

Clinical Trial

Rosacea and exposure to tandoor heat: Is there an association?

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Abstract

Background Particularly in eastern and southeastern regions of Turkey, women use tandoor ovens to bake bread and as a result are exposed to excessive heat. Exposure to heat for long periods may lead to the initiation or exacerbation of rosacea.

Objectives The aim of this study was to investigate whether there is a relationship between exposure to heat from a tandoor and rosacea.

Methods A total of 350 female patients with various dermatological diseases were included in this study. These patients were divided into two groups comprising a control group and a group of tandoor users. Subjects in both the control and tandoor-user groups were screened to identify clinical and other characteristics, and symptoms and findings of rosacea and other dermatological disorders.

Results The frequency of rosacea was significantly ($P < 0.001$) higher and that of acne markedly ($P < 0.001$) lower in the tandoor-user group than in the control group. Incidences of temporary and persistent types of erythema and telangiectasia, which are considered to be among the symptoms and findings of rosacea, were also significantly ($P < 0.001$) higher in the tandoor-user group than the control group. Frequencies of asthma and ex-smoker status differed significantly ($P < 0.001$ and $P < 0.002$, respectively) between the tandoor-user and control groups. Furthermore, the period of exposure to tandoor heat was positively correlated with the frequency of telangiectasia ($r = 0.321$, $P < 0.01$).

Conclusions Our study revealed a strong association between exposure to tandoor heat and rosacea. Further studies including higher numbers of patients are required to confirm our results.

Introduction

Rosacea is a common disease characterized by the occurrence of temporary or permanent facial erythema, telangiectasia, papules, and pustules.¹ It affects approximately 10% of the population. Its prevalence is higher in light-skinned people, and it is particularly common in northern Europe. The age of onset of the disease is 20–50 years. Although rosacea mostly affects women, its clinical symptoms are more severe in men.² According to a recent study reported by the National Rosacea Society Expert Committee,³ at least one symptom (temporary erythema or flushing) or finding (persistent erythema, papules and pustules, or telangiectasia) is needed for the diagnosis of rosacea (Figs. 1 and 2).

The exact pathogenesis of rosacea is still unknown. Several changes occur in blood vessels and their peripheral tissues as a result of repeated vasodilatation. The most important alterations concern impairments in the

regulatory function of vessels, the invasion of inflammatory cells, and the addition of microorganisms and parasites such as *Helicobacter pylori* and *Demodex follicularum*, which play important roles in the development of rosacea.^{4–6} Exposure to both heat and cold, sunlight, wind, emotional changes, alcohol, spicy foods, cosmetics, exercise, topical irritants, menopausal flushing, and some drugs are primary factors that trigger rosacea.⁷ Wilkin⁸ reported heat exposure to be the principal factor in the onset of rosacea, whereas Bae *et al.*⁴ cited sunlight as the primary factor. However, the symptoms and findings of rosacea are known to be exacerbated by bathing in hot water and by the consumption of hot food, especially in women.

The tandoor is a pit-like structure made of clay that is frequently used by women in east and southeast Anatolia to bake bread (Figs. 3 and 4). Its temperature reaches approximately 400 °C.⁹ Because the face of a person using a tandoor is exposed to the heat emitted by the



Figure 1 Rosacea on the face of a patient with telangiectasia and erythema



Figure 2 Active form of erythematotelangiectatic rosacea with persistent erythema

oven, capillary vasodilatation is especially likely to occur in this area. Recurrent capillary vasodilatation has been asserted to cause permanent telangiectasia (an important finding of rosacea).⁴



Figure 3 A woman baking bread in a tandoor



Figure 4 The tandoor is a pit-like structure made of clay

In this study, we aimed to investigate whether there is a relationship between rosacea and exposure to tandoor heat in women. This is the first such investigation to be reported in the literature.

