

## CLINICAL REPORT

# The Influence of Body Weight on the Prevalence and Severity of Hidradenitis Suppurativa

Charles B. KROMANN<sup>1</sup>, Kristina S. IBLER<sup>1</sup>, Viggo B. KRISTIANSEN<sup>2</sup> and Gregor B. E. JEMEC<sup>1</sup>

<sup>1</sup>Department of Dermatology, Roskilde Hospital, Health Sciences faculty, University of Copenhagen, Roskilde, and <sup>2</sup>Department of Surgical Gastroenterology, Hvidovre Hospital, Hvidovre, Denmark

**The prevalence of hidradenitis suppurativa (HS) has been estimated to be 1% of the population. Obesity is considered a co-morbidity, but the prevalence of HS in obese population is not known. A retrospective questionnaire was distributed to 383 patients over 2 years after bariatric surgery. Data on pre- and post-surgery HS symptoms and disease severity were studied. Disease severity was assessed by number of involved sites. General skin problems rated numerically on an anchored 1–10 scale. Valid responses were obtained from 249/383 (65%). A point prevalence of 18.1% (45/249) HS was found. The number of patients reporting HS symptoms after weight loss decreased by 35% and the mean number of involved sites was reduced from 1.93 to 1.22 following weight loss ( $p=0.003$ ). The prevalence of HS appears higher in the obese than in the background population, and a weight loss of more than 15% is associated with a significant reduction of disease severity. Key words: hidradenitis suppurativa; prevalence; BMI; obesity; co-morbidity.**

Accepted Jan 8, 2014; Epub ahead of print Feb 27, 2014

Acta Derm Venereol 2014; 94: 553–557.

Gregor Jemec, Department of Dermatology, Roskilde Hospital, Køgevej 7, DK-4000 Roskilde, Denmark. E-mail: gbj@regionsjaelland.dk

Hidradenitis suppurativa (HS) is a chronic, inflammatory, recurring, debilitating skin disease of the hair follicles that usually presents after puberty with painful, deep-seated, inflamed lesions in the apocrine gland-bearing areas of the body, most commonly the axillae, inguinal and anogenital regions (Dessau definition, 1<sup>st</sup> International Conference on Hidradenitis suppurativa/Acne inversa, March 30–April 1, 2006, Dessau, Germany) (1, 2).

HS typically has physical as well as psychological consequences for the patients. Physically it causes pain, and is often associated with foul smelling discharge either from ruptured elements or from sinus tracts. The combination of pain, malodour, and a high degree of self-imposed isolation due to the stigmatising symptoms often lead to a considerable reduction in quality of life (1, 3–6).

The symptoms are readily identifiable and familiar to the patients, hence screening for HS by questionnaire

is feasible. A series of screening questions addressing location and recurrence of lesions have previously been validated. In a population of hospital patients the screening questions showed a positive predictive value of 0.85–0.89 (7).

Population studies in Denmark (physical examination following screening questions) and France (questionnaire) are in good agreement, and indicate that approximately 1% of the adult population suffers from HS, whereas a recent study based on validated questionnaires indicates an even higher prevalence of approximately 2% in the general population (8, 9).

HS patients are generally thought to be overweight, and studies have indicated significant obesity in HS patients, although non-obese patients are not uncommon (10, 11). Furthermore, disease severity appears to correlate with degree of obesity, suggesting that a dose-response effect occurs between these 2 factors, raising questions of cause and effect (12). In spite of many speculations, the relationship between HS prevalence or severity, and weight reduction has not previously been studied.

In order to provide some background data, it was therefore decided to study the prevalence of HS in an obese population (BMI > 30) undergoing bariatric surgery (gastric bypass or banding).

The research questions were: 1) What was the point prevalence of HS in obese? 2) What is the effect of substantial weight loss by gastric bypass on disease severity in HS patients?

