EL-198 revision 6: 02/2009 of Immunospec Corporation, 7018 Owensmouth Ave. Suite 103, Canoga Park, CA 91303. REF. EI-198 in accordance with the colorimetric method of (24).

Statistical analysis

The data obtained from the recruited volunteers (control and experimental groups) via well structured questionnaire were analyzed using descriptive statistic of frequency and percentage while the results obtained from the quantitative measurement of their plasma biochemical parameters and hormonal profile status were expressed as mean and standard deviation with the differences between the control and experimental groups assessed using the student's" t" tests, which were considered statistically significant at $p \leq 0.05$

III. Results and Discussion

Welding fumes are harmful metal fumes that are generated in the course of welding. The harmful effects of these fumes coupled with gross non compliance with safety measures by majority of roadside welders in the studied community have become a burden that demands swift attention. In furtherance to increase knowledge on these harmful effects, data on compliance with safety measures while working were obtained from the recruited volunteers in experimental groups one and two via well structured questionnaire as shown in Table 1.

The data revealed that 80% of these volunteers are non compliant with the use of leather hand gloves and particles masks safety measures respectively while 90% and 100% are non compliant with the use of long sleeve jackets and helmets with dark ultra violet filtering face plate safety measures respectively. However, the results went further to show that 100% of the volunteers are compliant with the use of goggles as a safety measure. These findings as established in this study may easily permit the dangers posed by fumes and gases generated from these welding rods on the roadside welders in the studied community taking into consideration the high percentage rate of non compliance with these welding safety measures which may however, be attributed to the non provision of these safety gadgets by the management of the roadside welding and construction industries or gross neglect of usage by the roadside welders.

In this study the mean values of biochemical parameters in plasma of the control group were also compared with that of the experimental group one as shown in Table 2. The results revealed no significant alterations ($p \geq 0.05$) in the mean values of all the measured plasma biochemical parameters as against that of the control group. This finding which is established in this study is suggestive that welding with ≥20welding rods/day for a duration of ≤10 years may not pose danger to the health status of roadside welders in the studied community.

In this study the mean values of hormonal profile status in plasma of the control group were also compared with that of the experimental group one as shown in Table 3. The results revealed no significant alterations ($p \geq 0.05$) in the mean values of all the measured plasma hormonal profile status as against that of the control group. This finding which is established in this study may be suggestive that welding with ≥20 welding rods/day for a duration of ≤10 years does not alter hormonal profile status thus may not pose danger to the health status of roadside welders in the studied community.

In this study the mean values of biochemical parameters in plasma of the control group were also compared with that of the experimental group two as shown in Table 4. The results revealed significant elevations ($p \leq 0.05$) in the mean values of plasma alanine aminotransferase (ALT), plasma aspartate aminotransferase (AST) and plasma alkaline phosphatase (ALP) as against that of the control group. This finding as established in this study is presumed to be linked with liver injury caused by the inhalation of heavy metal such as manganese which is generated from the fumes of ≥20 welding rods/day used for welding for a duration of ≥11 years by these roadside welders thus resulting in the release of these enzymes from the liver into the plasma.

The mean value of C-reactive protein in plasma of the recruited volunteers in experimental group two as shown in Table 4 revealed significant elevation ($p \leq 0.05$) as against that of the control group. This finding which is established in the study and in conformity with the previous work of (25) is suggestive of inflammatory disorder which may be due to the exposure and inhalation of gases and fumes generated from the use of ≥20 welding rods/day for a duration of ≥11 years by the roadside welders with the resultant release of interleukin 6 as well as cytokines that are capable of triggering the synthesis of C-reactive protein via the liver.

The mean values of urea and creatinine in plasma of the recruited volunteers in experimental group two as shown in Table 4 revealed significant elevations ($p \leq 0.05$) as against that of the control group. This finding which is established in the present study may be suggestive of renal impairment caused by the inhalation of heavy metals such as manganese, cadmium etc which are produced from the fumes of ≥20 welding rods/day used for welding for a duration of ≥11 years by the roadside welders.

