

## Effect of Lead, Cadmium, and Continuous Exposure to Heat as an Occupation Hazards on Fertility in Male Workers.

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### Abstract

In this work, sample of workers who are in contact with heavy metals were selected. Those were distributed as follow car customizers and welders (CW) (25), bakers (20) local power generator operators “operators” (15), and control men who their occupation was far from such contact (20). The study included measurement of testosterone, LH and FSH as fertility hormones, measurement of lead and cadmium (Cd) as heavy metals, and exposure to heat during the working day. Results showed that fertility hormones were within the control levels in all subjects; only a significant increase ( $p \leq 0.05$ ) was recorded in LH in (CW) compared with control. Seminal fluid analysis (SFA), showed a decrease in total sperm count in all samples when compared with control. No significant raise was found in heavy metals in bakers, while a significant elevation of both types of heavy metals were recorded in blood of (CW) and (operators). It is concluded that occupation might result in elevating levels of heavy metals in welders and car customizers, and local power generator operators.

Keywords: heavy metals, fertility, occupation hazards.

### Introduction

Problems of the human reproductive tract lead to a variety of undesired outcomes such as complete or partial infertility; spontaneous abortion, including early undiagnosed miscarriage; teratogenic insults and birth defects; mutation development and genetic defects; cancers in progeny [1]. One of the first materials to be demonstrated as detrimental to fertility was lead. An increase in the level of lead in blood tests in men was linked to an amplified risk of miscarriage in a case-control study from Finland [2]. Analysis of sperm counts in lead workers showed a decrease in sperm count, as well as decreased motility and lifespan of sperm, in direct relation to the level of lead in the blood [3]. In laboratory animals, high levels of hexavalent chromium and Cd caused testicular atrophy and decrease in sperm count. In human, it had been found that exposure to chromium or Cd was significant in welders. Diminished sperm quality among welders had been demonstrated in a number of studies [4;5].

This work focused on fertility in males working in different occupations that may put them in risk of contact with heavy metals and heat exposure. We parameters of our study were on measurement of fertility hormones

(testosterone, FSH, and LH) , sperm count and ability of them to reproduce.

### Materials and Methods

#### Occupation:

Males subjected to this study were at the following occupation, car customizers and welders “cw” (25), bakers (20) and local power generator operators “operators” (15), control (20).

#### Semen sample collection:

Semen samples were collected from subjects under study and were incubated at 37 °C for 30 min. liquefaction for each sample was recorded and differential count was performed under microscope.

#### Blood sample collection

Blood samples from each male were collected (5 ml) and preserved in ice until delivery to the laboratory. Fertility hormones including testosterone, FSH, and LH were measured by Minivids type Biomereux (France).

Lead an Cd concentrations were measured in serum using Buckman Scientific atomic absorption.

**Personal life information data**

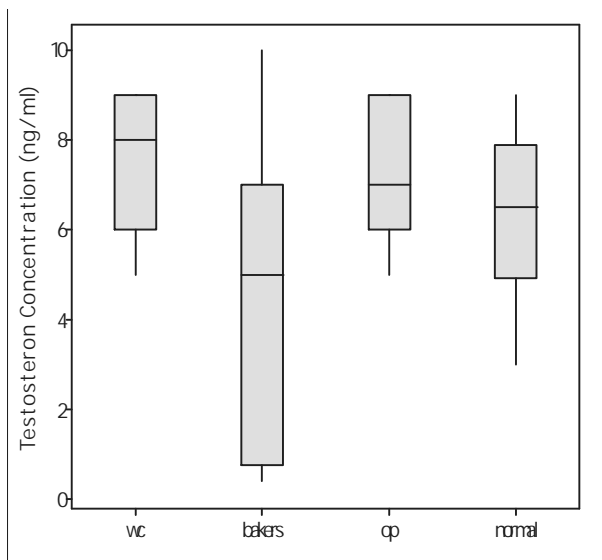
Each subject under study was asked to fill a form containing the following information: age, no. of children, smoker or non smoker, alcohol drinking, hours of work, exposure to welding and heat, operation of generator hours and health status of the wife.

