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Determination Some Biochemical Parameters as Biomarkers for Exposure to High Temperature in Bakery Workers

Eman Naji Saleh[1], Marwa Thear Abd[2], Othman Aeed Salih[3], Marwan Mahmood Saleh[4, a)], Nabeel Fawzi Lattoofi[4], Mohamed Abdel Rahman Farhan[4]

[1] College of Education for Women, University of Anbar, Al-Anbar, IRAQ
[2] Education College for Pure Sciences, University of Wasit, Wasit, IRAQ
[3] General Directorate of Education in Anbar, Ministry of Education, IRAQ
[4] College of Applied Sciences, University of Anbar, Al-Anbar, IRAQ

a) Corresponding author: ah.marwan_bio@uoanbar.edu.iq

ABSTRACT: The purpose of this study is to investigate the effects of continuous exposure to high temperatures on multiple biochemical variables in a group of bakery workers who are professionally exposed to heat continuously for extended periods while working in the bakery. The study included (50) bakery workers and (20) volunteers as a control group. The heat-exposed groups were divided into three groups based on age (15-25, 26-35 and 36-50 years). Their exposure to heat was calculated at an annual rate, with the overlapping effect of smoking on occupational workers exposed to heat. The efficacy of ALP, AST, ALT, total protein, bilirubin, creatine and urea was assessed according to the method included in the measurement kit manufactured by the French company BioMerieux. Cholesterol, triglycerides and HDL were measured by the enzymatic method used by SYRBIO in France. The results of the three age categories showed clear differences. The concentration of total protein, triglycerides and urea increased significantly ($P<0.05$) in workers exposed to heat in the second age categories. While the concentrations of liver enzymes (ALP, AST and ALT), cholesterol, bilirubin and low-density lipoproteins showed a significant ($P<0.05$) decrease in the second age category. compared to the control group. While the effect of smoking for workers exposed to heat showed a significant difference. A decrease in the level of an enzyme (ALT), cholesterol and high-density lipoprotein in the group of smokers. While a higher level of triglyceride was observed in the smoker group, compared with nonsmokers than those exposed to heat only, while the rest of the variables are taking the same direction in both groups. The results of the effect of the period of exposure to the temperature at a clear annual rate were significant as there was a significant ($P<0.05$) decrease in the level of (ALP and ALT), accompanied by an increase in the amount of total protein, cholesterol, low-density lipoproteins and triglycerides in the group who have been exposed to heat for more (15-30) years compared with the group who were exposed for fewer years (2-15). The biochemical alterations in the workers, which were strongly indicative of cellular damages, might have been a consequence of the exposure to high temperature.

Key words: high temperature; Bakeries; biochemical; smoking.

INTRODUCTION

Temperature is one of the environmental factors that have a direct impact on the human body, the temperature of the human body internal nearly 37 °C. This is an indication of the health of the body and its ability to give and when the temperature is increasing above this level, the body works to regulate this heat and secrete the sweat. Thermal pollution is a natural contaminant, it is in the form of heatwaves varying in wavelength and emitted in the form of energy moving in straight lines to a temperature above the absolute zero, and their wavelength depends on the temperature of the body radiating to them as heat emitted from the bakery [1]. light, temperature, humidity and atmospheric pressure are natural effects different from the chemical effects, as they do not need to enter the body to show their effect. The mere exposure of the body to it led to various diseases and may affect these natural factors in