## METHODS

This study was designed as a retrospective postal questionnaire based study registering pre- and post-surgery weight, general skin problems and diagnostic questions regarding HS. A one-page questionnaire was distributed to patients who had undergone bariatric surgery. Enclosed was a brief cover letter explaining the study at asking for participation and a stamped envelope for returning the questionnaire.

### Participants

Early 2013 we identified 383 social security numbers and the addresses of patients who had had either gastric bypass or gastric banding operations in 2010–2011 at the Department of Surgical Gastroenterology, Hvidovre Hospital, Hvidovre. All patients treated were identified. Participants were aged from 21

to 67 years (mean age 46 years) on the day of surgery. There were 101 males and 282 females. Pre-surgery BMI was between 30.9 kg/m<sup>2</sup> and 70.9 kg/m<sup>2</sup> (mean 41.9 kg/m<sup>2</sup>).

### Measurement

The diagnostic HS questions used in the questionnaire, were previously validated. Diagnostic for HS was an affirmative answer to having 3 or more eruptions in one site during the past 6 months (7). Six different sites were pre-defined, and the sum of eruption sites was used as an indirect measure of disease severity. For the purpose of this study the questionnaire was modified to include a description of the pre-surgical state, using the same questions. This was considered possible due to the simplicity of the questions and the easily recognisable symptoms of the disease.

The patients were furthermore asked to grade the severity of their skin problems by use of a Patients Global Numeric Rating Scale (PGNRS) (range from 1 to 10, where 1 represented no skin problems and 10 the worst possible skin problems).

A decrease in pre- vs. post-surgery BMI of at least 15% was considered a substantial weight loss.

### Statistics

The point prevalence of HS was calculated for the respondents with fully completed questionnaires only. Point prevalence reported as point prevalence  $\pm$  95% confidence interval (PP  $\pm$  CI). For comparing differences of the means in overall skin problems, the mean results of the PGNRS before and after bariatric surgery were compared. A normal distribution was assumed and student's *t*-test for paired and unpaired datasets were applied where relevant. A *p*-value of  $<0.05$  was considered statistically significant.

To evaluate the clinical importance of the results we calculated effect sizes (ES) using Cohen's *d*. Evaluation of ES was done according to Hojat (ES  $\approx$  0.2,  $\approx$  0.5 and  $\approx$  0.8, respectively, was considered of negligible, moderate and crucial clinical importance) (13).

All statistic calculations were done using STATA 12 for Mac OSX, 2011 (STATA Corp, Texas USA), except PP  $\pm$  CI and ES calculations that were done by hand calculator.

### Ethics

Participation was voluntary and no remuneration of any kind was given to the participants. As the format was an entirely voluntary postal questionnaire no ethical approval was required according to Danish law. However, formal approval was given from the Danish Data Protection Agency (Datatilsynet). Only anonymised data were stored and used in further analysis.

## RESULTS

The overall response rate was 267/383 (69.7%), 7/383 (1.8%) were lost (died/moved/letter returned unopened) and 28.5% did not return the questionnaire. Of the 267 returned questionnaires 18 did not provide complete answers to the questionnaire and were excluded. Among the remaining 249 valid respondents, 45 (18.1%) suffered from HS, yielding a PP  $\pm$  CI = 18.1  $\pm$  4.8% (see Fig. 1). Only 10 of the 45 respondents with HS reported that they had been diagnosed with HS. Just over half (23/45) of the participants with HS-symptoms had sought medical help for their condition.

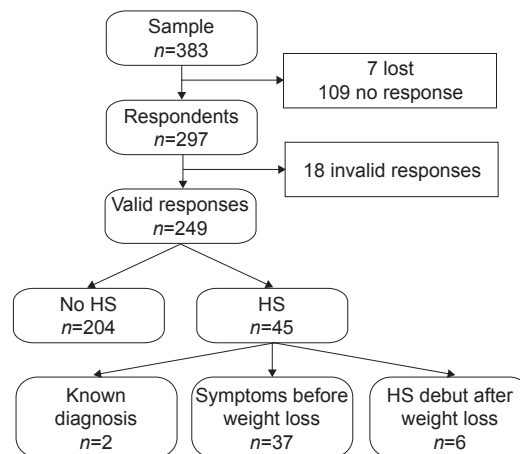


Fig. 1. Flow chart of participant distribution.