**Statistical Analysis**

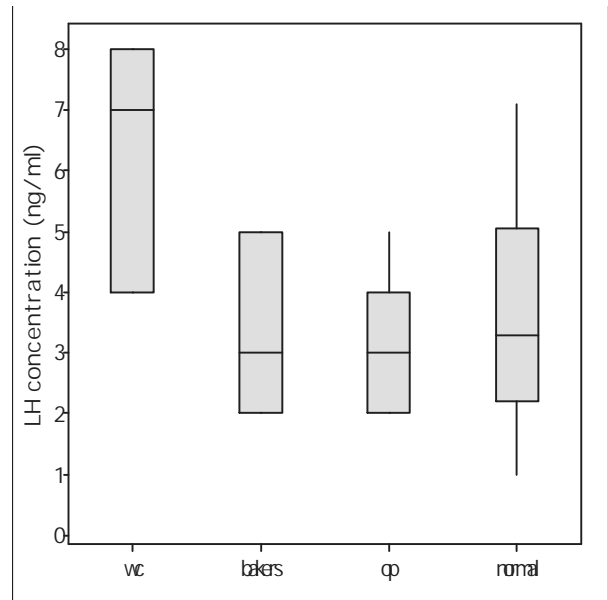
Statistical analysis was made using Minitab statistical analysis package. The comparison was made using one way ANOVA test with  $p \leq 0.05$ . Graphs were generated by the program depending on results of comparison.

**Results**

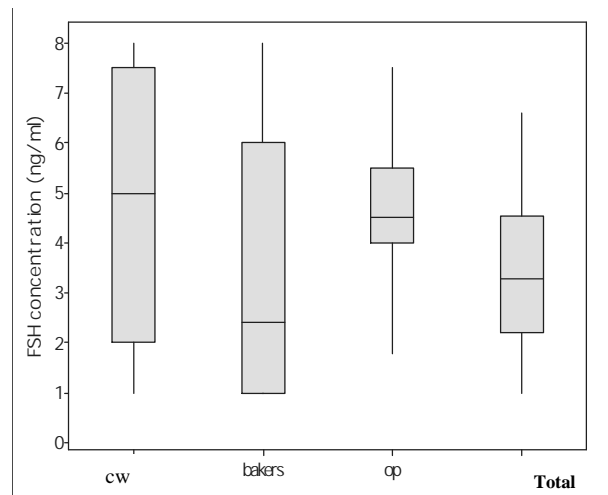
Measurement of fertility hormones (testosterone, and FSH) did not reveal significant difference when compared with control and healthy people only for workers as car costumizers and welders (cw), since LH showed a significant increase ( $p \leq 0.05$ ) when compared with control values. Fertility hormones measurements (testosterone, LH, and FSH) are shown in Fig.(1, 2, and 3) respectively.



**Fig. (1) Testosterone levels in sera (ng/ml) of subjects under study and control.**

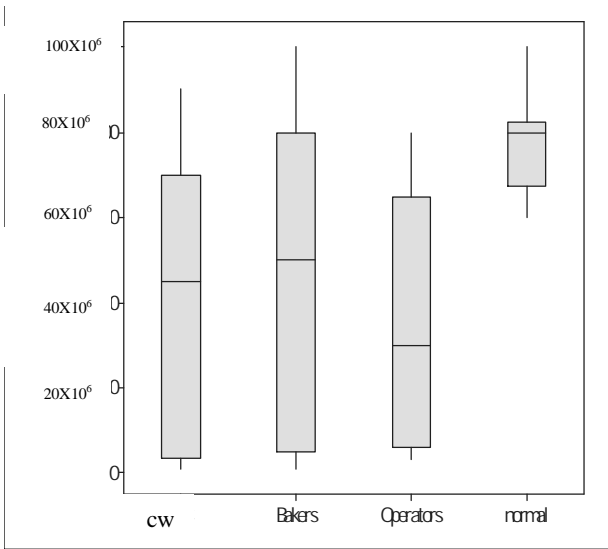


**Fig. (2) LH levels in sera (ng/ml) of subjects under study.**

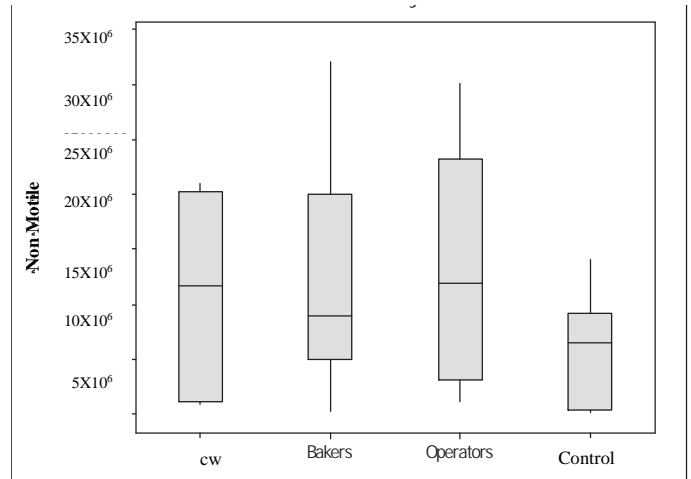


**Fig. (3) FSH levels in sera (ng/ml) of subjects under study. The figure shows no fluctuation in hormone level in subjects studied.**

Further work was conducted in collecting seminal fluid for differential analysis. Our finding showed that semen from subjects studied decreased in total count when compared with control people. The differential count (total, motile, sluggish, and non motile) is shown in Figs. (4, 5, 6 and 7) respectively.

