ASSESSMENT OF SOME BIOCHEMICAL PARAMETERS AMONG SMOKERS

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ABSTRACT
This study was designed to evaluate the serum levels of creatinine, urea and activities of Alkaline phosphatase (ALP), Gamma glutamyl transferase (GGT), Creatine kinase (CK) and Lactate dehydrogenase (LDH) among cigarette smokers in Ekpoma, Edo State. This study employed a total of 80 subjects consisting of 50 cigarette smokers and 30 non cigarette smokers which served as the control. All laboratory analysis was carried out using Randox kit assay system. Creatinine values among cigarette smokers (0.81 ± 0.11mg/dl) were significantly higher (P<0.05) when compared with the control (0.73 ± 0.10 mg/dl). Similarly, serum urea levels among cigarette smokers (20.60 ± 1.58mg/dl) were also found to be significantly higher (P<0.05) than the control (17.82 ± 0.49 mg/dl). Comparatively, activities of both ALP (23.80 ± 2.70U/L) and GGT (32.43 ± 2.46U/L) in cigarette smokers were significantly higher (P<0.05) when compared with their respective controls (19.54 ± 1.30 U/L and 23.50 ± 1.60U/L). It was also observed in this study that the levels of these parameters were significantly higher as age increases. Also, activities of CK was significantly higher (p<0.05) among cigarette smokers (173.03±47.31 U/L) when compared with the control (149.10±59.98 U/L). The activities of LDH were significantly higher among cigarette smokers (373.55 ± 119.11 U/L) when compared with the control (302.62 ± 93.80 U/L). Similarly there was a significant alteration when ALP, GGT, CK, LDH, creatinine, Urea were compared with exposure to cigarette smoking. Therefore, this study showed that the serum biochemical parameters investigated were significantly affected by smoking.

KEYWORDS: Smokers, Cigarette, Biochemical, Creatinine, Urea.

INTRODUCTION
Smoking refers to the inhalation and exhalation of fumes from burning cigarette in cigars, cigarettes and pipes. Historically, smoking as a practice, was followed by natives of the Western Hemisphere, in religious rituals and for medicinal purposes (Whitehead et al., 1996). Smokers are defined as persons who smoke at least 100 cigarettes during their lifetime and who, at the time of interview, reported smoking every day or some days. Regular smoking is to be understood as daily smoking, even if only small amounts of cigarette are involved (Perkins and Leone, 2004). According to the recommendations of the World Health Organization (WHO), A heavy smoker is defined as a smoker with a daily cigarettes consumption of more than 20 pieces. The age at start of smoking is the age, in which regular smoking began for the first time (Perkins and Leone, 2004).

For years man has used drugs for recreational purposes as long as history itself. Arabic traders smoked opium in the 3rd century BC, and the Aztecs enjoyed the effects of hallucinogenic mushrooms at a similar time. In the last 30 years, the number of people using recreational drugs and other addictives appears to have increased (Strang, 1995). There are numerous medical consequences to recreational drug use, and this has resulted to high death rate. By 1997, 25% of the population reported using illicit drugs and other addictives at some point in their lives (Crowe et al., 2000). These substances have different wide health implications ranging from acute to chronic state. Heroin which can be sniffed, eaten, smoked, injected subcutaneously or intravenously have several renal complications from its abuse, pressure induced muscle damage and rhabdomyolysis (Crowe et al., 2000). The health consequences of smoking cannot be overemphasized which has led to many complications such as cardiovascular disease, lung, kidney, and liver cancer.

Smoking is a global public health problem associated with excessive morbidity and mortality (Stavridis, 2008).
Smoking caused 4.84 million premature deaths. According to World Health Organization (WHO) survey, 3.83 million male death and 1.0 million female deaths are associated with smoking. Cigarette smoke contains over 4000 compounds, including at least 200 toxicants, 80 known or suspected carcinogens, large quantities of oxidants and free radicals that induce oxidative stress (de Heens et al., 2009). Moreover, cigarette smoking generates many toxic and carcinogenic compounds harmful to the health, such as nicotine, nitrogen oxides, carbon monoxide, hydrogen cyanide and free radicals (Hoffmann et al., 2001). Worldwide cigarette-attributable deaths were 4.83 million in 2000, projected to reach 6.4 million in 2015 and 8.3 million in 2030. Worldwide, out of 300 million young people who are smokers, 150 million will die of smoking related causes later in life. In the low and middle income countries, such deaths are projected to increase from 3.4 million to 6.8 million between 2002 and 2030 (Makwana et al., 2007). Considering these facts, it is therefore important to evaluate some selected biochemical parameters (Creatinine, Urea, ALP; GGT, CK and LDH) among smokers.

MATERIALS AND METHODS

Area of Study

This study was carried out in Ekpoma, the Headquarter of Esan West Local Government area of Edo State. It is located at latitude 6° 45’N and longitude 6° 08’E. It is moderately populated with the peoples’ occupation being farming and trading. The main sources of water in the locality are rainfall and well. The well is augmented by irrigation scheme provided by the Government for public use. University is situated in this region. It is usually cold at night and very hot during the day. It also has undulating topography (World Gazetteer, 2007).