### Self-reported severity of skin problems

Before surgery 45 of 249 (18.1%) were suffering from HS. However, among the valid respondents only 229/249 (92%) experienced a substantial weight loss of at least 15% BMI. The following data are based on those experiencing a substantial weight loss: skin problems rated by PGNRS in those with HS symptoms and substantial weight loss showed a tendency to improve with a mean decrease of  $-0.2$  ( $p=0.74$ , ES = 0.48). Although not significant, this change still demonstrates a moderate clinical effect size. In the group with no HS-symptoms there was a significant increase in self-reported severity of skin problems after weight loss with a mean difference of 0.9, ( $p<0.001$ , ES = 5.15) with a very high ES (see Table I). Many respondents indicated that excess skin was the primary cause of their skin problems.

### Symptoms and severity of hidradenitis

Before surgery and substantial weight loss 35 patients registered symptoms of HS. After surgery and substantial weight loss 24 reported symptoms. There was a decrease of 11/35 (35%) patients reporting HS symptoms after weight loss.

When looking at participants with HS symptoms before surgery and substantial weight loss following surgery 17/35, 48.6% experienced no HS symptoms after weight loss, 7/35 (20%) experienced fewer active eruption sites, 7/35 (20%) experienced no changes in

Table I. Patients Global Numeric Rating Scale (PGNRS) of skin problems (1–10)

	PGNRS before weight loss Mean (SD)	PGNRS after weight loss Mean (SD)	Mean difference
Sample, <i>n</i> = 249	2.8 (2.5)	3.5 (3.0)	0.7*
HS, <i>n</i> = 45	4.8 (2.6)	4.6 (2.9)	-0.2 NS
Non-HS, <i>n</i> = 204	2.3 (2.2)	3.3 (3.0)	0.9*

\*Significant  $p<0.0001$ , NS  $p=0.74$ .

HS: hidradenitis suppurativa

disease activity and 4/35 patients experienced more active eruption sites (See Fig. 2).

The mean number of eruption sites was significantly reduced from 1.93 to 1.22 ( $p=0.003$ ,  $ES=2.92$ ) with an effect size of crucial clinical importance. Also scarring sites after eruptions was reduced from 1.31 to 0.84 ( $p=0.02$ ,  $ES=0.33$ ). Using these measures substantial weight loss in the participants was associated with reduced severity of HS symptoms (See Table II).

## DISCUSSION

### Point prevalence of hidradenitis suppurativa among obese

In this study we estimated the point prevalence of HS in a sample of obese patients who subsequently went through bariatric surgery. Prevalence estimates from studies conducted on the background population range from 0.05% to 4% (8, 9, 14). Obesity has long been speculated to play a role in the development of HS. In his review of obesity related skin diseases, Yosipovitch et al. (15) describes that patients with HS are more likely to be overweight. Studies in patients with known HS indicate that many patients are overweight. In a recent series of 154 patients enrolled in a randomised controlled trial 130/152 patients had BMI >25 (16). We found the point prevalence in the sample to be  $18.1 \pm 4.8\%$ , which is greater than previously published estimates of prevalence in the background population by an order of magnitude, and appears even higher than estimated prevalences of diabetes mellitus type 2 (DM2) among obese and far greater than cardiovascular disease (17). Other inflammatory skin diseases such as psoriasis have also been shown to be associated with obesity (1, 2, 18–20). A paper examining skin disease in a series of obese in Mexico found possible linear association between obesity and acne (1, 3–5, 21). However, to our knowledge, no real cross sectional studies among obese regarding psoriasis or other inflammatory skin disease have been published and we are unable to reliably compare our findings for HS among obese with other inflammatory skin diseases.