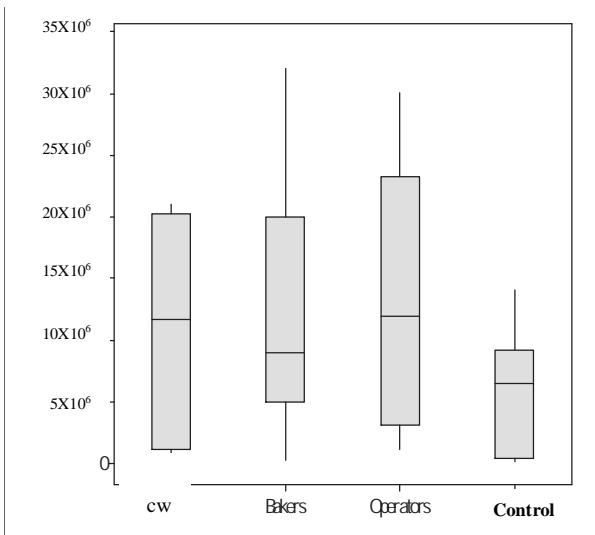


**Fig. (4) Total count of sperm in seminal fluid of subjects under study and control.**

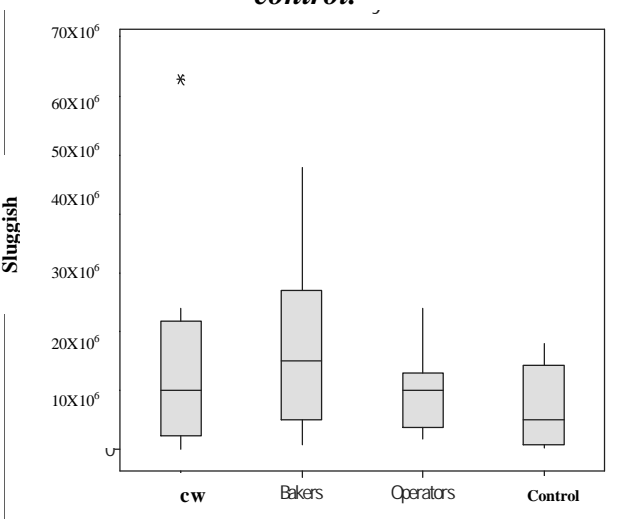


**Fig. (7) Count of non motile sperm in seminal fluid of subjects under study and control.**

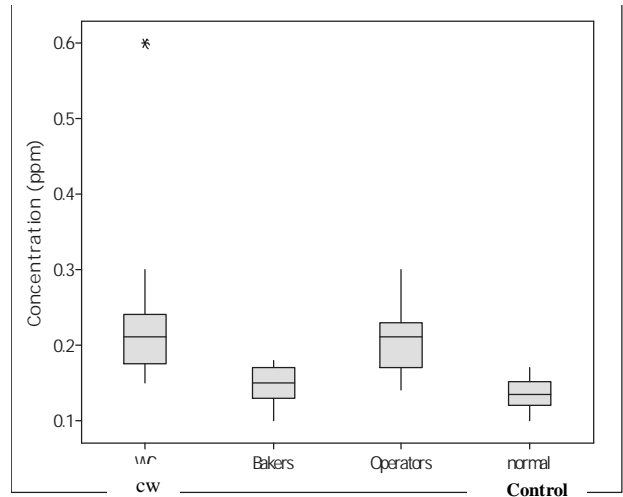
Furthermore, subjects tested may encounter occupation hazards represented by continuous exposure to heat (bakers), and heavy metals (cw, op) as a consequence of their occupation. Testing of lead and Cd revealed significant increase ( $p \leq 0.05$ ) of lead and Cd in cw and op. this is shown in Figs. (8 and 9).



