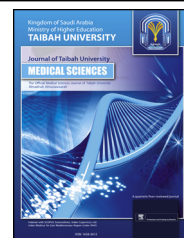




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Original Article

Male infertility among bakers associated with exposure to high environmental temperature at the workplace

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المخلص

أهداف البحث: تهدف هذه الدراسة إلى معرفة معدل انتشار العقم لدى الذكور بين الخبازين المعرضين لدرجات حرارة بيئية عالية.

طرق البحث: أجريت دراسة مقطعية عرضية لجمع المعلومات باستخدام استبانة موثقة تدار من خلال مقابلة شخصية. حيث تم قياس مؤشر متوسط درجة حرارة الترمومتر المبلل في المخابز. واستخدمت صيغة إحصائية جديدة لتقدير انتشار العقم بين الخبازين.

النتائج: تطوع في هذه الدراسة عدد 137 خبازا يعملون في 20 مخبزا و107 مجموعة ضابطة مماثلة من حيث العمر، والعرق، والحالة الاجتماعية، والدخل، وتدخين السجائر. كان معدل انتشار العقم باستخدام الصيغة المحدثة بين المجموعة المعرضة 22.7%، مقارنة مع 3.0% في المجموعة الضابطة. تم استبعاد جميع العوامل الخارجية المحتملة للعقم بين الخبازين مثل تدخين السجائر، والعمر والعرق. وجد أن هناك ظروف عمل بحرارة عالية غير ملائمة في المخابز حيث بلغ مؤشر متوسط درجة حرارة الترمومتر المبلل في المخابز 37.4 درجة مئوية، في حين بلغ متوسط درجة حرارة الترمومتر المبلل للمكاتب 25.5 درجة مئوية.

الاستنتاجات: أظهرت هذه الدراسة معدلات مرتفعة للعقم بين الخبازين نتجت من التعرض لدرجات حرارة بيئية عالية في مكان العمل كما أظهر متوسط درجة حرارة الترمومتر المبلل. هذه النتائج ينبغي أن تنبه سلطات العمل الصحي لاتخاذ التدابير اللازمة بموجب قانون العمل للحد من العقم بين الخبازين.

الكلمات المفتاحية: الذكور؛ العقم؛ الخبازين؛ درجات حرارة عالية؛ مكان العمل

Abstract

Objective: This study aimed to evaluate the prevalence of male infertility among bakers exposed to high environmental temperature.

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Methods: This cross-sectional study was conducted to obtain information using a validated questionnaire administered through an interview. The mean wet bulb globe temperature (WBGT) index in the bakeries was measured. A new statistical formula was used to estimate the prevalence of infertility among bakers.

Results: A total of 137 bakers working in 20 bakeries and 107 individuals included in the comparable control group with variations in age, race, marital status, and income and with history of cigarette smoking were recruited. Using a newly devised formula, the prevalence of infertility among the exposed group was 22.7%, compared with 3.0% in the control group ($p = 0.013$). All possible confounding factors associated with infertility among bakers were excluded such as cigarette smoking, age, and race. There were unfavorable hot working conditions in bakeries, with a WBGT index of 37.4 °C, while the average WBGT for offices was 25.5 °C ($p < 0.0001$).

Conclusion: Our study showed that the rate of infertility among bakers was high, which resulted from exposure to high environmental temperature at the workplace as evidenced by the WBGT index. This finding should alert the healthcare authorities to take necessary measures under the labor code to curtail infertility among bakers.

Keywords: Bakers; High temperature; Infertility; Male; Workplace

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Introduction

Elevation of scrotal temperature in relation to normal core body temperature results in failure of spermatogenesis in men. This phenomenon has been evaluated as a potential method of male contraception and shown to be clinically effective.^{1,2}