The data indicate that HS may resolve following significant weight-loss in a substantial proportion of patients. It may therefore be speculated that a causal relationship between obesity and HS exists. The *de novo* occurrence of self-reported by a small minority of patients after weight loss however also strongly suggest that the association is multi-factorial and that e.g. mechanical, microbiological or immunological factors may also be involved.

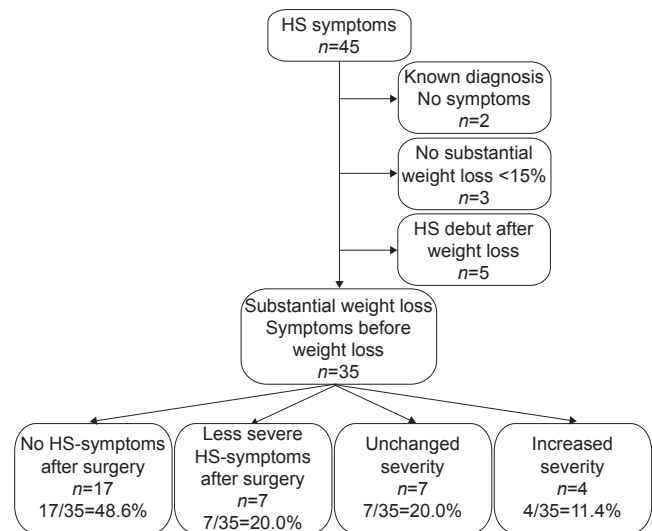


Fig. 2. Analysis of participants with Hidradenitis suppurativa (HS) symptoms. Severity outcome measure by number of eruption sites.

### Effects of substantial weight loss

It has been speculated that the pathogenic concept of obesity is multi-factorial entailing more friction from skin folds, humid skin milieu favouring microbial growth and the systemic low grade inflammation of the obese body (22), hence a positive effect of weight loss was a likely finding.

We investigated the effect of a substantial weight loss on HS disease burden. Here we found a significant reduction in disease severity as assessed by flares and number of involved regions. In view of the easily recognisable symptoms this is considered a significant finding, and provides significant support for the planned prospective study that will involve a clinical assessment of patients. This finding is further supported by the reduction of the overall skin symptoms as reflected by the PGNRS. Albeit not statistically significant, the reduction of general skin complaints may be considered clinically relevant after bariatric surgery. The importance of the reduction in overall symptoms among HS patients provides an interesting perspective to the significant increase in general skin problems reported by patients without HS. According to statements by the patients the increased skin problems occurred mainly due to a postoperative excess of skin.

Limited data exist on the results of similar interventions in other skin diseases. Bariatric surgery has previously shown to ameliorate psoriasis (7, 23–28), although it has been speculated that obesity is not a

Table II. Hidradenitis suppurativa (HS) – symptom severity by eruption and scarring sites (1–6 sites)

	Eruption sites			Scarring sites		
	Before weight loss Mean (SD)	After weight loss Mean (SD)	Difference Mean (SD)	Before weight loss Mean (SD)	After weight loss Mean (SD)	Difference Mean (SD)
HS $n=45$	1.93 (1.71)	1.22 (1.48)	0.71 (1.52)*	1.31 (1.56)	0.84 (1.24)	0.46 (1.29)*
Significance/effect sizes			$p=0.003/2.92$			$p=0.02/0.33$

risk factor of psoriasis but rather a consequence of the disease (8, 9, 29). A recent study shows that almost 2/3 of patients with psoriasis reported post-operative improvement in psoriasis after undergoing weight loss surgery (10, 11, 23). Psoriasis and HS are chronic inflammatory skin diseases and both have been associated with obesity and metabolic syndrome through possible common yet currently unidentified mechanisms (10, 12, 20). Thus, it has been speculated that obesity may play an important role in the development of inflammatory skin diseases in general. It has previously also been speculated that inflammatory changes in the vascular system may be linked to arteriosclerosis. The metabolic syndrome may therefore adversely affect a number of significant co-morbidities including HS.

