

Hypertension in leather tanning workers working in Istanbul, Turkey

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ABSTRACT

Introduction: Leather tanning may result in various occupational diseases. The aim of this study was to compare the relation between blood pressure levels and vocations in leather tanning.

Methods: Our study was conducted in Turkey's leading leather process plant located in Tuzla organised industry zone, between March 11 and May 30, 2005. All leather plants that consented to participate in our study were included. The blood pressure, height and weight of the workers were measured. Their ages, educational levels, smoking habits and hypertension history were obtained via interviewing the subjects. The relation between three main factors, i.e. age, body mass index (BMI), working period, and hypertension were analysed through multiple logistic regression analysis.

Results: 40.4 percent (295) of 730 workers' blood pressure values were found to be within normal limits. 59.6 percent (435) were found to be hypertensive. The hypertension correlation remained significant, along with BMI and their working period (p-values were 0.0001 and 0.035, respectively).

Conclusion: Our study demonstrated that BMI and working period have a key influence on the increased risk of hypertension, which leads us to consider the importance of occupational exposure. Different hypertension studies to be conducted in various occupational fields would likely be able to confirm our findings.

Keywords: hypertension, leather tanning, occupational exposure, tanning workers

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process, the epidermis and subcutaneous tissues are removed and the dermal collagen fibres are stabilised. This is known as tanning.⁽¹⁾ Leather tanning includes various occupational diseases. Fungi, bacteria and pesticides are found in the leathers to be processed, as well as chemicals and dust during the processes cause various clinical forms. There have been numerous studies conducted concerning the frequent health problems that the leather tanning workers encounter (such as, cancer, dermatitis, asthma, chronic bronchitis, hypertension, chromosomal abrasion, back pains, metabolic syndrome, haemoglobin changes resulting from iron metabolism, DNA detriment in lymphocytes).⁽²⁻¹¹⁾ Hypertension among the leather tanning workers was found to be high, according to these studies.⁽¹¹⁾ In the light of this information, our study has focused on examining the correlation between the changes in leather tanning workers' blood pressures and their vocations.

METHODS

Our study was conducted between March 11 and May 30, 2005 in Turkey's leading leather process plant located in Tuzla organised industry zone. All leather plants that allowed our study to be conducted were included (no sampling was carried out). 77% (23) of 30 plants in this zone were contacted. 730 workers working in these 23 plants was studied. In these plants, the workers were rotated to all the tanning processes. Alcohol consumption and influence of noise were not evaluated and these are two of the limitations of the study.

The blood pressure, height and weight of the workers were measured. Data on their age, education level, smoking habits, past history of hypertension and whether or not antihypertension drugs were used, was obtained by interviewing the subjects. Smokers' smoking conditions were calculated by means of the Brinkman index (BI). For BI calculation, the daily smoking level was multiplied with the duration of smoking (year).⁽¹²⁾ The height and weight of the subjects were measured after they had removed their clothes and shoes. Height was measured with the workers barefoot, standing completely erect, and with their heels together. Body mass index (BMI) was calculated as weight (kg)/height² (m²). Subjects were

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INTRODUCTION

Leather production is one of the world's oldest trades, and consists of several chemical processes. During this

Table I. The demographic variables of tannery workers.

	Male (n = 646)	Female (n = 84)	Two-tailed p-value
Mean and SD age (years)	35.5 ± 8.7	36.8 ± 7.9	0.173
Education level (years)			
< 8	77.9 (n = 503)	59.5 (n = 50)	0.001
≥ 8	22.1 (n = 143)	40.5 (n = 34)	
Mean and so BMI (kg/m ²)	25.4 ± 3.4	25.6 ± 3.4	0.576
Mean working period (years)	13.3 ± 8.3	9.5 ± 5.8	0.0001
Existing smoking habit, no. (%)	317 (49.1)	25 (29.8)	0.001
Average no. of cigarettes smoked daily	16.0 ± 8.0	9.1 ± 5.4	0.0001
Brinkman index	242.50 ± 12.85	51.97 ± 102.91	0.0001
Hypertension*, no. (%)			
None	253 (39.2)	42 (50.0)	0.057
Available	393 (60.8)	42 (50.0)	

