Quality of Life in Danish Blood Donors Treated for Superficial Fungal Infections

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SHORT COMMUNICATION

Superficial fungal infections (SFI) of the skin, nails or hair are treated with topical or systemic antifungal drugs (1). Physical symptoms, such as itch, pain and hair loss, can lead to impaired quality of life (QoL) in patients with SFI (2). Previous studies on QoL in patients with SFI have either focused exclusively on nail infections (2) or patients treated in hospitals, representing more severe cases of SFI (3–5). The aim of this study was to investigate QoL in individuals treated for SFI compared with those not treated for SFI in a cohort of Danish blood donors.

Blood donors (> 18 years of age) participating in the Danish Blood Donor Study (DBDS) (from June 1, 2018 to March 29, 2019) were included in the study. As blood donors are required to be in good health to donate blood, the study cohort had no predisposing conditions for SFI, i.e. immunosuppression and cardiovascular disease. Participants with a history of SFI were identified using a questionnaire item: “Have you had fungal infection in your skin or nails?”.

To further validate the phenotype, only participants treated by a physician with > 1 antifungal agent were considered to be cases. Participants who answered “no” and had no relevant prescription were classed as “controls”. Data on antifungal treatment were obtained from the Danish National Prescription Registry (DNPR) (from January 1, 1995 to June 30, 2018).

MATERIALS, METHODS AND RESULT

QoL was measured using the Short Form 12 questionnaire, scored in 2 dimensions; the physical component score (PCS) and mental component score (MCS). The PCS includes general health perception, physical functioning, and pain, while the MCS includes mood, social activities, and work ability explained by emotional factors (6). Symptoms of depression were assessed with the validated Major Depression Inventory (MDI) (7) and questionnaire data on previously diagnosed depression. Cohen’s Perceived Stress Scale categorized psychological stress into low, moderate, and high stress levels. Other covariates, including sex, age, annual income, work status, and highest obtained education level, were obtained through national registers, while smoking and body mass index were obtained through the DBDS questionnaire.

Cumulative prevalence was determined as the proportion with self-reported SFI only, and the proportion of prescription-validated SFI cases. Associations between SFI treatment and demographic factors and lifestyle were investigated with logistic regressions. Linear regressions predicted QoL by SFI were adjusted for age, sex, smoking, BMI, and demographic. Similarly, logistic regressions, adjusted for the aforementioned confounders, assessed associations between stress/depression (outcome) and SFI treatment (predictor). p-values < 0.05 were considered statistically significant and Holm-Bonferroni corrected for multiple tests. Analyses were performed in RStudio® version 1.2.1578 (RStudio®, Boston, MA, USA).

The study included 30,334 participants (52.1% males, 47.9% females). A total of 7,553 participants reported SFI, corresponding to a cumulative prevalence of 24.9% (95% confidence interval (95% CI) 24.4–25.4%). Of these, 3,466 (11.4% in total, 95% CI 11.1–11.8%) were treated for SFI (Table I). In comparison, 12,406 participants were considered as controls. A total of 2,038/3,466 (58.8%) received topical agents only, 267/3,466 (7.7%) received systemic agents only, and 1,161/3,466 (33.5%) received both. Table SII presents cumulative age-adjusted prevalence of SFI treatment. SFI treatment was associated with male sex (OR 1.41; 95% CI 1.30–1.52), increase in age per year (OR 1.02; 95% CI 1.01–1.02), increase in BMI (OR 1.03; 95% CI 1.02–1.04), and education level higher than high-school (OR 1.37; 95% CI 1.26–1.48).

Treatment for SFI was negatively associated with PCS (−1.58 points; 95% CI −2.19, −0.99) and MCS (−2.75 points; 95% CI −3.48, −2.02) after adjustment. Likewise, participants treated for SFI had an increased risk of higher stress level (OR 1.31; 95% CI 1.21–1.43) and higher risk of previous depression diagnosis (OR 1.58; 95% CI 1.30–1.91), than control participants (Table I). Effect sizes of relevant confounders of QoL are shown in Tables SII and SIII. Separate data on participants treated for onychomycosis are shown in Table SIV.

DISCUSSION

Dermatophytosis has been shown to markedly decrease QoL, correlating with the severity and spread of the disease in patients treated in hospital (3–5). Furthermore, patients with SFI may experience psychological distress due to embarrassment, low self-esteem, anxiety, and depression (4). However, these results are of Indian origin, a country with a widespread epidemic of dermatophytosis in up to 37–78% of the population, often occurring as recalcitrant disease (3). However, our results support that, even in Danish blood donors, with presumably milder disease than subjects in India, SFI, or at least SFI treatment, is associated with QoL impairment (Table I). Furthermore, the current study showed correlations with previous depression and mental stress in participants treated for SFI (Table I). However, these findings may be confounded by SFI treatment as a proxy for other diseases or a general health-seeking behaviour.