Other effects of bariatric surgery include improvement in hypertension, diabetes and apnea during sleep as well as dyspnoea, chest pain and physical activity in leisure time (13, 30). Some of these effects may be due to a reduction in the physical discomfort alone, and their associations to HS are not known. Long-term follow-up of patients undergoing bariatric surgery has shown a significant reduction in overall mortality and decreased incidences of diabetes (8, 9, 14, 31), myocardial infarction, stroke and cancer. It is hypothesised that these findings are explained by a reduction of the physical inflammatory processes.

#### *Smoking cessation as confounding factor*

Smoking is known to be associated with an increase in the severity of HS (15, 32). A major lifestyle change such as bariatric surgery could potentially lead to healthier living in general. It is therefore relevant to question whether the decrease in HS symptoms and severity of HS could be caused by smoking cessation. This question remains unanswered by this study. However, 2 recent studies report that composite substance abuse (including cigarette smoking) generally is increased among patients after bariatric surgery (16, 33, 34), leaving smoking cessation an unlikely candidate in explaining the positive effect of weight loss on HS.

#### *Response and recall bias*

The response rate in our study reached 69.5%, which is comparable with similar studies (9, 17, 35). However response bias must be considered as it is generally accepted that persons with a particular symptom or condition are more likely to participate in studies related to that symptom or condition because of the relevance of the study to their lives (35). Accordingly, the response rate to a HS-oriented questionnaire is likely higher in a group that feels affected by HS symptoms – leading to a possible overestimation of point prevalence of HS in the sample.

Nonetheless, supposing that all HS patients in the sample answered the questionnaire due to the relevance

of the subject to their lives, the point prevalence in the sample of obese would still be  $PP \pm CI 11.7 \pm 3.2\%$  (45/383) which is 5 to 10 times higher than the estimated prevalence in the background population. This sizeable difference is unlikely to be explained by response bias.

In any retrospective questionnaire recall bias will pose a problem. Designing this study we weighed recall bias against factors such as number of observations and sufficient time for weight loss to happen and the change of disease status to take place.

#### *Design of diagnostic questions*

Although physical examination and diagnosis is generally preferable when studying a clinical diagnosis, we chose to use a validated questionnaire in order to maximise sample size in this explorative study. The questions were validated prior to the study (7, 9) and the diagnostic questions were designed to minimise recall bias. We asked if the patients had suffered eruptions 3 or more times during a half-year period. In asking for 3 instances we increased the likelihood that the symptoms were not merely a single boil or inflamed nodule, but rather a recurring inflammatory eruption compatible with HS. We also designed a simple one-page questionnaire to avoid tiring the respondents to point of indifference toward the answers. Finally, the clear symptomatology and protracted course of the disease is generally thought to ensure that most patients are familiar with the signs and symptoms of HS and therefore able to provide more reliable self-reported data than for e.g. more ephemeral diseases with less obvious symptoms.

#### *Generalisability of results*

Although patients suffering from HS are often overweight, slender patients also suffer from HS (10), and further weight loss would in all probability not improve their symptoms. Our study has concentrated on obese with a substantial weight loss. Although plausible, there is no certainty that HS patients with only moderate overweight will experience amelioration of HS symptoms after weight loss.

Both the sample of bariatric patients and HS patients in general are heavily skewed towards women, hence no meaningful gender stratification could be performed.

Hence, caution must be taken when generalising the results of this study to HS patients in general.

