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Original Research Article

BIOCHEMICAL CHANGES IN ALBINO RATS EXPOSED TO RICE HUSK DUSK AT ABAKALIKI RICE MILL INDUSTRIAL AREA.

ABSTRACT

Purpose: The effect of rice husk dust inhalation on some biochemical parameters was conducted on albino rats. **Method**: 100 albino rats were divided into five groups with each group containing twenty albino rats. Group A served as the control and were housed at the animal house away from rice dust while group B, C, and D were exposed to rice husk dust for two week, three weeks and four weeks respectively for dust inhalation. They were allowed access to rats feeds and deionized water *ad libitium*. Blood samples were collected from each group at the end of exposure by cardiac puncture. Glucose level was determined using the glucose reagent kit, acid phosphatase concentration was performed using reagent kits, creatinine and uric acid concentration was determined spectrophotometrically, the weight of the rats were recorded daily. **Results**: Result showed significant reduction in body weight of the exposed. The glucose level decreased significantly while the serum acid phosphatase and serum uric acid level showed a significant increase. Histological result showed various degrees of damage to the kidney of the exposed rats. **Conclusion**: We therefore conclude that rice husk dust inhalation induces glucose depletion, injury to the kidney and prostatic glands in the albino rat and impairs the renal function.

Key words: Rice husk dust, renal function, inhalation, prostate gland and exposure period.

INTRODUCTION.

Rice husk (or husk dust) are the coatings of seeds or the grain of rice which enables the grain to be protected especially during the growing season. Silica and lignin are the major hard material from which rice hull is formed and it is mostly indigestable to humans [1]. In Abakaliki rice mill industry, rice husk is removed from milled rice by winnowing which involve throwing the rice with its hull on the air for wind to blow away the hull while the heavy rice grain remain in the pan. This leads to the rice husk dust inhalation by the occupational workers and also those living around the industy. Some research has shown that rice husk dust inhalation might lead to liver function impairment [2]. Chemical irritant are contained in the particles generated from rice husk dust through microscopic view showing fine thorns that drops off from the sheath of the rice and can irritate the skin, throat, eyes and also lead to inflammation of the liver [3]. Other chemical constituent that might be present in rice husk dust which might attenuate liver damage among workers in industrial area includes some heavy metals which are present in the rice hull [4]

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Prostatic acid phosphatase also known as prostatic specific acid phosphatase (PSAP), is an enzyme produced by the prostate in males. It may be found in increased amounts in men who have prostate cancer or other diseases, while the highest levels of acid phosphatase are found in metastasized prostate cancer. Diseases of the bone, such as Paget's disease or hyperparathyroidism, diseases of blood cells, such as sickle-cell disease or multiple myeloma or lysosomal storage diseases, such as Gaucher's disease, will show moderately increased levels. Certain medications can cause temporary increases or decreases in acid phosphatase levels. Its physiological function may be associated with the liquefaction process of semen [5]. Glucose on the hand is a simple monosaccharide found in plants. It is one of the three dietary monosaccharides, along with fructose and galactose that are absorbed directly into the bloodstream during digestion. An important carbohydrate in biology, cells use it as the primary source of energy and a metabolic intermediate. Glucose is one of the main products of photosynthesis and serves as fuel for cellular respiration [6]. Glucose is a common medical analyte measured in blood samples. Eating or fasting prior to taking a blood sample has an effect on the result. A high fasting blood sugar level may be a sign of prediabetes or diabetes mellitus [7,8].

Creatinine is a breakdown product of creatine which is an important part of muscle. Serum creatinine (a blood measurement) is an important indicator of renal health because it is easily-measured by-product of muscle metabolism that is excreted unchanged by the kidneys [9]. It is produced via a biological system involving creatinephosphocreatine (also known as creatine phosphate) and adenosine triphosphate (ATP, the body's immediate energy supply) [10]. Uric acid otherwise called carbamide is an organic compound with the chemical formular $Co(NH_2)_2$. It serves an important function in the metabolism of nitrogen-containing compound by animals and is the main nitrogen-containing substance in the urine of mammals. Its colourless and odourless solid, highly soluble in water and practically non-toxic. It is used by the body for nitrogen excretion. Rice hull dust is a potential source of amorphous reactive silica and other chemical components which can be ingested by occupational workers. In this research, we aimed at providing information on how rice husk dust inhalation effects some biochemical parameters.

Methodology

Animals and Management (Exposure)

A total of twenty-four 100 albino rats weighing 170-200 were used for this research, the animals were grouped into A, B, C, D and group B, C and D were exposed to the rice husk dust at the Abakaliki rice mill for a period of one week, two weeks and four weeks respectively while group A which served as the control were kept in the department's animal house away from the rice mill industry. Each group contained twenty rats. The exposed rats were kept safe and away from the sun with the aid of the umbrella to mimic the natural environment under which occupational worker does they work. They were allowed access to grower's mash feed and deionized water *ad libitium*. At the end of exposure, the animals were sacrificed under light ether anesthesia and blood samples were collected for biochemical analysis.

Determination of biochemical / clinical parameters in serum.