The effects of occupational and lifestyle exposures to heat on human sperm counts has been reported. From these studies, it is clear that constant exposure to any factor that compromises the ability of the scrotum to thermoregulate will result in an adverse effect on one or more aspects of semen quality. The risk of adverse reproductive outcome of male workers may range from loss of libido and potency to infertility, including impairment of fecundity as a result of disturbance in hormonal balance or nervous system.^{3,4} Male infertility primarily results from reduction in sperm count or defective sperm production. Infertility influences roughly 15% of all wedded couples. In around 33% of these couples, the essential issue dwells in the male accomplice and, in an extra third, issues in both the male and the female add to infertility. There is rising proof to recommend that presentation at the work environment for male infertility may exist in numerous men as of now named idiopathic. Occupational exposure to radiant heat (e.g., in bakers, workers in kitchens, welders, furnace workers, and ceramics workers) and other hazardous agents at workplace can induce such effects. Exposure to high environmental temperature at the workplace contributes to heat stress in males especially with exposure to a source of radiant heat over long working hours. Those working directly with sources of severe heat, such as bakers and ceramic oven operators, have a longer time to pregnancy with poorer sperm quality, which suggests that occupational heat exposure has an effect on fertility. Studies involving these workers demonstrate the decline in semen quality. They are more prone to having increased scrotal temperatures, which impair sperm production and function. The negative effect of long hours of work increases in severity with the number of years spent engaging in such activities. Men who work in close range to sources of intense heat seem to face infertility-related problems.⁵⁻¹⁰ An assortment of work-related exposures has been connected to weakened male fertility. However, studies have been constrained by limited sample sizes, unseemly review outlines, as well as choice inclination. Moreover, the utilization of semen measures as surrogates for male infertility has been risky, since there is extensive intra-individual changeability, generous cover between infertile and fertile men, and poor connection between fertility and decrements in semen measures within the "normal" range.^{11,12}

This study aimed to fill the gap of knowledge about male infertility in KSA by addressing the effects of heat exposure at the workplace where such a problem is amenable for prevention. Furthermore, this study aimed to evaluate the prevalence of infertility among bakers exposed to extreme heat at the workplace.

Materials and Methods

This cross-sectional study involved 137 male employees working in 20 bakeries in Al-Khobar area, KSA, with a

response rate of 100%. This high response rate would add considerable validity to the findings of this study.

This study was approved by the ethical review board of Imam Abdurrahman Bin Faisal University. The management of the bakeries was officially contacted, and their cooperation was requested. Verbal consent from all participants was obtained after explaining to them the aim of the study. Participants were informed that they are free to withdraw from the study at any time, and confidentiality of the recorded data was assured.

The control group (107 males) was selected based on the following criteria:

- Individuals who were not exposed to heat in their present jobs, like janitors, clerks and managers at offices, butchers, salesman at shops, and others.
- Individuals without previous history of work demanding exposure to high environmental temperature.

All bakers and control groups were interviewed using a pre-tested (through a pilot study) standard questionnaire. The questions were related to the demographic characteristics, smoking habit, number of children, and duration of work service in addition to drug and medical history.

For the purpose of this study, infertility was said to exist if the participant had been examined or treated for infertility for at least 1 year.⁵

The following is the newly devised formula used to find out and exclude from the analysis those who were infertile before taking their present job:

$$C = A - B$$

Where:

A = The age of the youngest child in months +9 (9 equal to duration of pregnancy in months) For an infertile participant with no children $A = 0 + 9$.

B = The duration of work in weeks divided by 4.2 (4.2 to convert weeks to months).

C = Time lapse between beginning work and conception of last child.

If the value of C is > 0 (i.e., $A > B$), this means that the participant was fertile before starting work; if he was infertile at the time of the study, the infertility must have happened after starting work. If C is < 0 , this means that the participant's infertility was doubtful (infertility might have happened before starting work). All respondents in the latter category were subsequently excluded from further analysis.

The natural wet bulb (NWB) temperature was measured in different locations in the bakeries and offices using a mercury-in-glass thermometer, which was shielded against radiant heat. Globe temperature (GT) was measured using a globe thermometer (hollow matt black sphere with a 15 cm diameter). The wet bulb globe temperature (WBGT) index was calculated as follows:

$$WBGT = 0.7 \text{ NWB} + 0.3 \text{ GT}$$

The data after being checked for accuracy were fed on a personal computer, and SPSS/PC+ program version 15 was used for analysis. The statistical tests used included Student's t-test, chi-square test, and Mantel-Haenszel chi-square test.

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