#### *Implications*

This study has several implications. Firstly, it supports the notions that obese people have a higher prevalence of HS. The point prevalence of HS in obese of almost 20% could make screening obese patients for HS at the general practitioners offices relevant. Secondly it provides initial support for the belief that weight loss can

ameliorate symptoms. Lifestyle recommendations regarding management of HS therefore stand strengthened in light of these findings. It is also implied that patients suffering from HS ought to be diagnosed with much less delay and their treatment managed by specialists at an earlier time to ensure the best possible course of this stigmatising and painful disease. Finally, our study highlights that we need more cross sectional studies done from “both sides” of any comorbidity. In order to get the full picture we need to estimate both the prevalence of obesity in HS patients and the prevalence of HS in obese.

*The authors declare no conflict of interest.*

## REFERENCES

- Jemec GBE. Clinical practice. Hidradenitis suppurativa. *N Engl J Med* 2012; 366: 158–164.
- Paus RL, Kurzen H, Kurokawa I, Jemec G, Emtestam L, Sellheyer K, et al. What causes hidradenitis suppurativa? *Exp Dermatol* 2008; 17: 455–456.
- Werth von der JM, Jemec GB. Morbidity in patients with hidradenitis suppurativa. *Br J Dermatol* 2001; 144: 809–813.
- Matusiak L, Bieniek A, Szepletowski JC. Psychophysical aspects of hidradenitis suppurativa. *Acta Derm Venereol* 2010; 90: 264–268.
- Wolkenstein P, Loundou A, Barrau K, Auquier P, Revuz J, Dermatology QOLGOTFSO. Quality of life impairment in hidradenitis suppurativa: A study of 61 cases. *J Am Acad Dermatol* 2007; 56: 621–623.
- Onderdijk AJ, van der Zee HH, Esmann S, Lophaven S, Dufour DN, Jemec GBE, et al. Depression in patients with hidradenitis suppurativa. *J Eur Acad Dermatol Venereol* 2013; 27: 473–478.
- Esmann S, Dufour DN, Jemec GBE. Questionnaire-based diagnosis of hidradenitis suppurativa: specificity, sensitivity and positive predictive value of specific diagnostic questions. *Br J Dermatol* 2010; 163: 102–106.
- Jemec GB, Heidenheim M, Nielsen NH. The prevalence of hidradenitis suppurativa and its potential precursor lesions. *J Am Acad Dermatol* 1996; 35: 191–194.
- Revuz JE, Canoui-Poitrine F, Wolkenstein P, Viallette C, Gabison G, Pouget F, et al. Prevalence and factors associated with hidradenitis suppurativa: Results from two case-control studies. *J Am Acad Dermatol* 2008; 59: 596–601.
- Sabat R, Chanwangpong A, Schneider-Burrus S, Metternich D, Kokolakis G, Kurek A, et al. Increased prevalence of metabolic syndrome in patients with acne inversa. *PLoS One* 2012; 7: e31810.
- Jemec GBE: Body weight in hidradenitis suppurativa. In Marks R & Plewig G (Editors): *Acne and related disorders*. London: Martin Dunitz, 1989: p. 375–376.
- Sartorius K, Emtestam L, Jemec GBE, Lapins J. Objective scoring of hidradenitis suppurativa reflecting the role of tobacco smoking and obesity. *Br J Dermatol* 2009; 161: 831–839.
- Hojat M, Xu G. A visitor’s guide to effect sizes: statistical significance versus practical (clinical) importance of research findings. *Adv Health Sci Educ: Theory Pract* 2004; 9: 241–249.
- Cosmatos I, Matcho A, Weinstein R, Montgomery MO, Stang P. Analysis of patient claims data to determine the prevalence of hidradenitis suppurativa in the United States. *J Am Acad Dermatol* 2013; 68: 412–419.