* includes BPs which are not found within normal limits.

categorised as underweight, normal, overweight or obese if BMI was < 18.5, between 18.5 and 24.9, between 25 and 29.9, or ≥ 30 kg/m², respectively.⁽¹³⁾

In a quiet and calm examination room, after having rested for minimum period of five minutes, the blood pressure (BP) of the workers standing in a wholly erect position was measured from the upper right arm through a standard aneroid (dial) tension tool (The cuff size was 25 cm × 13 cm). Initial Korotkoff was defined as voice systolic BP (SBP), and final Korotkoff voice was defined as diastolic BP (DBP). For the BPs that were found to be relatively high (systolic ≥ 120 mmHg and/or diastolic ≥ 80 mmHg), the subject was rested for 15 minutes and then the BP was re-measured. The measurements were carried out by the doctors who were involved in the study, and each result that was found to be relatively higher was re-measured by at least two doctors.^(14,15)

Diagnosis of high BP was via the criteria recommended by the The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure for individuals of both gender 18 years of age and older.⁽¹⁶⁾ Workers with measured BP readings were defined as follows: normal for SBP < 120 mmHg and DBP < 80 mmHg; prehypertension for SBP 120–139 mmHg and DBP 80–89 mmHg; stage I hypertension for SBP 140–159 mmHg and DBP 90–99 mmHg; and stage II hypertension for SBP ≥ 160 mmHg and DBP ≥ 100 mmHg.⁽¹⁶⁾ We questioned the workers with normal BP for past history of hypertension and whether or not antihypertensive drugs were previously used.

The obtained data were evaluated by using appropriate statistical methods. Chi square test was used for discrete variables, and Student's *t*-test was utilised for continual variables. Median value of continual variables, such as age, working period, BMI, and BI, were also calculated. Obtained median results were grouped as below and

above. Through this grouping method, the relationship between these variables turned to discrete variables and hypertension was examined. The results of the variables found significant by univariate analysis (age, working period and BMI) were evaluated by using logistic regression multivariate analysis.

RESULTS

646 (88.5%) of the subjects were male and 84 (11.5%) were female. They worked a fixed day shift with an eight-hour work day and five-day work week. The mean age was 35.6 ± 8.6 years. The distribution of the workers' age, education level, BMI, average working period, smoking habits and hypertension frequency rate by gender are listed in Table I. 463 (63.4%) of the workers had a history of cigarette consumption and 342 (46.8%) of the total workers were current smokers. Gender-oriented difference between the female and male workers in terms of their average age, BMI and hypertension frequencies, was not found to be significant. Compared to their male counterparts, the women's education levels found as "eight years or more" were significantly higher. The average working period, current smoking habit and average BI of the men, compared to their female counterparts, were found to be significant. 338 (46.3%) of all workers' BMI was found to be within normal limits, 11 (1.5%) were underweight, 307 (42.1%) were overweight, and 74 (10.1%) were obese.

Arterial hypertension was not found to be within normal limits in 36.4% of 11 underweight participants, 50.3% of 338 participants with normal BMI, 64.2% of 307 overweight participants and 86.5% of 74 obese participants. It was also found that the more their BMI values increased, the less their BP value remained within normal limits (chi square 39.49, *p* = 0.001). Evaluations of BP were: mean SBP was 116.04 ± 20.17 (range 70–220) mmHg, and mean DBP was 74.51 ± 11.80 (range 40–120)

Table II. Gender, age, BMI, working period, BI and hypertension.

	No. (%) normal BP	No. (%) high BP	Two-tailed p-value
Gender			
Male	253 (39.2)	393 (60.8)	0.057
Female	42 (50.0)	42 (50.0)	
Age (years)			
< 35	174 (47.4)	193 (52.6)	0.0001
≥ 35	121 (33.3)	242 (66.7)	
Working period (years)			
< 11	175 (48.1)	190 (51.9)	0.0001
≥ 11	119 (32.7)	245 (67.3)	
Median BMI (kg/m ²)			
< 25.19	183 (50.1)	182 (49.9)	0.0001
≥ 25.19	112 (30.7)	253 (69.3)	
Brinkmann index			
< 100	48 (54.5)	40 (40.5)	0.191
≥ 100	118 (46.5)	136 (53.5)	