certain organs of the body and lead to the occurrence of various diseases, Industrial workers exposed to high ambient temperatures due to technical atmospheric heating processes [2]. In such cases, such as bakery workers, the heat of the human body may prevent the loss of an appropriate amount of heat, which leads to an increase in heat, in which case it increases the means of heat loss. Attempts to dilate the blood vessels around the skin to raise the temperature of the skin and increase the amount of sweat to increase heat loss due to evaporation limit the body's ability to adapt, which can result in illness [3]. When an organism is exposed to different types of stress, thermal shock proteins are formed, including exposure to high temperatures and stress from different chemicals [4]. As a result, new research focuses on the study of metabolic and biochemical events in organisms exposed to high temperatures. Because they are essential for understanding the risks of environmental pollution and reflecting damage to cells, tissues, and their bodies [5]. A study of people with a heat stroke in the summer of Spain has shown a high concentration of urea in the blood, due to the effect of high temperature in serum proteins and their increased degradation [6]. Constant exposure to high temperatures increases the kinetic energy of all cells, which diffuses and disperses within the cells. It is capable of causing hydrolysis or accumulation of heat proteins in cells and in various organelles such as nuclei, mitochondria, and microorganisms [7]. Physiological responses in the body occur due to heat stress caused by increased skin temperature, sweating and increased heart rate [8]. In addition, many studies have reported impaired cognitive function in hot conditions as a possible cause of human error due to decreased attention and increased likelihood of dangerous behavior [9]. A recent study showed that high temperatures significantly affect the blood parameters of bakery workers [10]. Therefore, the present study aims to determine the effect of high temperature in a number of biochemical variables of the blood of workers in the bakery. High temperatures greatly affect Bloody parameters in bakery workers.

MATERIALS AND METHODS

Experimental Design

The study involved 50 randomly selected bakery workers who were exposed to high temperatures. This group was divided into three groups based on age. Worker's approvals were obtained before initiating the study. Specific information was also collected based on detailed questionnaires such as name, age, place of residence, work duration, daily exposure time and smoking status. Workers with chronic illnesses were excluded, besides 20 individuals who were not exposed to high temperatures (as a control group). This work was approved by local committee at University of Anbar.

Biochemical Analysis

The efficacy of ALP, AST, ALT, total protein, bilirubin, creatine and urea was assessed according to the method included in the measurement kit manufactured by the French company BioMerieux in Al-Ramady Teaching Hospital. Cholesterol, triglycerides and HDL were measured by the enzymatic method used by SYRBIO in France. The concentration of LDL and VLDL in serum was measured using the following equations [11]:

$$LDL = TC - (HDL + TG/5). \quad (1)$$
$$VLDL = \text{Triglyceride concentration} / 5 \quad (2)$$

Statistical Analysis

All data were analyzed by Statistical Package Social Science (SPSS) version 17.0. One-way ANOVA is used to show the mean differences between all samples (* $p \le 0.05$).

RESULT AND DISCUSSION

The results are shown in Figure 1 the effect of high temperature in some biochemical variables and compare them between the three age groups and control. Fig. 1(a) shows a significant($P<0.05$) decrease in serum ALP concentration in the serum of studied groups exposed to heat compared with a control group (89.05). The decline in the second age group was (67.35 IU/L). In Fig. 1(b) there was a relative increase in serum creatine and a decrease in the level of bilirubin in the second age group but did not rise to a significant ($P<0.05$) level. The results in Fig. 1(c) showed a relative increase in the concentration of total proteins and urea in the second age group, while there was a significant