Selection of Subjects

A total of Fifty (50) smokers were selected for this study after verbal informed consent was sought and thirty (30) apparently healthy non-smokers were also included in the study to serve as control. All the subjects recruited for this study were males and they have been smoking at least a stick of cigarette per day for the past six months.

Sample Collection

5ml of blood from the ante-cubital vein was collected from subjects (Smokers and Non-smokers). The samples were transferred into sterile non anti-coagulant sample containers (plain containers). The blood samples were allowed to stand for an hour to clot and then centrifuged with laboratory centrifuge. The serum was collected and analyzed for urea, creatinine, and activities of ALP, GGT, CK and LDH.

Sample Analysis

Creatinine was estimated using the modified alkaline picrate method. Urease- Berthelot method was employed for the estimation of urea. The ALP activity in the sample was determined using the Deutsche method described by Rec, (1972). The GGT activity in the sample was determined using the method described by Szasz, (1969). The activity of CK and LDH in the sample was determined using the method described by Rec, (1977).

Statistical Analysis

The results obtained were subjected to statistical analysis using SPSS (version 21). The test groups’ values were compared with the values of the control group using ANOVA (LSD) and Student’s t-test at 95% level of confidence. The mean and standard deviation (SD) were also calculated in each case.

RESULTS

The mean and standard deviation obtained for creatinine in cigarette smokers are 0.81± 0.11 mg/dl while that of the control is 0.73 ± 0.10 mg/dl; and when compared statistically, there was a significant difference (P<0.05) between the values obtained. Also there was a significant difference (P≤ 0.05) when the levels of serum urea in cigarette smokers (20.60 ± 1.58mg/dl) were compared with that of the control (17.82 ± 0.49mg/dl). Furthermore, the mean and standard deviation obtained for Alkaline phosphatase among cigarette smokers and control are 23.80±2.70 U/L and 19.54±1.30 U/L respectively. When compared statistically there was a significant difference (P≤ 0.05) between values obtained. Similarly, there was a significant difference (P≤ 0.05) when the activities of serum GGT in cigarette smokers (32.43±2.46 U/L) were compared with that of the control (23.50 ± 1.60 U/L). Also, the activities of CK was significantly higher (p<0.05) among cigarette smokers (73.03±7.31 U/L) when compared with the control (49.10±59.98 U/L). The activities of LDH were significantly higher among cigarette smokers (37.55 ± 19.11 U/L) when compared with the control (20.60 ± 19.80 U/L) (Table 1).

The comparison of age related differences of serum creatinine, urea and activities of ALP, GGT, CK and LDH was also evaluated. The results showed that the biomedical parameters (creatinine, urea, GGT and ALP) were significantly different (p<0.05) within the age ranges while CK and LDH were not significantly different (P>0.05) (Table 2).

Furthermore, biochemical parameters were also evaluated in relation to cigarette smoking per day. The results showed significant differences in the parameters (Table 3).
The liver is the central organ in the metabolism and detoxification of drugs and toxins. Consequently, drugs affect the liver more frequently than any other organ and place the liver at great risk for toxic damage (Bussieres and Habra, 1995). Liver Enzymes are well known enzymes used as biomarkers to predict possible toxicity to the liver (Gray and Howorth, 1982; Rahman et al., 2001). Generally, alterations and disruptions to the liver cells result in elevations of both liver enzymes in the serum. Furthermore, measurement of enzymatic activities of ALP and GGT is of clinical and toxicological importance as alterations in their activities are indicative of liver damage. The observed increase in the activities of serum ALP and GGT in smokers may be an indication of liver dysfunction. This dysfunction may be mainly due to leakage of these enzymes into the bloodstream, which gives an indication on the hepatotoxic effect of smoking. The elevated levels of alkaline phosphatase (ALP) as observed in this present study may be an indication of either liver problem or bone disease, since the two main sources of ALP are liver and bone. The high values of the activities of ALP and GGT may be an indication of either liver problem or bone disease.

DISCUSSION

This study was designed to evaluate serum levels of creatinine and urea; and activities of ALP, GGT, CK and LDH among cigarette smokers. However, serum levels of creatinine and urea are used as diagnostic tool for renal function while the activities of ALP and GGT can be used to monitor liver function. More importantly is the fact that serum levels of AST and ALT are also used for liver function assessment.

In this study, serum levels of ALP and GGT in smokers was determined and compared with non-smokers which served as the control. It was observed that smoking induced changes in the serum levels of these parameters. The levels of serum ALP and GGT activities were higher in smokers when compared to non-smokers.

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The result obtained in this study supports earlier studies by Nishimura and Tescke, (1982) where smoking increased the activities of ALP and GGT in the serum. They reported that activities of ALP and GGT were altered by smoking, chronic alcoholism, coffee or tea drinkers. However, this finding is in disagreement with the observations of Tanaka et al., (1998); which demonstrated the inverse relation between smoking, coffee or green tea drinking with serum GGT.
Also, elevated parathyroid hormone causes increased bone turnover resulting in higher serum alkaline phosphatase levels (Fauci et al., 2008; Banihosseini et al., 2013). Similar findings had been reported in a cohort study which found higher level of parathyroid hormone in the smokers than non-smokers (Szulc et al., 2002).