Materials and methods

A total of 350 female patients examined at the dermatology outpatient clinic of Yuzuncu Yil University (Van, Turkey) for various dermatological disorders during the period from August 2012 to May 2013 were included in the present study. Their mean $\pm$ standard deviation (SD) age was 43.88 ± 15.6 years (range: 18–80 years). Patients were divided into two groups consisting of, respectively, control subjects and tandoor users.

The tandoor-user group comprised 200 women (mean $\pm$ SD age: 43.56 ± 13.5 years; range: 18–80 years) who were exposed to tandoor heat. The remaining 150 women were included in the control group (mean $\pm$ SD age: 44.32 ± 14.6 years; range: 19–78 years). Because the tandoor is more commonly used in rural areas, most of the women included in both groups lived in villages. The actual reasons of all patients for attending the dermatology outpatient clinic were noted. Fitzpatrick skin type (FST) and symptoms and findings of rosacea, including flushing, telangiectasia, papules, pustules, and persistent erythema localized in the facial region, were recorded. The total period of exposure (with monthly exposure times) to tandoor heat was noted for each individual. All patients were asked about their use of cigarettes, alcohol, and any drugs. In addition, data on the presence of any systemic disease and body mass index (BMI) were recorded for all subjects. The study was approved by the local ethics committee and was conducted according to the ethical principles of the Declaration of Helsinki.

Statistical analysis

Descriptive statistics for the continuous variables studied (characteristics) are presented as the mean $\pm$ SD and as minimum and maximum values. Categorical variables are presented as counts and percentages. One-way analysis of variance (ANOVA) was used to compare categorical variables. After one-way ANOVA, Duncan's test was utilized to determine different groups. Pearson's correlation analysis was carried out to examine linear relationships among the continuous variables. Pearson's chi-squared test was also used to indicate relationships among categorical variables. In addition, odds ratios and relative risk were calculated for 2×2 tables. A P -value of <0.05 was considered to indicate statistical significance. SPSS for Windows Version 13.0 (SPSS, Inc., Chicago, IL, USA) was used for all statistical computations.

Results

Mean $\pm$ SD BMI in the tandoor-users group was significantly higher than that in the control group (26.5 ± 13.5 kg/m² and 23.1 ± 11.3 kg/m², respectively; $P < 0.01$). Mean age was similar in both groups. Data on clinical and other characteristics in the tandoor-user and control groups are presented in Table 1. The incidence of FST I was significantly lower in the tandoor-users group than in the control group ($P < 0.034$). In addition, frequencies of asthma and ex-smoker status differed significantly ($P < 0.001$ and $P < 0.002$, respectively) between the groups.

Rates of rosacea symptoms in the tandoor-users and control groups are presented in Table 2. Incidences of all symptoms other than papules and pustules differed significantly ($P < 0.001$) between the groups.

Table 1 Clinical characteristics of the tandoor-users and control groups

	Tandoor-users group (n = 200) n (%)	Control group (n = 150) n (%)	P-value
Fitzpatrick skin type			
I	3 (1.5%)	9 (6.0%)	0.034
II	74 (37.0%)	50 (33.3%)	NS
III	108 (54.0%)	78 (52.0%)	NS
IV	15 (7.5%)	13 (8.7%)	NS
Smoking status			
Non-smoker	112 (56.0%)	96 (64.0%)	NS
Current smoker	62 (31.0%)	48 (32.0%)	NS
Ex-smoker	26 (13.0%)	6 (4.0%)	0.002
Alcohol consumption	0	0	NS
Comorbidities			
Diabetes mellitus	8 (4.0%)	6 (4.0%)	NS
Hypertension	18 (9.0%)	10 (6.7%)	NS
Depression	21 (10.5%)	13 (8.7%)	NS
Asthma	35 (17.5%)	10 (6.7%)	0.001
Co-medication used			
Beta-blockers	16 (8.0%)	8 (5.3%)	NS
CCBs	15 (7.5%)	9 (6.0%)	NS
Paracetamol	96 (48.0%)	68 (45.3%)	NS
NSAIDs	110 (55.0%)	79 (52.7%)	NS

CCB, calcium channel blockers; FST, Fitzpatrick skin type; NS, not significant; NSAIDs, nonsteroidal anti-inflammatory drugs.