The serum were separated from the blood samples using standard clinical procedures and were stored at -20°C until when the time for the analysis ACP (acid phosphstase), glucose levels, uric

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acid and creatinine levels. The glucose level were assayed by the colorimetric method outlined in the glucose oxidase kit of Quinnica Clinica Aplicada (Spain). Creatinine levels were assayed by colorimetric method with deproteinisation using kit (Syrbio / France). The method was based on the Jaffe reaction in which the coloured product was formed from creatinine and picric acid in alkaline solution while Serum uric acid determination was performed by an enzymatic method (Uricase) using kit (biomerieux /France). Acid phosphatase activities was determined using *MaxDiscovery™ Acid Phosphatase Assay Kit which* uses a unique colored reaction for specific visible detection of acid phosphatase activity within a ten minute time interval. The method involves the cleavage of naphthylphosphate by the enzyme to form naphthol and phosphate. The naphthol product hence reacts with Fast TR reagent included in the Reagent Mix to form a colored product. The amount of acid phosphatase in the various sample is quantified by measuring the absorbance at 405 nm within 5 minute time interval. To distinguish prostatic from nonprostatic acid phosphatase (TRAP) enzyme, sodium tartrate is added to the reaction to selectively inhibit the prostatic acid phosphatase.

RESULTS

Weight change

Table 1: Weight change in grams of mean ± standard deviation of both control and exposed rats.

GROUP	A	B	C	D
	204.28±4.49[a]	193.57±6.26*	192.5±7.78*	180.95±17.14*
	192.14±11.49[a]	201.42±5.94[a]	182.5±11.05*	183.33±19.05*
	206.78±11.53[a]	187.85±2.67*	197.5±11.56*	200±19.05
	210.71±7.80[a]	186.42±4.75*	186.78±10.30*	180.47±12.75*
	184.76±11.58[a]	196.42±3.77	188.57±10.08	180.47±17.16*
	210.47±11.16	175.71±5.34*	168.57±9.88*	169.76±14.27*

Value bearing the superscript * are statistically significant from the control.

Table 2: Shows the mean glucose concentration (mg/dl), acid phosphatase(u/l), uric acid(µmol/L) and creatinine(µmol/L) for the exposed and control of the albino rats.

	Glucose	Acid phosphatase	Uric acid	Creatinine
A (Control)	66.0 ± 2.37	1.69 ± 0.34	191.50 ± 14.73	75.47 ± 7.67
B (Week2)	65.83 ± 5.64	1.81 ± 0.41*	213.67 ± 34.42*	82.12 ± 23.18*

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C (Week3)	62.67 ± 4.18*	1.73 ± 0.40*	226.0 ± 34.44*	84.35 ± 16.64*
D (Week 4)	60.0 ± 5.22*	2.02 ± 0.19*	218.83 ± 35.10*	82.77 ± 10.91*

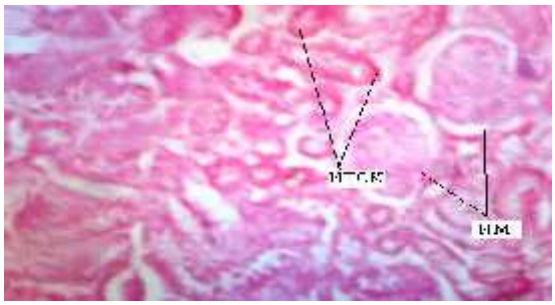

Plate 1: The photomicrograph of the kidney of control rats shows normal glomeruli and normal tubular cells (NTCK])of the kidney. Method of staining (H & E) X 40

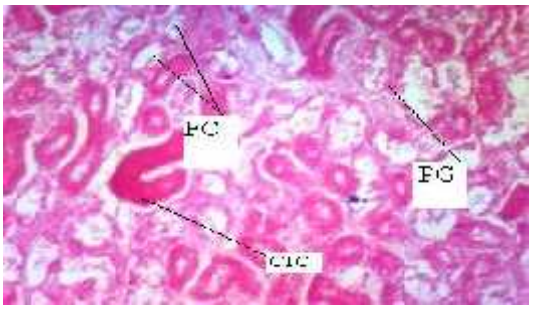

Plate 2: The photomicrograph of kidneys of rats exposed for 7 days shows fatty changes (FC) in the background, the tubular cells appear congested (CTC) and the glomeruli appear pale (PG).Method of staining.(H &E X

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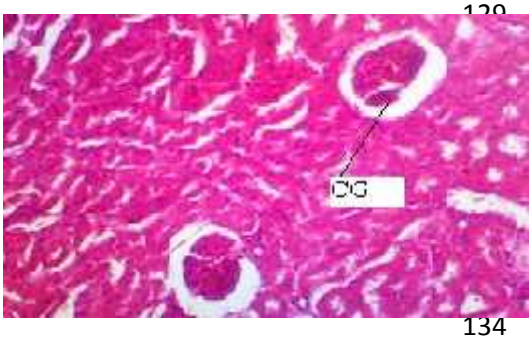

Plate 3: The photomicrograph of kidneys of rats exposed to rice dust for 14 days shows congested glomeruli (CG).Method of staining (H & E X40)

