

LIVER FUNCTION PROFILE OF WORKERS OCCUPATIONALLY EXPOSED TO YAM FLOUR DUST.

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ABSTRACT

BACKGROUND: Flour grinding is one of the commonest medium scale vocations in this part of the world, workers in this vocation are routinely exposed to yam flour dust which they inhale and even ingest with little or no information as to the possible contents and biochemical effects of the dust on the major organs of the body. This becomes imperative considering the mode of generation of the dust. This study investigated contents and effects of Yam flour dust on liver functions among occupationally exposed workers.

MATERIALS AND METHODS: 26 men working as yam-flour grinders (cases) for upwards of 3- 35years were recruited along with 20 men (civil servants) not exposed to yam flour dust (controls). Liver function tests [Total and conjugated bilirubin, Alkaline phosphatase (ALP), Alanine amino transferase (ALT), Aspartate amino transferase (AST), Total protein and Albumin (ALB)] were estimated spectrophotometrically in cases and controls using standard laboratory methods.

RESULTS: Mean Liver enzyme activities were ALP (109.26 ± 20.95 iu/L and 97.45 ± 22.85 iu/L), AST (40.11 ± 6.75 iu/L and 29.45 ± 8.29 iu/L) and ALT (39.26 ± 5.52 iu/L and 23.70 ± 10.49 iu/L) for cases and controls respectively. ALT and AST activities were statistically significant in cases relative to controls ($P < 0.05$). Mean Plasma Total protein levels were (8.57 ± 0.46 g/dl

and 7.99 ± 0.74 g/dl) while mean Albumin levels were (4.00 ± 0.23 g/dl and 4.27 ± 0.42 g/dl) in cases and controls respectively. Total protein was significantly higher in cases compared to controls ($p < 0.05$). There was no significant difference in mean total (0.80 ± 0.29 mg/dl and 0.75 ± 0.23 mg/dl) and conjugated (0.32 ± 0.21 mg/dl and 0.32 ± 0.18 mg/dl) bilirubin levels in cases and controls respectively.

CONCLUSIONS: Exposure to Yam flour dust in this group of artisans may cause elevation in liver enzymes and total protein which may be an indication of liver dysfunction.

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INTRODUCTION

Yam flour grinding is an important small-scale vocation in Nigeria, especially in the South Western part of the country. The process of yam grinding involves crushing of dried yam tuber mechanically in between two metals leading to the generation of dust containing particles of the yam and metals of the mechanical grinders. Since liver is the “factory” of the body, the dust generated is inevitably metabolized in the liver (Marc 2009). The cumulative effect of the dust particles on the liver is the focus of this paper.

Dust is a small, dry, solid particle projected into the air by natural forces such as wind, volcanic eruption, and by mechanical or man-made processes such as crunching, grinding, milling, drilling, demolition, shoveling, conveying, screening, bagging and sweeping (WHO, 1999). Whenever dust particles are deposited either on the head or in lungs they have the potential to cause harm either locally or subsequently elsewhere in the body (Brunekreef and Forsberg, 2005; WHO, 1999).

The possible health effects of long-term exposure to dust are a factor of the metabolic processes which contents of the dust will undergo in the body especially in the developing world where enforcement of standard work ethics is not enforced (Fatusi & Erbabor, 1996). Since dust particles are of very small molecular weight, prolonged occupational exposures to dust even at relatively low levels may lead to accumulation of insoluble particles in the lungs leading to impaired clearance (the so-called ‘dust overload’) which may cause various types of dermatoses (WHO, 1999) among other ailments. Reports on the transposition of toxic elements and their compounds contained in dust from the lungs to other tissues and organs including liver also abound in the literature (WHO, 1999).

In Nigeria, though yams can be consumed by boiling, roasting and processed to yield Amala (a popular type of food in the South-western part of the country), the processing of yam to be used for “Amala” largely involves generation of dust through grinding as stated above. Aside from this, fresh yams are difficult to store and are subject to post harvest losses during storage, because of these, yam is commonly processed into flour by drying yam slices. When dried, the pieces turn a dark brown colour, these are then milled to create a brown powder known as Yam flour powder (Elubo) (Afoakwa and Sefa-Dedeh, 2001; Otunsanya and Jeger,1996).