Incidences of rosacea symptoms and findings were compared in the tandoor-users group according to FST (Table 3). Flushing, telangiectasia, and persistent erythema were mostly detected in patients with FSTs I and II in this group.

The distributions of dermatological diseases in the tandoor-users and control groups are presented in Table 4. The frequency of rosacea was significantly ($P < 0.001$) higher and that of acne markedly ($P < 0.001$) lower in the tandoor-users group than in the control group.

In the tandoor-users group, the mean $\pm$ SD period of exposure to tandoor heat was 16.44 ± 11.5 years (range: 1–50 years). This period was correlated with the occurrence of telangiectasia ($r = 0.321$, $P < 0.01$). The mean $\pm$ SD number of times per month members of the tandoor-users group were exposed to tandoor heat was 3.58 ± 2.3 (range: 1–12 times). No correlation between rosacea symptoms and exposures per month was determined.

Discussion

Rosacea is a disease commonly seen in middle-aged women. It includes four subclinical types:

Table 2 Rates of rosacea symptoms and findings in the tandoor-users and control groups

Rosacea symptoms and findings	Tandoor-users group (n = 200) n (%)	Control group (n = 150) n (%)	P-value
Flushing	120 (60.0%)	16 (10.7%)	0.001
Persistent erythema	146 (73.0%)	85 (56.7%)	0.001
Telangiectasia	148 (74.0%)	45 (30.0%)	0.001
Papules and pustules	29 (14.5%)	28 (18.7%)	NS

NS, not significant.

erythematotelangiectatic rosacea; papulopustular rosacea; phymatous rosacea, and ocular rosacea. Because it presents in these different clinical forms, the precise incidence of the disease is not known.¹⁰ In addition to the aforementioned clinical types, there is a further variant of rosacea known as granulomatous rosacea.³ This study represents the first investigation to be reported in the literature into the existence of a relationship between rosacea and exposure to tandoor heat.

As Table 1 shows, asthma was significantly more common in the tandoor-users group than in the control group. This may be attributed to the detrimental effects of tandoor smoke and is consistent with the findings of earlier studies in which different obstructive lung diseases including asthma were reported to be related to exposure to tandoor smoke.^{11–13} Further, status as an ex-smoker was also detected more frequently in the tandoor-users group than in the control group. This may relate to the higher frequency of tandoor smoke-induced asthma detected in this group. Fitzpatrick skin types I–IV were detected in participants included in the current study, whereas FSTs V and VI were not. The most common skin type was FST III. These results are in line with the skin type profile of the Turkish population.¹⁴

Table 4 Distributions of dermatological disorders in the tandoor-users and control groups

Diagnosis	Tandoor-users group (n = 200) n (%)	Control group (n = 150) n (%)	P-value
Acne	6 (3.0%)	25 (16.7%)	0.001
Eczema	43 (21.5%)	44 (29.3%)	NS
Rosacea	73 (36.5%)	8 (5.3%)	0.001
Pigmentation diseases	17 (8.5%)	14 (9.3%)	NS
Papulosquamous diseases	10 (5.0%)	8 (5.33%)	NS
Hair diseases	7 (3.5%)	6 (4.0%)	NS
Benign vs. malignant tumors	12 (6.0%)	5 (3.3%)	NS
Infections (viral, bacterial, fungal)	15 (7.5%)	12 (8.0%)	NS
Vesiculobullous diseases	6 (3.0%)	2 (1.3%)	NS
Others (allergic diseases, photo-dermatology, autoimmune diseases)	11 (5.5%)	35 (23.3%)	0.001

NS, not significant.

