International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

The Relationship between Serum Lipid Profile and Sebum Secretion in Seborrheic Dermatitis Patients

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ABSTRACT

Background: Pathogenesis of seborrheic dermatitis (SD) is not fully elucidated, but this dermatosis is commonly linked with *Malassezia spp*, skin surface lipids film, sebaceous gland activity, and seborrhea. Sebum lipids are essential proinflammatory factors to provide permissive conditions for SD development. *Malassezia spp* contain lipases that hydrolyze triglycerides sebum, freeing specific saturated fatty acids that requires to proliferate. The influence of serum lipid on the sebum synthesis is still controversial and the study is ongoing.
Objective: To determine the relationship between serum lipid profile and sebum secretion in seborrheic dermatitis.
Methods: Case series study was conducted from 1st May to 30th June 2016 at Clinic of Dermatology and Venereology Department, Dr. Mohammad Hoesin General Hospital Palembang. Correlation between variables were analyzed by Pearson correlation coefficient test; p<0,05 was considered significant statistically. Statistical analyses were performed using SPSS software (version 17,0).
Results: A total of 30 SD outpatients fulfilled the inclusion criteria and no drop out. This study revealed that majority of sample were female (67,77%) and followed by males (33,3%).This study showed strongly correlation significantly between serum total-cholesterol levels and sebum secretion (r = 0,860; p = 0,000); strongly correlation significantly between serum LDL-cholesterol serum levels and sebum secretion (r = 0,929; p = 0,000); moderately correlation significantly between serum triglyceride levels and sebum secretion (r = 0,445; p = 0,014); and slightly correlation not significant between serum HDL-cholesterol levels and sebum secretion (r = -0,283; p = 0,129).
Conclusions: It can be concluded that there was strongly correlation between serum total-cholesterol as well as LDL-cholesterol levels and sebum secretion in SD patients.

Keywords: *seborrheic dermatitis, lipid profile, sebum secretion, case series.*

INTRODUCTION

Seborrheic dermatitis (SD) is a chronic, relapsing inflammatory skin condition with a predilection for areas rich in sebaceous glands. [1] The disorder is characterized by scaling and poorly defined erythematous patches, with large variations in extent and morphologic characteristics depending on the area of skin involved. [2] The etiology dermatitis is incompletely understood. Despite of its name, SD is not regularly associated with excessive secretion of sebum (i.e., "seborrhea"), nor are the sebaceous glands primarily affected. [1]

However, functioning sebaceous glands may be a permissive factor because SD occurs most often during periods of active sebum production (e.g., the neonatal period) and in areas of the skin where

sebum is produced. [3] This dermatosis is also commonly linked with *Malassezia spp*. [2] *Malassezia spp* contain lipase enzyme that hydrolyze triglycerides sebum, freeing specific saturated fatty acids that requires proliferating. [2] Therefore, sebum lipids are essential proinflammatory factors to provide conducive conditions for SD development. [4]

The influence of serum lipid on the sebum synthesis is still controversial and the study is ongoing. [5] The aim of this study to determine the relationship between serum lipid profile and sebum secretion in seborrheic dermatitis. [6,7]

MATERIALS AND METHODS

Thirty SD patients were examined for serum triglyceride, total-cholesterol, LDL-cholesterol, and HDL-cholesterol levels with sebum secretion. These patients were aged between 20 and 60 years old. Case series study was conducted from 1st May to 30th June 2016 at Clinic of Dermatology and Venereology Department, Dr. Mohammad Hoesin General Hospital Palembang, Indonesia. The protocol of study has been approved by ethic committee Medical Faculty of Sriwijaya University.

Lipid profile measurements

Subjects were fasting for 12-14 hours before the venous blood specimens were taken. Serum total-cholesterol, LDL-cholesterol, HDL-cholesterol and triglyceride levels were determined using by an enzymatic colorimetric test according to the manufacturer recommended procedure (Tokyo Boeki Medysis Inc.®)

Sebum measurements

Facial sebum secretion in each subject was measured by using a Sebumeter® (SM 815, C-K electronics, Cologne, Germany). Three different sites or T-zone area of the face were selected; forehead (mid-glabella), nose (the tip) and chin (mental prominence). Sebum was collected from each site on a plastic strip using a constant pressure of 10 N for 30 seconds. Participants were asked not to use any cosmetics and not to wash within 2 hours of measurements. Sebum secretion amounts were recorded and The patient facial skin types were determined using the sebum secretion guidelines supplied with the Sebumeters. [8] All procedures were performed by the same investigator in a room at constant temperature and humidity a relative humidity of 42% and a temperature of 22^0 C. [8]

Statistical analysis of the data was performed using the statistical package for the social science (SPSS) program version 17,0. Results were expressed as mean±standard deviation. Correlation between variables were analyzed by using Pearson correlation coefficient test; p<0,05 was considered to be statistically significant.