Traditionally, sun drying is a popular method of preserving agricultural products in the tropics, although this method is cost effective, open sun-drying as it is generally practiced has some limitations (Afoakwa and Sefa-Dedeh, 2001; Otunsanya and Jeger,1996). These include the inability to control the drying process and parameters, weather uncertainties, the requirement of a large drying area, insect infestation, and more importantly contamination with dust and other undesirable materials (Jimoh et. Al, 2009).

This study was therefore designed to determine effects of these contaminants in yam flour dust on the liver by estimating liver function indices such as serum Aspartate amino transferase (AST), Alanine amino transferase (ALT), Alkaline phosphatase (ALP), Total and Conjugated Bilirubin, Total protein and Albumin levels in subjects occupationally exposed to yam flour dust.

METHODS

A total of 46 participants consisting of 26 men working as yam flour grinders (cases) from Bodija International market in Ibadan for upwards of 3- 35years along with 20 men (civil servants) not exposed to yam flour dust (controls) were recruited for this Cross-sectional study.

Ethical approval for the study was obtained from the University of Ibadan/University College Hospital Ethical Review Committee.

Liver function indices [Total (TB) and conjugated (CB)- bilirubin, Alanine amino transferase (ALT), Aspartate amino transferase (AST), Alkaline phosphatase (ALP), total protein (TP) and albumin (ALB)] were determined spectrophotometrically using Landwind LWC 100Plus Automated Chemistry Analyzer. All laboratory procedures were based on standard laboratory practice.

RESULTS

Table 1 is a summary of anthropometric parameters for yam flour grinders (cases) and controls. From the result, the age bracket for cases was 41.69 ± 8.75 yrs and 36.67 ± 8.98 yrs for controls, there was no significant difference in their age bracket. The mean height for cases was 1.68 ± 0.06 m and 1.67 ± 0.13 m for controls, the difference was also not significant. The mean weight for cases was 69.96 ± 11.82 kg and 70.05 ± 10.60 kg for the control, there was no significant difference in the weight of both groups. The hours of exposures for cases was 6-7 hours per day and they have been on the vocation for between 3- 35 years; only one of the cases was a smoker.

Table 2 is a summary of liver function indices for cases and controls. From the results, mean plasma Total bilirubin was 0.80 ± 0.29 mg/dl and 0.75 ± 0.23 mg/dl while mean conjugated bilirubin results was 0.32 ± 0.21 mg/dl and 0.32 ± 0.18 mg/dl for cases and controls respectively. There was no statistically significant difference in both the total and conjugated bilirubin levels of both groups. Therefore, the conjugating ability of the liver in the two groups may be said to be normal.

Mean ALP activity was 109.26 ± 20.95 iu/L and 97.45 ± 22.85 iu/L. The difference in ALP activities was not significant ($P > 0.05$). Mean AST activity was 40.11 ± 6.75 iu/L and 29.45 ± 8.29 iu/L while mean ALT activity was 39.26 ± 5.52 iu/L and 23.70 ± 10.49 iu/L for cases and controls respectively. The differences in ALT and AST enzymes activities between cases and

controls were statistically significant ($P < 0.05$, $P < 0.05$). The increase AST and ALT activities in cases may be an indication of increased parenchymal cell destruction.

Mean plasma total protein concentration were 8.57 ± 0.46 g/dl and 7.99 ± 0.74 g/dl while mean plasma Albumin concentrations were 4.00 ± 0.23 g/dl and 4.27 ± 0.42 g/dl for cases and controls respectively. The mean result of total protein was significantly higher in cases than the controls ($P < 0.05$). Therefore, observed increase in total protein with normal Albumin levels in cases may be an indication of increase in globulin levels, which may be a marker of an alteration in immunological response to the exposed dust.

Table 1: Anthropometric parameters for controls and yam flour grinders

Variable	Yam flour grinders n = (26)	Controls n= (20)
Age	41.69±8.75	36.67±8.98
Height (meter)	1.68±0.062	1.67±0.13
Weight (kilogram)	69.96±11.82	70.05±10.60
Smokers	1	0
Hours of exposure (hrs)	6-7	0
Years of	3-35	

exposure (yrs)		
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Table 2: Showing the liver function parameters for yam flour grinders and controls.