Symptoms and findings of rosacea, such as flushing, telangiectasia and persistent erythema, were observed significantly more often in the tandoor-users group than in the control group (Table 2). These occurrences may have resulted from excessive heat exposure in the tandoor-users group because exposure to heat is reported to have an important relationship with rosacea.^{1,15,16} Vasodilatation occurs as the result of heat exposure. Repeated vasodilatation leads to angiogenesis, which also plays an important role in the pathogenesis of rosacea. The post-capillary venules are activated by repeated vasodilatation. This activation leads to the generation of protein and aggregation of leukocytes, after which selectin and cell adhesion molecules are released and stimulate angiogenesis.^{17,18} In a previous

Table 3 Rates of rosacea symptoms and findings in the tandoor-users group according to Fitzpatrick skin type (FST) (n = 200)

Skin type	Flushing n (%)	Persistent erythema n (%)	Telangiectasia n (%)	Papules and pustules n (%)
FST I (n = 3)	3 (100%)	3 (100%)	3 (100%)	0
FST II (n = 74)	56 (75.7%)	71 (95.9%)	63 (85.1%)	19 (18.9%)
FST III (n = 108)	60 (55.6%)	70 (64.8%)	81 (75.0%)	14 (13.0%)
FST IV (n = 15)	1 (6.7%)	2 (13.3%)	1 (6.7%)	1 (6.7%)
Comparisons, P-values				
FST I vs. FST II	0.001	0.077	0.001	0.001
FST I vs. FST III	0.001	0.001	0.001	0.001
FST I vs. FST IV	0.001	0.001	0.001	0.301
FST II vs. FST III	0.004	0.001	0.084	0.035
FST II vs. FST IV	0.001	0.001	0.001	0.02
FST III vs. FST IV	0.001	0.001	0.001	0.382

study, biopsies obtained from lesional and non-lesional skin of patients with non-phymatous rosacea were compared using immunohistochemical techniques.¹⁸ Dermal expression of vascular endothelial growth factor (VEGF) was found to be significantly higher in lesional skin. This high expression of VEGF was reported to play a role in the occurrence of some findings in rosacea, such as telangiectasia and erythema.¹⁸ In our study, the high frequencies of telangiectasia, flushing, and persistent erythema detected in the tandoor-users group may be associated with repeated vasodilatation resulting from exposure to tandoor heat over a long time. Oral exposure to heat (oral-thermal theory) has also been reported to be involved in the pathogenesis of rosacea.⁸ According to oral-thermal theory, heat increases in the internal jugular vein during the consumption of hot drinks, after which increased heat is transmitted through the common carotid artery and internal carotid artery. Finally, the hypothalamus and tympanic membrane are stimulated and flushing occurs.⁸ Women lower their heads into the tandoor opening in the course of baking bread. This results in increased heat in the oral cavity and flushing occurs. Repeated attacks of flushing cause permanent telangiectasia. The results obtained in our study support the premise outlined in oral-thermal theory.

Rosacea is more common in light-skinned people and is rarely seen in Black individuals.^{19,20} In our study, most participants had FST III. However, rosacea symptoms were most commonly seen in subjects with FST II. There was a significant difference between the tandoor-users and control groups in the number of subjects with FST I ($n = 3$ and $n = 9$, respectively). This difference may be attributed to tandoor heat. In a study conducted by Nakazawa *et al.*,²¹ heat exposure was reported to induce melanogenesis. This trial investigated the influences of both heat and ultraviolet B (UVB) exposure on melanogenesis in cell culture and determined both to have similar effects.²¹ Heat was found to stimulate melanogenesis by increasing the number of dopa-positive melanocytes and tyrosinase-related protein in co-culture with keratinocytes. Moreover, the higher rate of dark pigmentation in patients with erythema ab igne indicates the role of heat exposure in the occurrence of pigmentation.²² When subjects with FSTs II, III, and IV were compared, rosacea symptoms were found to be significantly higher in those with FST II (Table 3). The results of our study support the opinion that rosacea is more common in light-skinned people.