decrease in LDL level (74.90 mg/dl) compared with a control group (81.88). In Fig. 1(d), a significant(P<0.05) decrease in cholesterol levels in the second age group (138.94 mg/dl) With a significant(P<0.05) increase in triglyceride levels in the first age group (144.23 mg/dl), while there were no significant (P<0.05) differences in HDL and VLDL among the three age groups and control group.
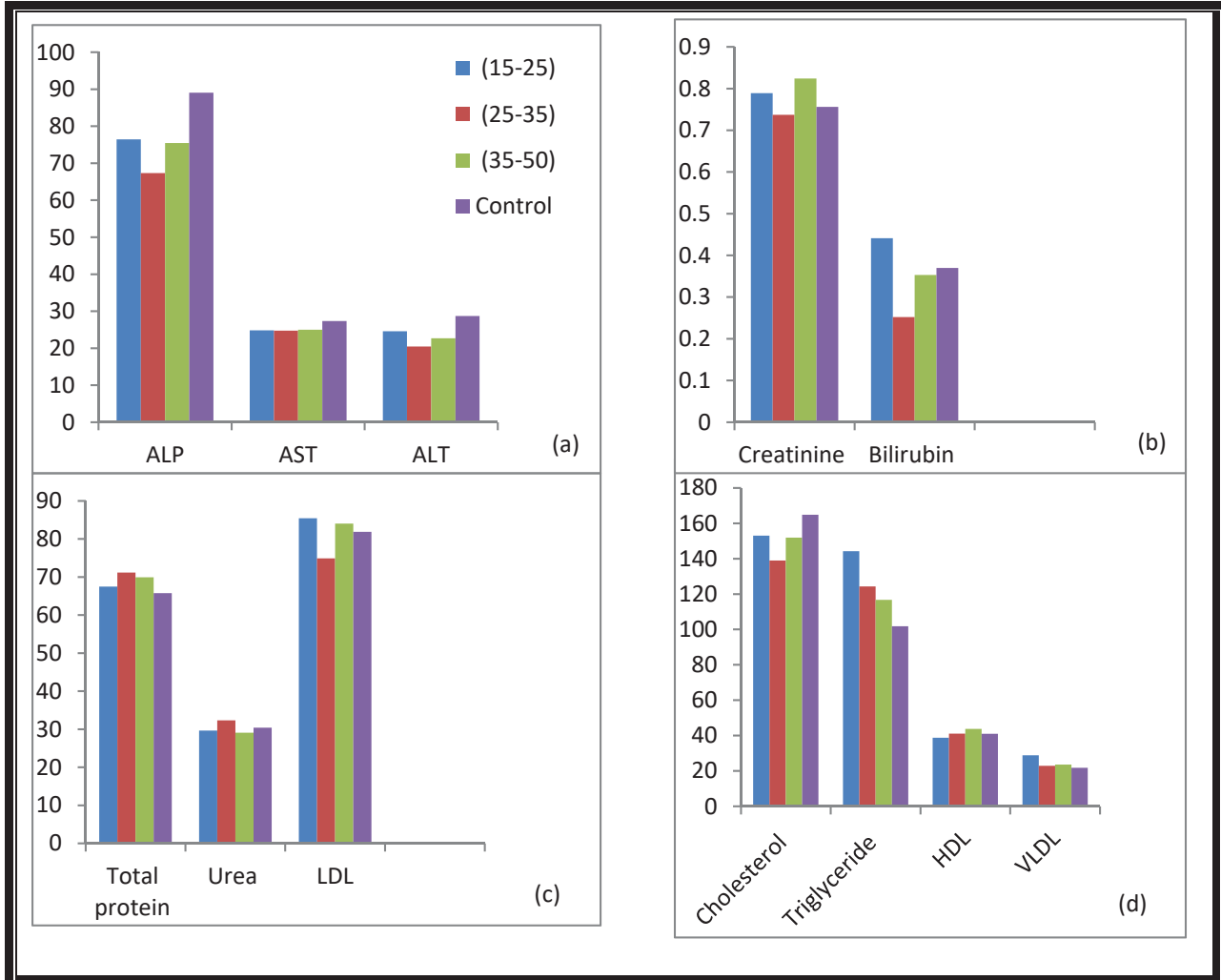

FIGURE 1. (a), (b), (c) and (d), Compare biochemical parameters between age groups.