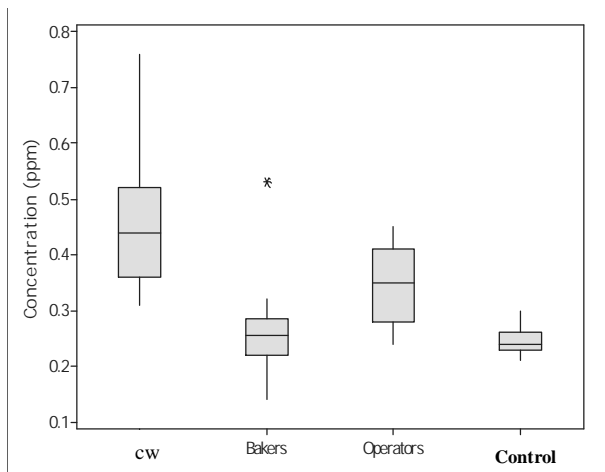
**Fig. (5). Count of non motile sperm in seminal fluid of subjects under study and control.**



**Fig. (6) Count of sluggish sperm in seminal fluid of subjects under study and control.**



**Fig. (8) Serum concentration of Cd (ppm) in sera of subjects under study and control.**



**Fig. (9) Serum concentration of lead (ppm) in sera of subjects under study and control.**

### Discussion

Occupation effect on fertility is an important issue that should be taken in concern when attending fertility clinics. Subjects studied in this work showed control fertility hormone levels except LH in cw samples mostly. In addition, total count of seminal fluid showed a decrease in all test subjects when compared with control [6]. This was the wide picture of results obtained. Our explanation was based on occupation hazards affecting these workers represented by exposure to heavy metals like vapor coming up from welders that was known to contain high concentration of Cd, continuous exposure to fuel containing lead as found in cw and power generators operators groups, and continuous exposure to heat beyond normal level which was (25 – 35 °C) as studied in bakers who were exposed to 45 – 55 °C in most of the year [7].

It was known that the normal active production of sperm requires a temperature about 3–4°C lower than normal body temperature. This fact was supported by the decreased sperm count seen in pathologies such as varicocele and cryptorchidism, as well as in cases of prolonged sauna exposure and in paralyzed patients restricted to wheelchairs [8]. Depending on this finding, bakers did not show a significant change in fertility hormones levels and was found in this group, reduction in total sperm count.

Hormonal analysis in subjects showed a significant change in LH in cw group, while a noticeable fluctuation was in other groups [9].

The reason for this might be attributed to lead, Cd, and continuous exposure to heat. A study provided [10] showed that there was a connection between occupational exposure of the father to lead and birth defects in children.

Results of semen total count in groups under study could be explained on the finding of Telisman [11] who concluded that even moderate exposures to lead (blood lead < 400 microg/L) and cadmium (blood cadmium < 10 microg/L) could significantly reduce human semen quality without conclusive evidence of impairment of male reproductive endocrine function. High levels of hexavalent chromium caused testicular atrophy and decreased in sperm count. In human studies, it was found that exposure to chromium is significant in welders [12]. Diminished sperm quality among welders had been demonstrated in a number of studies [4]. Lähdetie reported that there was a direct influence of lead and Cd on the structure of sperm, involving a partial exchange with zinc, which is an important ingredient of sperm that makes it heat-resistant [13].

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( $p \leq 0.05$ ) في الأشخاص تحت الدراسة من مصلحي السيارات واللحاميين. تحليل السائل المنوي المأخوذ من الأشخاص تحت الدراسة اظهر انخفاضا في المعدل الكلي عند مقارنته بالأشخاص الطبيعيين. لم يظهر فرق معنوي في مستوى المعادن الثقيلة في دم العاملين في المخابز بينما ظهر هذا الفرق في تركيز هذه المعادن الثقيلة في دم اللحاميين ومصلي السيارات ومشغلي المولدات. الاستنتاج الذي خرجت به هذه الدراسة أن المهنة قد تؤدي الى ارتفاع تركيز المعادن الثقيلة في دم الأشخاص خصوصا العاملين في مجال اللحام وتصليح السيارات وتشغيل المولدات.

#### الخلاصة

جمعت عينات من أصحاب مهن تجعلهم في تماس مباشر مع العناصر الثقيلة. هؤلاء توزعوا كما يلي: لحامين ومصلي سيارات عددهم (25)، خبازين عددهم (20)، مشغلي مولدات محلية عددهم (15)، وعينات من أناس مجموعة السيطرة ذوي مهن بعيدة عن التعرض لمثل هذه المخاطر. عدد (20). تضمنت الدراسة قياس مستوى testosterone، و LH، و FSH كمؤشرات لمستوى الخصوبة إضافة إلى قياس مستوى الرصاص والكاديوم ومدى التعرض للحرارة خلال اليوم. أظهرت النتائج ان مستوى هرمونات الخصوبة كان طبيعيا في الأشخاص تحت الدراسة عدا هرمون LH الذي اظهر زيادة معنوية