As Table 4 shows, among patients admitted to our outpatient clinic, the frequency of rosacea was significantly higher and that of acne markedly lower in the tandoor-users group than in the control group. Exposure to

excessive heat may have given rise to an increase in the frequency of rosacea in the tandoor-users group. *Propionibacterium acne* plays an important role in the pathogenesis of acne disease. This bacterium is known to lose viability in high temperatures.²³ Thus, the low frequency of acne disease observed in the tandoor-users group in the present study may be related to the high temperature of the tandoor. This result is consistent with the findings of a study of Al-Ameer and Al-Akloby,²⁴ in which acne symptoms were reported to decrease in summer.

In an earlier study reported by Guzman-Sanchez *et al.*,²⁵ the affected skin of patients with rosacea was found to have a lower heat-induced pain threshold and higher skin blood flow than non-affected skin. In our study, we also clinically observed that patients with rosacea had greater intolerance to solar heat, topical drugs and cosmetics, and hot environments such as bathrooms and tandoor ovens. Thus we suggest that the heat-induced pain threshold is reduced in these patients. In a manner consistent with the results of Guzman-Sanchez *et al.*,²⁵ the higher representation of rosacea in the tandoor-users group in the present study may reflect a high skin blood flow related to exposure to tandoor heat. As a result of fast skin blood flow and vasodilatation related to increased heat, transient erythema develops. If exposure to tandoor heat continues for long periods, permanent erythema and telangiectasia will eventually occur.

In a previous study conducted in rats, exposure to UVB was found to increase telangiectasia in the skin.²⁶ Histopathological findings in this trial revealed such telangiectasia to be similar to the telangiectasia occurring in rosacea. Bae *et al.*⁴ also suggested a relationship between sun exposure and rosacea. Some researchers have asserted that sun-generated heat has more impact than sunlight in the etiopathogenesis of rosacea.^{27,28} Our findings are consistent with those of earlier studies because we noted a positive correlation between the duration of tandoor heat exposure and telangiectasia among patients in the tandoor-users group.

In conclusion, the present study reveals a strong association between tandoor use and rosacea and establishes that exposure to heat for long periods can trigger this disease. People with particularly light skin who work in hot environments must be careful to avoid the development of rosacea. Further studies that include higher numbers of patients are required to confirm our results.

References

- 1 Crawford GH, Pelle MT, James WD. Rosacea: I. Etiology, pathogenesis, and subtype classification. *J Am Acad Dermatol* 2004; 51: 327–341.

