Research Article

A Study on The Plasma Osmolality Of Smokers

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Abstract: The research was set to assess whether habitual use or misuse of tobacco products through smoking would bring about a change in plasma osmolality in humans. A total of 120 blood samples were analysed.90 blood samples were collected from male smokers of various cigarette brands, the remaining 30 samples were collected from apparently healthy non smokers. The plasma concentration of sodium, potassium, urea and glucose was estimated in all the samples, the values subjected to statistical analysis using SPSS 17. The plasma osmolality was then calculated from the values of all estimated parameters. The plasma osmolality of the smoking group (297.35±8.93) was found to be higher than that of the control group (293.98±7.23).It was also found to be well outside the reference interval. Though the variation in plasma osmolality between the smokers and non smokers might not be statistically significant, it could be said to be of a clinically significant value when the mean plasma osmolality of smokers is compared with the reference interval. This research therefore discovered that plasma osmolality is higher in smokers than in non smokers.
Keywords: tobacco, plasma osmolality, nicotine, smoking

INTRODUCTION

Osmolality could be defined as the molal concentration of osmotically active solutes per litre of blood. The regulation of normal plasma osmolality to 286-294mOsm/kg is as a result of interplay of several mechanisms. In the online article titled, WATER METABOLISM: made easier; authored by Welch P.G [1], a summary of what happens when an individual takes a water load and then is deprived of water for several hours is explained. The article states "The individual Starts with a normal state of hydration ,electrolytes and plasma osmolality(POsm),then drinks 2 liters of water in 30 minutes The water is absorbed, reduces serum $[Na^+]$and plasma osmolality and suppresses vasopressin release. The low vasopressin causes the renal collecting ducts to become relatively impermeable to water and of maximally dilute urine ensues. If the individual drinks nothing for several hours , water is lost in the urine ,breath and sweat causing the plasma osmolality to increase, this causes vasopressin levels to increase when the threshold for its release is reached. The collecting ducts then becomes more permeable to water until maximum urinary concentration is reached. Water continues to be lost in urine, breath and sweat until the threshold for thirst is reached, when drinking again satisfies thirst, water is absorbed from the gut, reducing plasma osmolality, thirst drive, vasopressin levels and urine concentration. To summarize the above italicized, three major systems

are required to work properly if the body has to handle water normally. They are:
 a) normal vasopressin (Vp) production and release
 b) a kidney that responds normally to Vp and
 c) normal thirst and water intake.

Smoking on the other hand is a social habit. Alharbi [2] described it as a kind of lifestyle Factor that affects the health of humans which has been shown to be an important risk factor in aVariety of disorders where it is involved in the pathogenetic pathways. Harris [3] made the assertion that the habit of tobacco smoking starts during the period of adolescence or early adulthood as teenagers are attracted more by their peers than by the adults. There are numerous harmful substances found in tobacco and tobacco smoke. The tobacco plant contains over 2,200 compounds, of which nitrogenous compounds comprise more than 30 per cent [4]. Torikai *et al.* [5] demonstrated that in burley tobacco leaves; there is a significantly higher content of pyridinic nitrogen than in bright or oriental tobacco leaves. Nicotine is one of these substances that may be acquired through active and passive smoking.. In addition to nicotine and pyridine, a few of the other known toxic substances in tobacco are lead, cadmium and tar..This research work is therefore designed to assess the effect of cigarette smoking on plasma osmolality.

MATERIALS AND METHODS
Source of samples
A total of 120 blood samples were collected.90 blood samples were collected from male smokers of various cigarette brands irrespective of age, each being a smoker of more than five sticks of cigarette per day. The remaining 30 samples were collected from male non smokers. The criteria of the selection of subjects (either smoking or non-smoking) was that no one should have any medical complication such as hypertension, heart disease, stroke, diabetes or any other disorder. Hence,

All male subjects included in the present study are the normal healthy subjects. 5mls of each blood sample was collected by venous puncture of the cubital fossa using 22G needle and syringes .It was immediately dispensed into lithium-heparinized bottles, centrifuged at 2000 r.p.m for 10 minutes. The supernatant plasma was then removed using automatic pipettes and placed into a plain bottle. The plasma samples were then refridgerated at $4^{o}C$ until the samples were analysed within 24hours.

Plasma osmolality was calculated using the formula $2([Na^{+}] + [K^{+}]) + [glucose] + [urea]$ [6]. Estimations. Plasma glucose, urea and sodium-potassium levels in plasma were estimated using glucose oxidase-peroxidase, diacetyl monoxime and flame emission photometry methods respectively. Calculated plasma osmolality was preferred in this research work, the rationale being so that the pattern of the estimated parameters in plasma could be studied, analysed and also compared with that of non smokers. Total protein estimation was also carried out on all samples to assess the degree of intravascular dehydration, proteins being the bulk of the suspended or dissolved matter in plasma.