In this study the mean values of hormonal profile status in plasma of the control group were also compared with that of the experimental group two as shown in Table 5. The mean value of testosterone in plasma of the recruited volunteers revealed significant decrease ($p \leq 0.05$) as against that of the control group. This finding as established in the present study may be linked to the exposure and inhalation of heavy metals and gases generated from fumes of the ≥20 welding rods/day used for welding for a duration of ≥11 years by these roadside welders which could be inhibitory to spermatogenesis thus putting them at infertility risk. However, none of the recruited volunteers in this experimental group had significant mean values alterations ($p \geq 0.05$) of plasma luteinizing hormone, plasma follicle stimulating hormone and plasma prolactin as against that of the control group. The reasons for this are not clearly understood, thus further research is suggested.

Table 6 shows the percentage of volunteers in both experimental groups one and two with abnormal values as compared to the reference ranges for the measured parameters. As revealed in the Table, 7% of the volunteers in experimental group one had significant elevations of plasma alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, urea and creatinine respectively as against 50% of the volunteers in experimental group two respectively. This finding which is established in the present study is further suggestive that 50% of roadside welders in the studied community who had used ≥20 welding rods/day for welding over a duration of ≥11 years are prone to risks of hepato-renal disorder due to the longtime bioaccumulation of cadmium, manganese etc

which are toxic heavy metals generated from the fumes of welding rods as against 7% of those who had used ≥20 welding rods/day for welding over a duration of ≤10 year.

Also revealed in this study, 13% of volunteers in experimental group one had significant elevation of plasma C-reactive protein as against 67% in the experimental group two. This finding as established in the present study may as well be suggestive of inflammatory disorder which may be due to the bioaccumulation of toxic heavy metals over the duration of ≥11 years use of ≥20 welding rods/day which has thus yielded the release of interleukin 6 and cytokines that are capable of triggering the synthesis of C-reactive protein via the liver.

In this study, 13% decrease in the plasma value of testosterone in experimental group one volunteers was revealed as against 60% decrease in the plasma value of testosterone in experimental group two volunteers. It is further shown from this study that exposure to fumes and gases generated from the use of ≥20 welding rods/day for a duration of ≥11 years may put roadside welders in the studied community at the risk of oligospermia.

IV. Conclusion

In conclusion, this present study has established that chronic inhalation of gases and fumes generated during the course of using ≥20 welding rods/day for a duration of ≤10 years coupled with gross non compliance with safety measures appear not to have any significant toxic effects on the roadside welders in the studied community. However, chronic inhalation of gases and fumes generated during the course of using ≥20 welding rods/d ay for a duration of ≥11 years coupled with gross non compliance with safety measures may put 50% of roadside welders in the studied community at risks of liver and renal disorders respectively while 67% and 60% may be put at the risk of inflammatory and fertility disorders respectively.

V. Recommendations

(i) Management of roadside welding and construction industries should include health education in their apprenticeship programme so as to enlighten trainee welders and qualified roadside welders on the importance of adhering strictly to safety measures while working.

(ii) Safety gadgets should not only be provided by management of roadside welding and construction industries, but usage by welders and trainee welders while at work should be enforced.

(iii) Management of roadside welding and construction industries should register with reputable medical facilities so as to enable her members of staff go for routine medical check-up.

Acknowledgements

We humbly acknowledge Messrs Femi Adewunmi and Kayode Rotimi for linking us with the recruited volunteers (control and experimental groups). We are grateful to the volunteers for accepting to be used for this research.

Lastly our warm appreciation goes to the management of Oluwafemi Welding and Construction Industry, Oluwasegun Welding and Construction Industry and Adegoke Welding and Construction Industry all in Ajegunle, Lagos State, Nigeria for granting us the permission to use their members of staff (welders) as the experimental groups for this research.

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Table 1: Compliance with safety measures by volunteers in experimental groups one and two while working

Variables	Response of volunteers	Frequency (n=60)	Percentage
Use of leather hand gloves	YES NO	I2 48	20 80
Use of particles mask	YES NO	12 48	20 80
Use of long sleeve jackets	YES NO	6 54	10 90
Use of goggles	YES NO	60 0	100 0
Use of helmets with dark ultra violet filtering face plate	YES NO	0 60	0 100

Key:
n= number of volunteers in both experimental groups one and two

Table 2: The plasma values of biochemical parameters measured in the control group compared with the experimental group one