- 2 Gupta AK, Chaudhry MM. Rosacea and its management: an overview. *J Eur Acad Dermatol Venereol* 2005; **19**: 273–285.
- 3 Wilkin J, Dahl M, Detmar M, et al. Standard classification of rosacea: report of the National Rosacea Society Expert Committee on the Classification and Staging of Rosacea. *J Am Acad Dermatol* 2002; **46**: 584–587.
- 4 Bae YI, Yun SJ, Lee JB, et al. Clinical evaluation of 168 Korean patients with rosacea: the sun exposure correlates with the erythematotelangiectatic subtype. *Ann Dermatol* 2009; **21**: 243–249.
- 5 Pelle MT, Crawford GH, James WD. Rosacea: II. Therapy. *J Am Acad Dermatol* 2004; **51**: 499–512.
- 6 Wilkin JK. Rosacea. Pathophysiology and treatment. *Arch Dermatol* 1994; **130**: 359–362.
- 7 Pelle MT. Rosacea. In: Goldsmith LA, Katz SI, Gilchrist BA, et al., eds. *Fitzpatrick's Dermatology in General Medicine*, 8th edn. New York, NY: McGraw-Hill, 2012: 918–925.
- 8 Wilkin JK. Oral thermal-induced flushing in erythematotelangiectatic rosacea. *J Invest Dermatol* 1981; **75**: 15–18.
- 9 Albayrak Y, Cakır C, Albayrak A, et al. A comparison of the morbidity and mortality of tandir burns and non-tandir burns: experience in two centers. *Ulus Travma Acil Cerrahi Derg* 2011; **17**: 323–328.
- 10 Webster GF. Rosacea and related disorders. In: Callen PJ, Horn TD, Mancini AJ, et al., eds. *Dermatology*, 2nd edn. Madrid: Mosby Elsevier, 2008: 509–516.
- 11 Cimrin AH, Karaman C. Does exposure to biomass and occupational dust causative for asthma among women? *Tuberk Toraks* 2011; **59**: 388–391.
- 12 Babal'k A, Bak'rc' N, Taylan M, et al. Biomass smoke exposure as a serious health hazard for women. *Tuberk Toraks* 2013; **61**: 115–121.
- 13 Uzun K, Ozbay B, Ceylan E, et al. Prevalence of chronic bronchitis-asthma symptoms in biomass fuel exposed females. *Environ Health Prev Med* 2003; **8**: 13–17.
- 14 Ilter N, Öztas MO, Ad'şen E, et al. Evaluation of sun protection habits and melanocytic nevi of population screened in a shopping mall in Ankara. *Türkderm* 2009; **43**: 155–159.
- 15 Soybe P. Aetiology and pathogenesis of rosacea. *Acta Derm Venereol* 1950; **30**: 137–153.
- 16 Rebora A. Rosacea. *J Invest Dermatol* 1987; **88**: 56–60.
- 17 Steinhoff M, Schaubert J, Leyden JJ. New insights into rosacea pathophysiology: a review of recent findings. *J Am Acad Dermatol* 2013; **69**: 15–26.
- 18 Gomaa AH, Yaar M, Eyada MM, et al. Lymphangiogenesis and angiogenesis in non-phymatous rosacea. *J Cutan Pathol* 2007; **34**: 748–753.
- 19 Berth-Jones J. Rosacea, perioral dermatitis and similar dermatoses, flushing and flushing syndrome. In: Burns T, Breathnach S, Cox N, Griffiths C, eds. *Rook's Textbook of Dermatology*, 8th edn. Oxford: Wiley-Blackwell 2010; 43.1–43.9.
- 20 Rosen T, Stone MS. Acne rosacea in blacks. *J Am Acad Dermatol* 1987; **17**: 70–73.
- 21 Nakazawa K, Sahuc F, Damour O, et al. Regulatory effects of heat on normal human melanocyte growth and melanogenesis: comparative study with UVB. *J Invest Dermatol* 1998; **110**: 972–977.
- 22 Takashima S, Iwata H, Sakata M, et al. Widespread erythema ab igne caused by hot bathing. *J Eur Acad Dermatol Venereol* 2014; doi: 10.1111/jdv.12558. [Epub ahead of print.]
- 23 Ratkowsky DA, Olley J, McMeekin TA, et al. Relationship between temperature and growth rate of bacterial cultures. *J Bacteriol* 1982; **149**: 1–5.
- 24 Al-Ameer AM, Al-Akloby OM. Demographic features and seasonal variations in patients with acne vulgaris in Saudi Arabia: a hospital-based study. *Int J Dermatol* 2002; **41**: 870–871.
- 25 Guzman-Sanchez DA, Ishiuiji Y, Patel T, et al. Enhanced skin blood flow and sensitivity to noxious heat stimuli in papulopustular rosacea. *J Am Acad Dermatol* 2007; **57**: 800–805.
- 26 Bielenberg DR, Bucana CD, Sanchez R, et al. Molecular regulation of UVB-induced cutaneous angiogenesis. *J Invest Dermatol* 1998; **111**: 864–872.
- 27 Marks R. Concepts in the pathogenesis of rosacea. *Br J Dermatol* 1968; **80**: 170–177.
- 28 Nunzi E, Rebora A, Hamerlinck F, et al. Immunopathological studies on rosacea. *Br J Dermatol* 1980; **103**: 543–551.