The results are shown in Figure 2 show the effect of smoking in some biochemical variables for high temperature exposed workers. In Fig. 2(a) there were no significant (P<0.05) differences in the level of total proteins, urea, and low-density lipoproteins among smokers and non-smokers of workers. But Fig. 2(b) exhibited a significant (P<0.05) decrease in the ALT level enzyme in the group of smokers and the decrease was (15.64 IU/L) compared with a control group (25.64). In Fig. 2(c) the creatin concentration of the nonsmokers' group was relatively high but did not rise to a significant(P<0.05) level. While Fig. 2(d) showed a significant(P<0.05) decrease in cholesterol concentration (142.64 mg/dl) and high-density lipoproteins (34.64) of smokers, accompanied by a significant(P<0.05) increase in triglycerides (133.92).
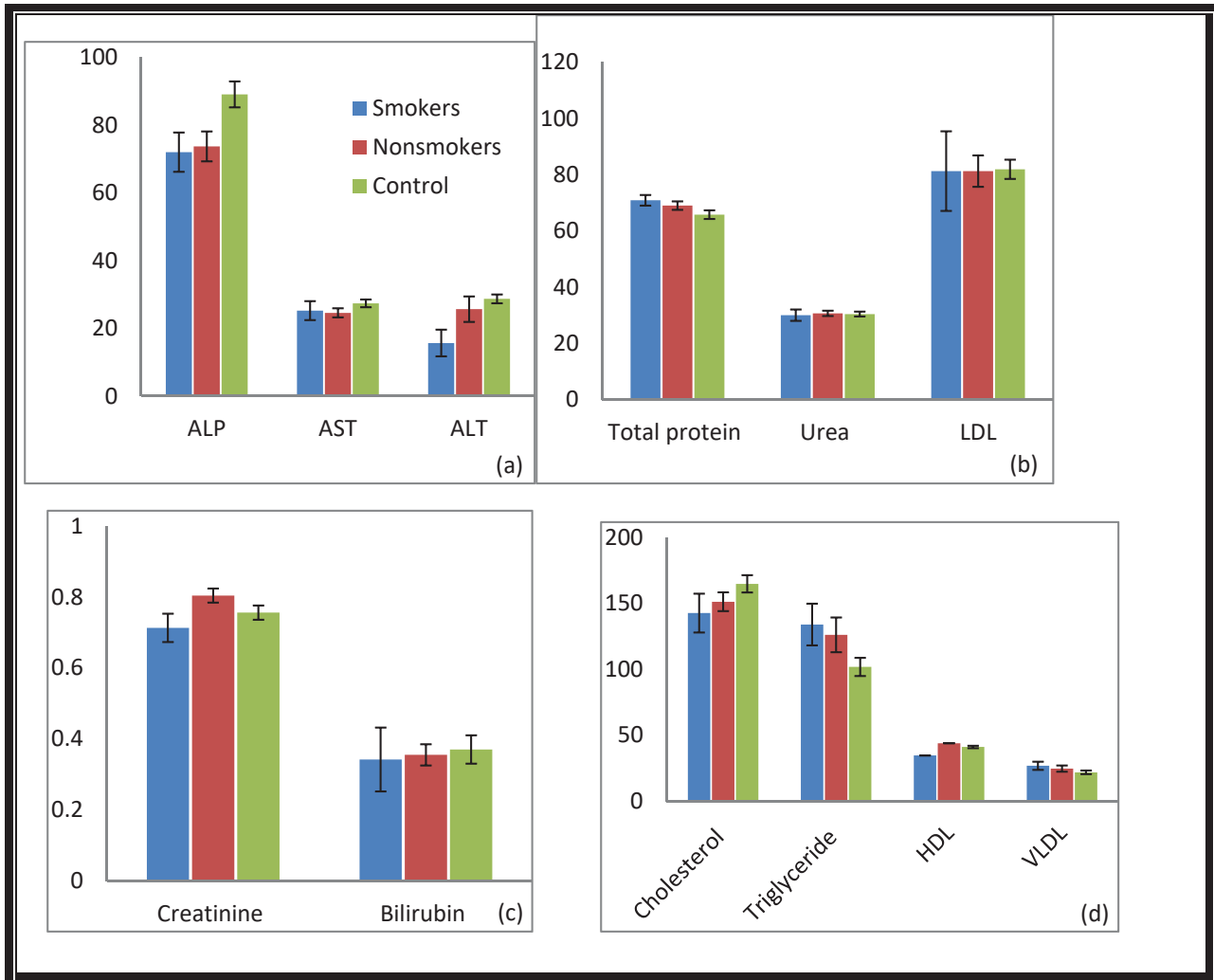
FIGURE 2. (a, b, c and d) Effect of smoking in Biochemical traits.