RESULTS

There were 30 outpatients who fulfilled the inclusion. This study showed that majority of sample were females (67,77%) and followed by males (33,3%).The mean age of SD patients were 37,7±13,55 years old (Table 1).

Table 1. Subject baseline characteristics

Characteristic	n	Percentage (%)
Sex		
Male	10	33,3
Female	20	67,7
Age (years old)		
20-29	11	36,6
30-39	5	16,67
40-49	7	23,33
50-59	7	23,33
Education		
Primary	4	13,3
Elementary	2	6,7
High school	13	43,3
University	11	36,7
Employment		
Nurse	8	26,67
Cleaning service	6	20
unemployment	6	20
Professional (doctors)	5	16,67
Tailor	2	6,67
Agriculture	2	6,67
Administration employee	1	3,33
Police	1	3,33

Table 2 demonstrated serum lipid profile of subjects. Most of subjects have high levels of serum LDL-cholesterol. The mean levels

of serum LDL-cholesterol was 114,5±36,58 mg/dl.

Table 2. Lipid Profile in SD Patients

Parameters	Mean ±SD (mg/dl)	n
Triglycerides	136,57±52,27	
Normal		22
Height		8
Total-cholesterol	186,77±40,07	
Normal		21
Height		9
LDL-cholesterol	114,5±36,58	
Normal		8
Height		22
HDL-cholesterol	53,6±18,68	
Normal		25
Rendah		5

Facial sebum secretion

The mean amounts of sebum secretion were 123,33±14,17 μg/cm$^{2.}$ There was no subject with oily skin. This study found 70% SD patients have normal skin type and the rest have dry skin type (Table 3).

Table 3. Sebum secretion in SD patients

Sebum Secretion (μg/cm^2)	Skin Type	n	Percentage (%)
< 100	Dry	9	30
100-220	Normal	21	70
> 220	Oily	0	-

The relationship between serum lipid profile and sebum secretion

Table 4 revealed that there was strongly correlation significantly between serum total-cholesterol levels and sebum secretion (r = 0,860; *p* = 0,000); as well as serum LDL-cholesterol levels and sebum secretion (r = 0,929; *p* = 0,000). There was moderately correlation significantly between serum triglyceride levels and sebum secretion (r = 0,445; *p* = 0,014). There is slightly correlation, not significant statistically, between serum HDL-cholesterol levels and sebum secretion(r = -0,283; *p* = 0,129).

Table 4. The relationship between serum lipid profile and sebum secretion SD patients.

Lipid profile	Rerata± SD	r	R^2	*p*
LDL-cholesterol	114,5±36,58	0,929*	0,864	0,000*
Total-cholesterol	186,77±40,07	0,860*	0,74	0,000*
Triglyceride	136,57±52,27	0,445*	0,198	0,014*
HDL- chlesterol	53,6±18,68	0,283*	0,08	0,129*

Pearson correlation, $p < 0,05$

r>0,7 = strongly correlation; 0,3<r<0,7 = moderately correlation; r<0,3 = slightly correlation.

DISCUSSION

Seborrheic dermatitis is a common, chronic papulosquamous disorder affecting infants and adults alike. It is characteristically found in regions of the body with high concentrations of sebaceous follicles and active sebaceous glands including the face, scalp, ears, upper trunk, and flexures (inguinal, inframammary, and axillary). [2,9]

The amount of sebum produced is not an essential factor, as not all SD patients have increased levels of sebum production. [2,10] However, 50% of patients have oily, sebum rich skin. [3] Patients with SD show higher skin surface lipid levels of triglycerides and cholesterol, but lower levels of free fatty acids and squalenes. [2]

The relationship between SD and lipid dependent *Malassezia* yeasts (formerly *Pityosporum ovale*) is supported by evidence of reduction of symptom severity with the use of antifungals active against *Malassezia spp*. [11] Sebum lipids, especially triglycerides, are essential for *Malassezia* proliferation and initial proinflammatory factors synthesis, therefore a certain amount of sebum is always required in order to provide permissive conditions for SD developments. [3] *Malassezia spp* have lipoprotein lipase activity resulting in transformation of triglycerides to free fatty acids. [2] Free fatty acids such as, oleic and arachidonic acid, have direct irritative and desquamative effects on keratinocytes. Arachidonic acid was metabolized by cyclooxygenase serves as a source of proinflammatory eicosanoids (particularly prostaglandins), leading to inflammation and consequent damage of stratum corneum. [3,12]