Consistent with the literature, treatment for SFI was associated with older age, male sex, and higher BMI (8). Surprisingly, no association was observed between smok-
Table I. Demographics and outcomes

| Demographics                  | Men                     | Women                   | p-value |
|-------------------------------|-------------------------|-------------------------|---------|
| **Diagnosis**                 |                         |                         |         |
| SFI/controls                  | SF1, n = 2,126          | Controls, n = 6,463     |         |
| **Demographics**              |                         |                         |         |
| Median age at inclusion, years (IQR) | 46.0 (36.0–54.8)       | 41.1 (29.2–52.2)        |         |
| Mean BMI (SD)                 | 26.6 (3.8)              | 26.1 (3.8)              |         |
| Current smokers, n (%)        | 248 (11.7)              | 910 (14.1)              |         |
| Median yearly income, DKK (IQR) | 439,824 (338,823–570,270) | 395,587 (257,407–522,484) |         |
| Highest education, n (%)      |                         |                         |         |
| Elementary school             | 142 (6.8)               | 681 (10.8)              |         |
| High-school                   | 964 (46.3)              | 3,177 (50.4)            |         |
| Short-cycle higher education 2–2.5 years | 550 (9.7)       | 212 (10.2)              |         |
| Medium-cycle higher education 3–4 years | 416 (20.0)   | 1,058 (16.8)            |         |
| Long-cycle higher education 5–6 years | 349 (16.8)   | 835 (13.3)              |         |
| Socioeconomic status, n (%)   |                         |                         |         |
| Working                       | 1,879 (88.4)            | 5,190 (80.3)            |         |
| Unemployed or receiver of public economic support | 37 (1.8)    | 38 (2.8)                |         |
| Students                      | 158 (7.4)               | 977 (15.1)              |         |
| Retired                       | 34 (1.6)                | 86 (1.3)                |         |
| Other                         | 18 (0.8)                | 60 (0.9)                |         |
| **Outcomes**                  |                         |                         |         |
| Health-related quality of life |                        |                         |         |
| SF1 (all), n = 2,126          | 55.16 (52.36–56.81)     | 55.8 (53.4–56.9)        | <0.001* |
| Controls, n = 6,463           | 55.5 (53.1–56.3)        | 56.8 (53.4–57.2)        |         |
| SF1 (all), n = 1,340          | 54.1 (49.0–56.7)        | 54.6 (49.8–56.7)        |         |
| Controls, n = 5,943 SFI (all), n = 6,463 | 52.2 (45.5–55.3) | 52.7 (46.5–55.3)        |         |
| Change in SF-12 score (%)     |                         |                         |         |
| 95% CI                        |                         |                         |         |
| Physical health (physical component score), median (IQR) | -1.58 [-2.19, -0.99] | -2.93 [-4.02, -1.83] | <0.001* |
| Mental health (mental component score), median (IQR) | -2.75 [-3.48, -2.02] | -5.53 [-7.01, -4.07] | <0.001* |
| Stress, n (%)                 |                         |                         |         |
| Low                           | 1,507 (72.7)            | 4,821 (76.1)            |         |
| Moderate                      | 563 (27.2)              | 1,496 (23.6)            |         |
| High                          | < 5 (1.1)               | 20 (0.3)                |         |
| Classification by major depression inventory, yes (%)/no (%) | < 5 (<2.0)/1267 | 14 (0.3)/3,994 | N/A |
| Diagnosed by a physician, yes (%)/no (%) | 71 (5.6)/1,198 | 198 (5.0)/3,799 | 1.58 [1.30, 1.91] | <0.001* |
| Depression, n (%)             |                         |                         |         |
| OR [95% CI]                   |                         |                         |         |
| OR [95% CI]                   |                         |                         |         |
| **Discussion**                |                         |                         |         |

In conclusion, treatment for SFI is common, even in a cohort without known predisposing factors. Furthermore, treatment for SFI seems to be associated with impaired QoL, higher level of mental stress, and previous depression, and higher level of education in Danish blood donors.

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Oral and written informed consent was obtained from all participants. The DBDS (1-10-72-95-13) and DBDSII (SJ-740) are approved by the Scientific Ethical Committees in Central Denmark Region and Region Zealand, respectively. The DBDS was approved by the Danish Data Protection Agency (P-2019-99). This study was conducted in accordance with the principles of the Declaration of Helsinki.

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