Also, the kidney is an organ with several functions and essential roles in most animals and they serve as the body’s natural filter of blood by removing metabolic by-products and wastes (Guyton and Hall, 2006; Sembuligam and Sembuligam, 2006). Therefore the serum levels of creatinine and urea reflects the function of the kidney. In this study serum levels of creatinine and urea were significantly higher in smokers when compared with control (Non smokers). This reflects nephrotoxic potential of smoking. Elevated levels of creatinine could be due to factors that decrease glomerular filtration rate such as pyelonephritis (Cheesbrough, 2000). Furthermore, the three general causes of a raised plasma urea concentration are decreased glomerular filtration rate, an increased load of urea for excretion (from the diet or tissue metabolism), and an increased tubular reabsorption of urea. The plasma creatinine concentration is only when glomerular filtration is low. The result however is in agreement with the study of Sravan et al., (2012). He reported a significant increase in serum creatinine and urea among smokers. This implies loss of renal function. Also, a recent study indicated that Lead (Pb)-linked glomerular dysfunction was observed in smokers, possibly due to more recent exposure to high levels of Pb, as reflected by 30-50 per cent higher serum cadmium (Cd) and Pb levels in smokers than nonsmokers (Saturag et al., 2004).

Furthermore, this study presented results on the age differences among smokers. It was observed in this study that serum creatinine values and activities of ALP increased significantly among the age group 31-40 years and 41 to 50 years. Comparing levels of serum urea and activities of GGT within the age groups 20-30 years, 31 - 40 years and 41-50 years, it was observed that there was significant difference within the age ranges. But however, activities of serum GGT were significantly higher when all the age ranges are compared. It is important to note that serum creatinine, urea, activities of ALP and GGT increased progressively as the age ranges increase. This suggests that the parameters have a positive relationship with age. This report is in line with the study of Gourlay and Benowitz, (1996); Messina et al., 1997; Molander et al., (2001) and Hezode et al., (2012).

Myocardium contains an abundant concentration of many enzymes such as AST, CK and LDH and once it is metabolically damaged, it releases its contents into the extracellular fluid (Sharma et al., 2001). The observed increase in the activities of serum creatine kinase and lactate dehydrogenase in smokers may be an indication that smoking has an effect on heart function; although that both creatine kinase and lactate dehydrogenase are also distributed in other parts of the body. This dysfunction may be mainly due to leakage of these enzymes into the blood stream, which gives an indication on the cardiovascular effect of smoking. The result of this study agrees with the work of Abdulrahman et al., (2008) (2010) which studied the effect of fire smoke on some biochemical parameters in firefighters of Saudi Arabia. They also reported that the observed increase could be attributed to the constituents of smoke Furthermore any elevated CK result is automatically reflexes to a myocardial infarction and muscle diseases. Creatine kinase may also be elevated following muscle injury or strenuous exercise (Roy et al., 2003). In this study, CK was statistically significantly increased in smokers as compared to normal control group. In a single case study, Cabaniss, (1990); reported that creatine kinase level was raised to a maximum of 3,277 U/L (normal, < 100 U/L) in a 39 years old cigarette smoking fireman.

Additionally, creatine kinase could also be elevated considering the fact the smoking also affects the lungs. Cigarette smoke induces damage to proteins and organelles by oxidative stress, resulting in accelerated epithelial cell senescence in the lung, which is implicated in chronic obstructive pulmonary disease (COPD) pathogenesis (Hara et al., 2011). This elevates isozymes, brain-type CK (CKB) which is the predominant CK in lung tissue (Hara et al., 2011).

Lactate dehydrogenase is most often measured to evaluate the presence of tissue or cell damage (Hosten, 1990). In the present study, lactate dehydrogenase was statistically significantly elevated in smokers as compared to normal control group. This report is in line with the study of Penney and Maziarka, (1976) which also found that there was a significant elevation in LDH activity post exposure to fire smoke in firefighters. Also, serum lactate dehydrogenase (LDH) activity, a marker of cell damage, is increased in several pulmonary disorders, especially when fibrosis is involved (Cobben et al., 1997). Deductively, pulmonary disorders resulted in the elevation of LDH since LDH is also found in the lungs.

Moreso, it was also observed that serum creatinine, urea, activities of ALP and GGT among smokers were higher within the group with the highest number of cigarette intake per day. This also showed that as the number of cigarette intake increases per day, there tends to be an increase in the serum biochemical parameters. This is also in agreement with the study of Hezode et al., (2012).

From the result of this study, it is evident that smoking has an effect on the serum levels of Creatinine, Urea and activities of ALP, GGT, CK and LDH. In view of the outcome of this research work, it is recommended that more research be done on these parameters to determine other biochemical parameters that may be elevated as a
result of smoking. Also, awareness programs should be created to educate and enlighten both smokers and non-smokers on the dangers of smoking.

REFERENCES