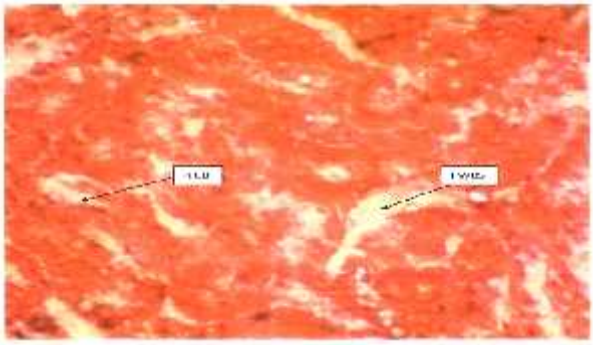

Plate 4: The photomicrograph of kidneys of rats exposed to rice husk dust for 21 days shows indistent tubules cell border (ITCB) and enlargement of tubules with partial obstruction of the lumen. The epithelial cells that suppose to align themselves along the tubular membrane are scattered. The glomerulus is contracted giving a focal widening Bowman space (FWBS). Method of staining (H&E X40)

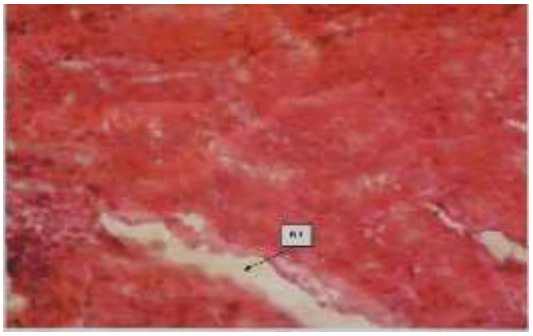

Plate 5: The photomicrograph of kidneys of rats exposed to rice husk dust for 28 days shows a necrotic tubules (NT). Method of stain (H&E X40)

DISCUSSION

The present result showed that body weight and serum glucose level decreased significantly in those rats exposed to rice dust inhalation while there was a significant increase in the serum acid phosphatase acivities , serum uric acid level and serum creatinine level relative to the control. The blood glucose level appears to decrease significantly among the experimental animals exposed to rice husk dust. The decrease were found to be severe as the period of exposure increases. This is related to works done by [11] where dietary administration of 0.5 or 1% rice

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hull smoke extract to alloxan-induced diabetic mice caused a decrease in blood glucose level and increased both serum insulin and hepatic glycogen level. These changes resulted in restoring glucose-regulating enzyme levels to control values. The body weight of the animals also decreased significantly relative to the control groups. This might explain the decrease in the blood glucose levels as the inhalation of this dust might lead to a wide variety of changes including loss of appetite and hence reduction in body weight. Oxidative stress might have also been induced by the rice husk dust inhalation just as smoke inhalation does as reported by [12].

On the other hand, acid phosphatase activities was elevated in the serum as evidenced by the result. This enzyme are suppose to be confined to the prostate gland, therefore, the high activities of this enzyme in the blood might suggest that an injury has been caused to the prostate as a result of the inhalation of the rice husk dust, hence its leakage into the blood. This can invariably lead to prostatic cancer. This is to say that a leision on the prostate gland can result to disruption in the reading of base sequence in nuclic acid synthesis thereby leading to uncontrolled cell growth[13]. Serum uric acid level and creatinine concentration in the blood was also significantly elevated in exposed group than in the control group. The increase was dose dependent. This is similar to findings by [14] where rabbits where exposed to industrial fumes (smoke) and it was after 28 days that the rabbits started recovering from excessive secretion of uric acid into the blood, this is possibly due to the ability of the renal system to functionally control the absorption and or excretion (homeostasis) of uric acid [15].

Our result also reveals that there was a significant increase in creatinine level in the first two weeks, but subsequently, a significant decrease was observed but still not compared to the control sample, this can be explained by works from [16] where a sub-acute toxicity experiment was conducted on wistar rats and it was observed that on subsequent administration of a particular dose (50mgkg) of Chromium, the creatinine level which was formerly increasing started decreasing , this is probably due to the recovery of activity by the renal system thereby maintaining the normal clearance rate of the kidney. Furthermore, creatinine level may increase when angiotensin- converting enzyme (ACE) inhibitors (ACEI) or angiotensin 11 receptor antagonist or angiotensin receptor blockers (ARB) are taken. Using both ACE1 and ARB concomitantly will increase creatinine levels to a greater degree than either of the two drugs would individually [17]. In a recent Japanese study a lower serum creatinine level was found to be associated with an increase risk for the development of type 2 diabetes in Japanese men [20]. Rice husk dust contained various heavy metals as well as other organic compounds that might elicit a wide degree of toxicity to the body [3]. The histological examination of the kidney showed varying degrees of damage to the kidney ranging from congestion of tubular cells, partial obstruction of the lumen, scattered epithelial cells and necrotic tubules.

CONCLUSION

We therefore conclude that rice husk dust inhalation result to certain level of toxicity to the body, individuals working at the rice mill industry are therefore advised to reduce the amount of rice husk dust ingestion by engaging in some preventive measures such as the use of nose mask during work hour.

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