- Yosipovitch G, DeVore A, Dawn A. Obesity and the skin: skin physiology and skin manifestations of obesity. *J Am Acad Dermatol* 2007; 56: 901–916.
- Kimball AB, Kerdel F, Adams D, Mrowietz U, Gelfand JM, Gniadecki R, et al. Adalimumab for the treatment of moderate to severe hidradenitis suppurativa: a parallel randomized trial. *Ann Int Med* 2012; 157: 846–855.
- Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. *JAMA* 1999; 282: 1523–1529.
- Cohen AD, Sherf M, Vidavsky L, Vardy DA, Shapiro J, Meyerovitch J. Association between psoriasis and the metabolic syndrome. A cross-sectional study. *Dermatology* 2008; 216: 152–155.
- Gisoni P, Tessari G, Conti A, Piaserico S, Schianchi S, Peserico A, et al. Prevalence of metabolic syndrome in patients with psoriasis: a hospital-based case-control study. *Br J Dermatol* 2007; 157: 68–73.
- Armstrong AW, Harskamp CT, Armstrong EJ. The association between psoriasis and obesity: a systematic review and meta-analysis of observational studies. *Nutr Diabetes* 2012; 2: e54.
- García-Hidalgo L, Orozco-Topete R, Gonzalez-Barranco J, Villa AR, Dalman JJ, Ortiz-Pedroza G. Dermatoses in 156 obese adults. *Obesity Res* 1999; 7: 299–302.
- Zee HH, Laman JD, Boer J, Prens EP. Hidradenitis suppurativa: viewpoint on clinical phenotyping, pathogenesis and novel treatments. *Exp Dermatol* 2012; 21: 735–739.
- Hossler EW, Wood GC, Still CD, Mowad CM, Maroon MS. The effect of weight loss surgery on the severity of psoriasis. *Br J Dermatol* 2013; 168: 660–661.
- Farias MM, Achurra P, Boza C, Vega A, Cruz C. Psoriasis following bariatric surgery: clinical evolution and impact on quality of life on 10 patients. *Obesity Surg* 2012; 22: 877–880.
- Porres JM. Jejunioleal bypass and psoriasis. *Arch Dermatol* 1977; 113: 983–983.
- Hossler EW, Maroon MS, Mowad CM. Gastric bypass surgery improves psoriasis. *J Am Acad Dermatol* 2011; 65: 198–200.
- Higa-Sansone G, Szomstein S, Soto F, Brasecsco O, Cohen C, Rosenthal RJ. Psoriasis remission after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Obesity Surg* 2004; 14: 1132–1134.
- de Menezes Ettinger JEMT, Azaro E, de Souza CAM, Santos Filho dos PV, Mello CAB, Neves M, et al. Remission of psoriasis after open gastric bypass. *Obesity Surg* 2006; 16: 94–97.
- Herron MD, Hinckley M, Hoffman MS, Papenfuss J, Hansen CB, Callis KP, et al. Impact of obesity and smoking on psoriasis presentation and management. *Arch Dermatol* 2005; 141: 1527.
- Karason K, Lindroos AK, Stenlöf K, Sjöström L. Relief of cardiorespiratory symptoms and increased physical activity after surgically induced weight loss: results from the Swedish Obese Subjects study. *Arch Intern Med* 2000; 160: 1797–1802.
- Sjöström L. Review of the key results from the Swedish Obese Subjects (SOS) trial – a prospective controlled intervention study of bariatric surgery. *J Int Med* 2013; 273: 219–234.
- König A, Lehmann C, Rompel R, Happle R. Cigarette smoking as a triggering factor of hidradenitis suppurativa. *Dermatology* 1999; 198: 261–264.
- Conason A, Teixeira J, Hsu CH, Puma L, Knafo D, Geliebter A. Substance use following bariatric weight loss surgery. *JAMA Surg* 2013; 148: 145–150.
- Adams CE, Gabriele JM, Baillie LE, Dubbert PM. Tobacco use and substance use disorders as predictors of postoperative weight loss 2 years after bariatric surgery. *J Behaviour Health Serv Res* 2012; 39: 462–471.
- Asch DA, Jedrzejewski MK, Christakis NA. Response rates to mail surveys published in medical journals. *J Clin Epidemiol* 1997; 50: 1129–1136.