mmHg. BP of 295 (40.4%) out of 730 workers were within normal limits; 435 (59.6%) were hypertensive, 308 (42.2%) were prehypertensive, 85 (11.6%) were found to have stage I hypertension, and 42 (5.8%) were found to have stage II hypertension. 20 (2.7%) workers reported to have been previously diagnosed by a doctor to have hypertension. Despite being on antihypertensive medication, BPs of 15 workers were still found to be high. Two of these workers' BP value was found to be within normal limits. Five workers were classified as having prehypertension, three workers with stage I, and ten with stage II hypertension. The average age of the 295 workers with normal BP was 33.83 ± 7.9 years, their average working years were 11.29 ± 7.32 . The average age of 435 workers with hypertension was 36.80 ± 8.8 years and their average working years were 13.83 ± 8.51 . The age and working years of the workers with hypertension were found meaningfully and statistically higher than those whose BPs measured within normal limits ($p = 0.0001$).

The correlation between hypertension and gender, age, working period, BMI and BI is summarised in Table II. The median for age, BMI, working period, and BI were calculated as 35 years, 25.19 kg/m², 11 years and 100, respectively. The univariate analysis demonstrated that the workers aged ≥ 35 years had meaningfully higher hypertension rates than those who were younger than 35 years ($p = 0.0001$). The same significant difference was also detected for those whose BMI value was ≥ 25.19 kg/m², compared to those whose BMI was < 25.19 kg/m². Hypertension frequency of the workers whose years of working were ≥ 11 was statistically and reasonably higher than those whose working period were < 11 years ($p = 0.0001$). We described age, working period and BMI as unpaired values which were found significant and we assumed hypertension as a paired value. We created

logistic regression models using these variables. When these three variables were analysed by using logistic regression, the relationship between hypertension and "BMI" and "working period" remained significant (p -values were 0.0001 and 0.035, respectively) The effect of the workers' age on hypertension risk was found irrelevant. The workers whose BMI values were ≥ 25.19 kg/m², hypertension was found to be 1.69 times more (95% confidence interval [CI] 1.42–2.68). For workers whose working period was ≥ 11 years, hypertension was found to be 1.46 times more prevalent (95% CI 1.028–2.074) (Table III).

DISCUSSION

The occupational diseases generated from the working environment can be prevented. The objective of work health studies is to protect the workers against the adverse effects in the working environment. Since the health of a worker is determined both by personal features and by working environmental factors, it is possible to protect the worker's health by keeping these factors under control. Specifying the problems in a working place is one of the main approaches of epidemiology.⁽¹⁷⁾ In our country, due to poor information dissemination on the vocational diseases, there is insufficient public knowledge concerning the levels of health problems in many fields of business. Hence, explanatory studies are fairly precious for our country. Many people work in the leather industry in our country. According to the Ministry of Labour data, the number of workers employed in the leather industry in 2005 was 80,716, and the percentage of unionised workers was 20.6% (16,640 persons).⁽¹⁸⁾ In the leather industry, from the production to processing phase, various kinds of chemicals, particularly chrome, are utilised. During the cutting process, the salt is extracted and the working

Table III. Logistic regression analysis of the correlation between hypertension and age, BMI and working period.

	B-coefficient	Standard error	Odds-ratio	95% CI	p-value
Median age (years)					
< 35	-0.271	0.182	1.00		0.137
≥ 35			0.762	0.533–1.090	
Median BMI (kg/m ²)					
< 25.19	0.673	0.161	1.00		0.0001
≥ 25.19			1.960	1.42–2.688	
Median working period (years)					
< 11	0.378	0.179	1.00		0.035
≥ 11			1.460	1.028–2.074	

environment is mostly too noisy, all of which influences the health of the worker adversely.