Figure 3 shows the effect of the period of exposure to high temperatures at an annual rate in several biochemical variables. The results of Fig. 3(a) exhibited a significant ($P<0.05$) decrease in ALP level (61.82 IU/L) and AST (20.36 IU/L). The decrease in the group exposed to heat in many years (15-30 years). The results of Fig. 3(b) showed a relatively high increase in the total protein intake (71.36 mg/dl) of the second group, accompanied by a significant ($P<0.05$) increase in the level of and low-density lipoprotein (93.25 mg/dl). While no significant ($P<0.05$) differences between the two groups were observed in Fig. 3(c) while the results of the Fig. 3(d) form showed a significant ($P<0.05$) decrease in the level of cholesterol (144.70 mg/dl)., accompanied by a significant ($P<0.05$) increase in triglycerides (144.72 mg/dl) in the group exposed to heat in many years compared to the first group exposed for less years, and the other variables took the same trend in both groups.
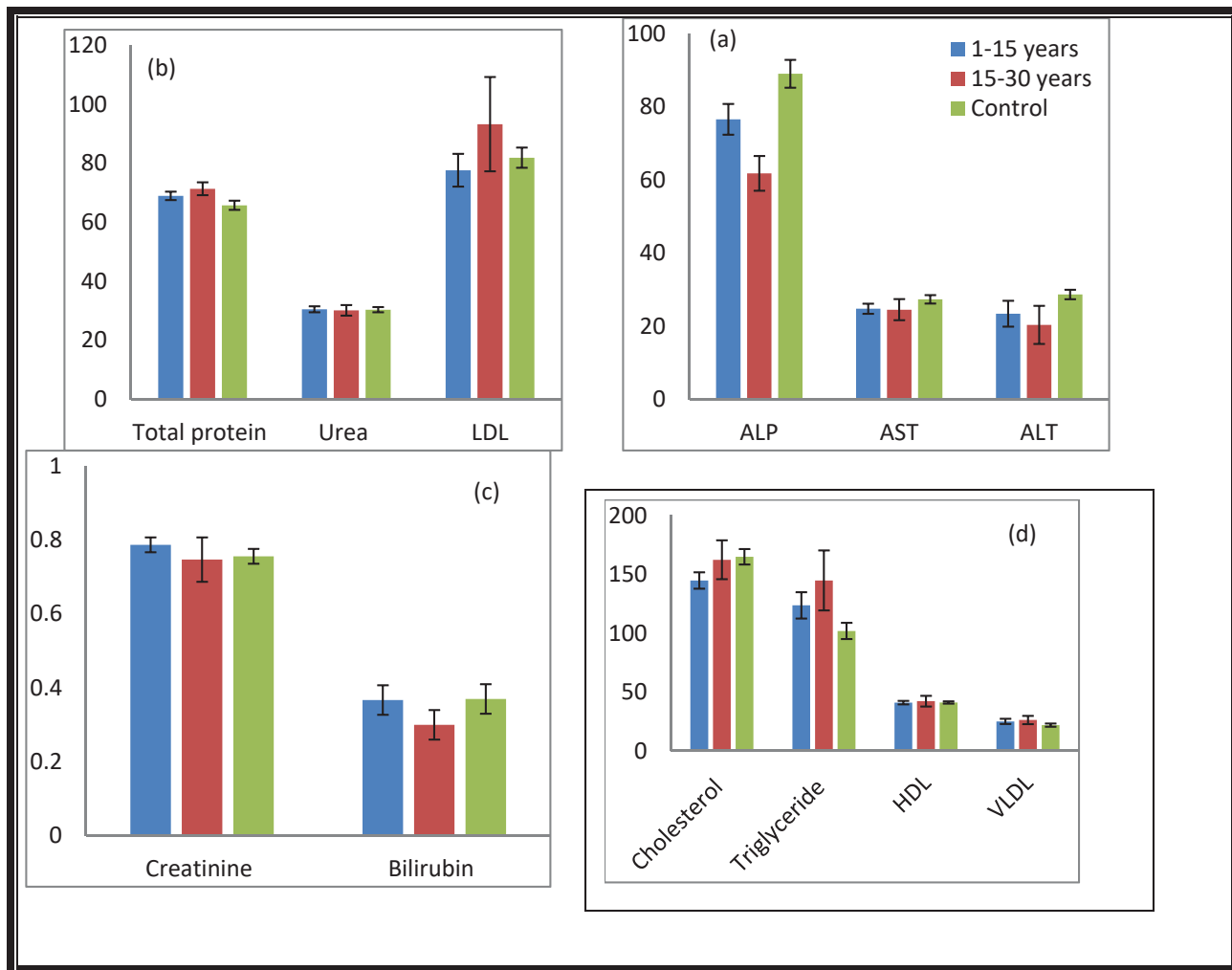
FIGURE 3. Effect of duration of work in Biochemical trait.