Statistical analysis
All values were expressed as Mean ± S.D. significance was tested using the t test and post test analysis. All values were found to be significant or otherwise at $P<0.05$.

RESULTS

Table-1: showing the mean ± standard deviation of sodium, potassium, urea, glucose, total protein concentration in plasma and plasma osmolality of both smokers and non smokers.

parameters	Non smoking N=30	Smoking N=90
Sodium(mmol/L)	139.1±1.99	138.5±2.11
Potassium(mmol/L)	3.91±0.76	3.87±0.84
Urea (mmol/L)	4.51±1.01	8.49±1.99
Glucose (mmol/L)	3.45±0.72	4.12±1.04
Total protein (g/L)	65.9±9.77	79.8±13.57
Plasma osmolality (mOsmol/Kg)	293.98±7.23	297.35±8.93

Table-2: showing the P value, Critical t and the Students t values when the plasma sodium, potassium, urea, glucose, total protein concentration in plasma and plasma osmolality of smokers are compared with that of non smokers

parameter	Critical t	Student t	Remarks
Sodium	1.98	2.72	significant
Potassium	1.98	0.23	Non significant
Urea	1.98	125	significant
Glucose	1.98	19.1	significant
Total protein	1.98	5.56	significant
POsm	1.98	1.93	Non significant

DISCUSSION
Many researchers have linked the adverse effects of smoking on health to be sequelae of its nicotine content's adverse effect on the cardiovascular system. Some others have linked it to the presence of heavy metals and other harmful substances in cigarette smoke. In a few word, smoking has been confirmed to be deleterious to health. Plasma osmolality is maintained within narrow limits. This research work found plasma sodium concentration in smokers (138.5mmol/L) to be lower than that of non smokers (139.5mmol/L).Similarly, the mean plasma potassium

level was also found to be slightly lower in non smokers. These findings are at variance with the work of Cooper [7] where smoking was found to compromise electrolyte-handling mechanisms in the nephron. The Mean urea concentration was found to be higher in smokers (8.49mmol/L) against that of non smokers (4.51mmol/L), this finding agrees with the work of Orth *et al.*[8] which documented the adverse effect of smoking on renal function and progression of renal diseases. In a study where non- smokers were compared with smokers, impaired renal function resulted in a significant reduction in renal plasma flow, Gambaro *et*

al. [9]. Hansen et al. [14] also explained that Nephropathies are accelerated by nicotine with an increased incidence ofof renal clinical conditions, Another work that have linked loss of renal function and smoking is that of Satarug *et al.* [10] with a 50% increase in Lead and Cadmium levels characteristic of smokers. Smoking is an important source of exposure to lead and especially to cadmium [11]. Cadmium in cigarettes has been proposed as a causative agent for cigarette smoke– induced cardiovascular disease [11,12]. We thus insinuate that cadmium and lead exposure through smoking increases the risk of vascular diseases thereby leading to a reduction in blood supply to organs of the body, the kidney being a vital one . In addition to cadmium and lead, several agents in tobacco are considered to contribute to cardiovascular disease, these include carbon monoxide, nitrogen oxides, hydrogen cyanide, tar, zinc, and carbon disulfide [11].

Glucose concentration was also found to be significantly higher in smokers (4.12mmol/l) than in non smoker (3.45mmol/l). This finding agrees with the work of Eliasson [13] which described smoking as a possible cause of type 2 diabetes. This would imply that smoking diabetics are at a greater risk of disease progression and therefore its attendant complications such increased risk for vascular complications such as coronary heart disease (CHD), stroke, and peripheral vascular disease. An increase in mean plasma total protein (smokers; 79.8mmol/L, non smokers; 65.9mmol/l) suggests intravascular dehydration which, in smokers, may also be a contributing factor towards the increase in glucose concentration found in the smoking group. Plasma osmolality was found to be 297.35mOsm/kg in smokers and 293.98 in non smokers. Considering the narrow limit within which plasma osmolality is maintaine, the plasma osmolality of smokers, though insignificantly higher when compared to that of smokers, could be said to be far removed from the normal range, therefore this research work ascertains that plasma osmolality in smokers is higher than that of non smokers, the nicotine and other harmful content of cigarettes most probably being the most potent factor.

CONCLUSION

In summary, despite the fact that tobacco smoking causes loss of renal function, it is still potent enough to bring about an increase in total osmotically active substances.

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