Dyslipidemias are disorders of lipoprotein metabolism that may be manifested by elevation of the serum total-cholesterol, low-density lipoprotein (LDL) cholesterol, and triglyceride levels, and a decrease in the high-density lipoprotein (HDL) cholesterol levels. [13] Lipids circulate in the blood embedded in specialized supramolecular structures

mostly synthesized in the liver, known as lipoproteins, formed by assembling various lipids with apolipoproteins. [5]

Hypercholesterolemia promotes inflammatory responses. Hypercholesterolemia leads to cholesterol accumulation in macrophages and other immune cells, which causes augmentation of Toll-like receptor (TLR) signalling, inflammasome activation, and the production of monocytes and neutrophils in the bone marrow and spleen. [14] Ghaderi et al., showed the mean level of serum LDL-cholesterol and triglyceride in SD patients was higher than control group. [15]

Various pro-inflammatory cytokines such as tumor necrosis factor (TNF)-α, interleukin (IL)-1, IL-6, interferon-γ (IFN-γ), and monocyte chemoattractant protein-1 modulate the enzymatic activity of lipoprotein lipase. [13] This enzyme was released by *Malassezia spp* and involved in transformation of triglycerides to free fatty acids. Trznadel-Grodzka et al., observed higher levels of IL-2 and IFN-γ in SD patients compared to the control group. [16]

The influence of the general lipid metabolism on the sebum synthesis in the sebaceous gland is still on under investigated area. [5] Peripheral tissues, such as sebaceous glands express the low density lipoprotein (LDL) receptors to uptake circulation lipoproteins. [5,13] Even if the sebaceous gland has autonomous lipid synthetic capacity and the expression of lipogenetic enzymes has been demonstrated in the sebaceous gland or in sebocyte cell lines. [5] Several data indicate a possible correlation between serum and sebum lipid. [5,17] The sebaceous gland can sequester circulating lipids and remodel the sebaceous type. The sebaceous gland and the human sebocyte cell line SEB-1 have proven to express the LDL receptors at mRNA levels. [18] This study revealed strongly correlation between serum LDL-cholesterol levels and sebum secretion (r = 0,929;*p* = 0,000). Serum LDL-cholesterol was up taken sebaceous gland by LDL receptors. Serum LDL-cholesterol was suggested as endogenous lipid resources in the sebum synthesis. However, in several studies, there is no difference amount of skin cholesterol between hypercholesterolemic and normocholesterolemic subjects. [19]

Glycerides and free fatty acids were the main lipid in human sebum. [2] During passage of sebum through the hair canal, bacterial enzymes hydrolyze some of the triglycerides, so that the lipid mixture reaching the skin surface consists of free fatty acids and small proportions of monoglycerides and diglycerides. [2] Fatty acids have to cross the plasma membrane and will be activated by their CoA thioesters. Although free diffusion through the membrane cannot be excluded, free fatty acids are mostly translocated to the cytoplasm through an active mechanism involving a six member Fatty Acids Transport Protein (FATP) family. [20,21] This study revealed moderately correlation between serum triglyceride levels and sebum secretion (r = 0,445; *p* = 0,014). This also suggests that triglycerides were endogenous lipid resources in sebum synthesis.

There is slightly correlation, not significant statistically between serum HDL-cholesterol levels and sebum secretion (r = -0,283; *p* = 0,129). Serum HDL-cholesterol was not up taken by sebaceous gland in sebum sythesis. Otherwise, these cholesterol would re-uptake lipids inperipher organ back to liver and then were excreted as cholesterol or bile salts. Acne vulgaris was also dermatoses related to sebaceous glands. [22] Several studies showed that serum HDL-cholesterol and apolipoprotein A in acne vulgaris patients were significantly lower than unaffected controls subjects. [23]

CONCLUSION

The study findings suggest that the relationship between serum total-cholesterol, LDL-cholesterol, and triglyceride levels with sebum secretion in SD patients.

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How to cite this article: Toruan TL, Nopriyati, Theodorus et al. the relationship between serum lipid profile and sebum secretion in seborrheic dermatitis patients. Int J Health Sci Res. 2017; 7(4):138-143.

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