Parameters	Control Group (n=30)	Experimental Group (n=30)	Remark
ALT (U/l)	9.50 ± 1.04	9.52 ± 1.05	NS
AST (U/l)	8.92 ± 0.95	8.95 ± 0.97	NS
ALP (UI/L)	12.10 ± 1.78	12.13 ± 1.79	NS
CRP (mg/L)	4.00 ± 0.18	4.02 ± 0.20	NS
Urea (mmol/L)	9.50 ± 1.04	9.53 ± 1.05	NS
Creatinine(μmol/l)	8.92 ± 0.95	8.95 ± 0.97	NS

Keys:
Values are in mean ± SD
NS= not significant
ALT = alanine aminotranferase
AST = aspartate aminotransferase
ALP = alkaline phosphatase
CRP = C-reactive protein

Table 3: The plasma values of hormonal profile status measured in the control group compared with the experimental group one

Parameters	Control Group(n=30)	Exp Group(n=30)	Remark
LH(mIU/ml)	7.10 ± 0.77	7.11± 0.78	NS
FSH(mIU/ml)	3.20 ± 1.02	3.22 ± 1.05	NS
PROL(ng/ml)	3.05 ± 0.98	3.08 ± 1.02	NS
TESTO(ng/ml)	5.32 ± 1.35	5.30 ± 1.32	NS

Keys:
Values are in mean ± SD
NS= not significant
Exp Group=Experimental Group
n=number of volunteers
LH = luteinizing hormone
FSH = follicle stimulating hormone
PROL = prolactin
TESTO = testosterone

Table 4: The plasma values of biochemical parameters measured in the control group compared with the experimental group two

Parameters	Control Group (n=30)	Experimental Group (n=30)	Remark
ALT (U/l)	9.50 ± 1.04	18.00 ± 2.02	S
AST (U/l)	8.92 ± 0.95	16.00 ± 1.84	S
ALP (UI/L)	12.10 ± 1.78	47.10 ± 3.79	S
CRP (mg/L)	4.00 ± 0.18	13.52 ± 2.02	S
Urea (mmol/L)	9.50 ± 1.04	18.74 ± 2.05	S
Creatinine(μmol/l)	8.92 ± 0.95	16.95 ± 1.97	S

Keys:
Values are in mean ± SD
S= significant
n= number of volunteers
ALT = alanine aminotranferase
AST = aspartate aminotransferase
ALP = alkaline phosphatase
CRP = C-reactive protein

Table 5: The plasma values of hormonal profile status measured in the control group compared with the experimental group two

Parameters	Control Group(n=30)	Exp Group(n=30)	Remark
LH (mIU/ml)	7.10 ± 0.77	7.12± 0.80	NS
FSH(mIU/ml)	3.20 ± 1.02	3.22 ± 1.05	NS
PROL(ng/ml)	3.05 ± 0.98	3.07 ± 1.00	NS
TESTO(ng/ml)	5.32 ± 1.35	2.10 ± 0.78	S

Keys:
Values are in mean ± SD
NS= not significant
S=significant
Exp Group=experimental Group
n=number of volunteers
LH = luteinizing hormone
FSH = follicle stimulating hormone
PROL = prolactin
TESTO = testosterone

Table 6: Percentage of volunteers in experimental groups one and two with abnormal values compared to the reference ranges for the parameters measured

Parameters	Exp Group 1 (n=30)	Percentage	Exp Group 2 (n=30)	Percentage
ALT (U/l)	*2	7	*15	50
AST (U/l)	*2	7	*15	50
ALP(IU/L)	*2	7	*15	50
CRP (mg/L)	*4	13	*20	67
Urea(mmol/L)	*2	7	*15	50
Creatinine(μmol/l)	*2	7	*15	50
LH(mlU/ml)	0	0	0	0
FSH(mlU/ml)	0	0	0	0
Prolactin(ng/ml)	0	0	0	0
Testosterone(ng/ml)	**4	13	**18	60

Keys:
n = number of volunteers
Exp Group = experimental group
**= number of volunteers with values greater than the maximum reference ranges for the parameters measured*
***= number of volunteers with value lesser than the minimum reference range for the parameter measured*
ALT = alanine aminotranferase
AST = aspartate aminotransferase
ALP = alkaline phosphatase
CRP = C-reactive protein
LH = luteinizing hormone
FSH = follicle stimulating hormone
PROL= prolactin
TESTO = testosterone