In the current study, we studied the effect of high temperature in several biochemical variables in the blood of workers in the bakery. The enzymatic activity in the blood was measured to assist in the overall assessment of the health status due to thermal pressure. A decrease in ALP, AST, and ALT was observed. The decrease in the effectiveness of these enzymes coincided with an increase in exposure time to heat, especially in the second age group of smokers. The results of our study are consistent with the results of a study that showed that a decrease in these enzymes indicates no liver damage, but may lead to a slowdown in liver function when exposed to heat pressure [12]. Regarding the function of the renal, there was a slight increase in creatin under high-temperature conditions although thermal stress had no significant effect on urea level, and this was consistent with the results of previous studies which explained that exposure to a temperature significantly increased serum creatine levels after different periods of thermal stress and this leads to damage to the muscles and the skeleton and is a result of disruption of the function and permeability of the cell membrane muscle [13,21]. The results of urea were similar to the results of several studies conducted during the summer season and showed that the values of urea were moderate during the summer season compared with other seasons, and maybe the highest level of urea during temperate temperatures due to increased efficiency in the digestion of food protein [14,17].

The results of creatin and urea that were verified were not statistically significant, and these differences may occur due to reduced air humidity that causes dehydration [15]. The results of our study were in line with the study, which proved that high temperatures lead to a low concentration of cholesterol in the serum of heat-exposed groups. All body

tissues can synthesize cholesterol, but its synthesis is concentrated in the liver, skin and intestinal lining cells, therefore, any defect in the function of the liver leads to a lower level of cholesterol than its normal level [16]. It also agrees with the findings of the study of the effect of continuous exposure to high temperatures of the employees of the General Company for the Glass Industry in Ramadi, which showed a decrease in cholesterol, LDL and HDL [17].

Higher temperatures above the normal level led to a series of systemic cellular responses, which led to higher values in the concentrations of total protein and triglycerides in the group of workers under the heat pressure and agrees with the conclusions reached by the results of the study in the dry season, which confirmed that the high temperatures in the summer season may be responsible for increased concentration of plasma protein [18]. On the other hand, the study revealed a decrease in total protein and albumin values during the summer season [19]. These results have clearly shown the negative effect of high temperature on the functions of important organs of the body, including the heart, liver and kidney. The enzymes of the amino group are important in the synthesis of non-essential amino acids and the release of energy from cell proteins. The irregularity of these enzymes and other variables is used to diagnose many cases of a disease in mammals [20].

CONCLUSION

In general, it is difficult to draw concrete conclusions about the heat stress of different types of studies and their adverse effects on cognitive ability in terms of learning procedures, task types, the timing of heat exposure, and so on. Also, functional performance depends on a person's reaction and sensitivity to heat. But the results of our study showed that the biochemical variables under study differed between the increase and decrease, indicating the effect of temperature which leads to disturbances in the metabolism of these variables. Acute heat stress affects blood chemistry and this indicates that it is likely to infect muscle cells during thermal stress.

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CONFLICT OF INTEREST

There is no conflict of interest.

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