Variables	Participants	Mean ± SD	T value	P value
Total bilirubin (mg/dl)	Control	0.75±0.23	-0.770	0.445
	Cases	0.80±0.29		
Conjugated bilirubin(mg/dl)	Control	0.32 ± 0.21	-0.118	0.907
	Cases	0.32±0.18		
ALP (IU/L)	Control	97.45±22.85	-1.861	0.069
	Cases	109.26±20.95		
AST (IU/L)	Control	29.45±8.29	-4.637	0.000*
	Cases	40.11±6.75		
ALT (IU/L)	Control	23.70±10.49	-6.467	0.000*
	Cases	39.26±5.52		
Total Protein (g/dl)	Control	7.99±0.74	-3.402	0.001*
	Cases	8.57±0.46		
Albumin (g/dl)	Control	4.27±0.42	-0.390	0.698
	Cases	4.00±0.23		

* Significant at $p \leq 0.05$

DISCUSSION

Dust consist of small dry particles ranging in size from 1 to 100 micrometers in diameter. They may be air borne depending on their origin, physical characteristics, and ambient conditions (WHO, 1999).

Exposure to these particles and their consequent effect may not be noticed especially among the vulnerable group and particularly in the developing world where occupational safety is of minimal consideration (Fatusi & Erbabor, 1996). Routes of exposure to particulate dusts could be through inhalation or ingestion depending on the type of dust; however, disease occasioned by the dust is often dependent on both the route and type of dust ingested/inhaled (Daniel 2014).

In 2004, the American Heart Association published its first scientific statement regarding air pollution and cardiovascular disease and concluded that short-term exposure to particulate matter (PM) through air pollution contributes to acute cardiovascular morbidity and mortality and that exposure to elevated PM levels over the long term can reduce life expectancy by a few years.

In this study, anthropometric indices (height, weight, age e.t.c) were found to be non-significantly different in the two groups of participants. It may therefore be inferred that they belong to a similar socio - strata of the society.

The liver synthesizes, detoxifies and also conjugates various materials that are ingested into the body. In all the liver function indices investigated, plasma AST, ALT and Total protein were

found to be significantly raised in workers exposed to yam flour dust (cases) than the controls. Elevation in liver enzymes suggests hepatic parenchymal cell injury (ALT and AST), hence serum liver enzyme activities are valuable indices for detecting liver injury. Several workers have shown that both ALT and AST are more specific enzymes for liver damage and therefore elevated level of this enzyme indicates stress on the liver (Shivaraj et. al.2009; Higashi et.al. 2005, Himmerich et al., 2001). Increase in plasma enzyme level is usually an indication of cellular damage with the attendant release of its contents into the circulation. Therefore, the observed increased liver enzyme activity maybe an indication of damage to hepatic cells due to exposure to yam flour dust in cases in this study.

Although proliferation of AST enzymes may not be specific indicator of liver cell damage, however, elevated ALT which is more specific to the liver observed in cases in this study may be said to be prognostic of innocuous damage to the liver.

Production of protein (albumin specifically) is one of the synthetic functions of the liver. Therefore, observation of normal plasma Albumin level in controls and cases may be an indication of preservation of the synthetic function of the liver especially in cases in spite of the long years of occupational exposure to yam flour dust. However, the significant difference in total protein levels in cases and controls which may be attributed to an alteration in globulin level especially in cases may be an indication of proliferating immunological process characteristic of inflammatory response attributable to dust exposure (Bengt Sjogren 1997). An assessment of immunological profile (IgG, IgM and IgA) of participant may be able to ascertain this.

CONCLUSION

It may be concluded that the effect of Yam flour dust on the liver of occupationally exposed yam flour grinders in Nigeria is of public health importance. The observed up-regulation of liver

enzymes (ALT, AST) and elevation of plasma globulin fraction of total protein in these subjects (though within the normal range) should be of interest especially since on a long-term basis this may be a clear indication of insidious long-term damage to the liver. Hence the need to reduce exposures to the population at risk. These finding demonstrated the need to adopt technical preventive measures such as well-ventilated working environment, work place hygiene, health education programs and wearing of appropriate respiratory protective devices in such workplaces. Although there are no statistical data on mortality and morbidity among the workers, these measures are expected to prevent or reduce exposure to dust which will in turn reduce morbidity and mortality as a result of occupational lung and systemic diseases.

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