According to the results of our study aiming at detecting the prevalence of hypertension among the leather tanning workers, the mean age of 730 workers was 35.6 ± 8.6 years. The average age was reported as 32 years in the study by Shukla et al on 577 leather workers.⁽¹⁹⁾ In our study, 11 (1.5%) participants had a BMI < 18.5 kg/m². In contrast, Ory et al's study conducted in 1988 found that 56% of the workers in Kanpur, India had a BMI < 18.5 kg/m² (the cut-off value for malnutrition). In 1994, the proportion of malnourished workers had decreased to 41%, being statistically significantly lower than in 1988.⁽²⁰⁾ In our study, 46.3% (338) of all workers' BMIs were found to be within normal limits and 42.1% of them were found to be overweight. In Corderio et al's study, only 58% of the workers showed BMI within normal limits, and being overweight was the most frequent alteration.⁽²¹⁾

In our study, 63.4% of the workers had a past history of smoking, and 46.8% of the workers still had the smoking habit. As almost half of the workers in our study group had a smoking habit, taking their worksite conditions into account, this was defined as a crucial health problem. The study by Corderio et al conducted in Brazil revealed that one-third of leather workers had a smoking habit, one-third of the workers used to smoke but quit afterwards, and the remaining one-third of their workers had never smoked.⁽²¹⁾ Controlling the smoking habit, as it has a synergistic influence on health problems such as respiratory system diseases, is quite important to structuring healthy worksites.

The worksite can offer excellent opportunities for implementing smoking cessation programmes. In fact, numerous studies have shown that worksite programmes are more successful than clinic-based programmes, because employer-sponsored programmes are more intense in nature and they offer economic and/or other incentives. It is also indicated that the elimination of occupationally-related chronic lung diseases and cancer frequently cannot

proceed without efforts to convert the smokers into ex-smokers. Furthermore, worksite interventions, including smoking cessation programmes, can produce lasting changes in reducing some cardiovascular risk factors for the employees.⁽²²⁾ 40.4% of the workers' BP values were within normal limits. 59.6% were found to have hypertensive, 42.2% were hypertensive, 11.6% were found to have stage I hypertension, and 5.8% were found to have stage II hypertension. In Corderio et al's study conducted on a group of workers, high BP prevalence was found in 56.1% and isolated systolic hypertension was detected in 15.8% of workers. This value is much higher than those who work in other business fields.⁽¹¹⁾ In the Corderio and Lima Filho's study concerning the correlation between working period and BP of leather tanning workers, a 1.5 mmHg increase in DBP was detected for each passing year. They indicated that this increase was twice as much as the expected actual increase.⁽²³⁾ Corderio et al indicated that hypertension frequency of the leather tanning workers which was 56.1% in 1993 gradually decreased and finally declined to 29.2% in 2000. This decline was explained by the hypertensive symptoms being detected and treated through the regular annual follow-up, and the workers becoming healthier.⁽²¹⁾

The Turkish adult risk factor study (TEKHARF), the most comprehensive hypertension study conducted in our country, showed that the prevalence of hypertension in the cohort was 40% for males and 51.6% for females.⁽²⁴⁾ The hypertension frequency found in our study was higher compared to the normal population. Because there is yet no local study conducted on hypertension frequency within various business fields in Turkey, it was not possible to compare the hypertension rates of the leather tanning workers with those of other occupations. The correlation between arterial BP and gender, age, working period, BMI and BI is summarised in Table II. The univariate analysis demonstrated that workers aged ≥ 35 years had meaningfully higher rates than those who were < 35 years of age ($p = 0.0001$). The same meaningful difference

was also detected for those whose BMI was ≥ 25.19 kg/m², compared to those whose BMI was < 25.19 kg/m². Hypertension frequency of the workers whose working period was ≥ 11 years was statistically and reasonably higher than those whose working period was < 11 years ($p = 0.0001$). When these three variables were analysed by using logistic regression, the relationship between hypertension and “BMI” and “working period” remained meaningful (p -values were 0.0001 and 0.035, respectively). The effect of the workers’ age on hypertension risk was found to be irrelevant (Table III). Our study demonstrated that both BMI and working period have a key influence on the increase of hypertension risk, which leads us to consider the importance of vocational exposure, as Corderio and Lima Filho’s study had implied.⁽²³⁾ Different hypertension studies to be conducted in various occupational fields would likely clarify our knowledge in this area.

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