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NOTES

Correlation of *Propionibacterium acnes* Populations with the Presence of Triglycerides on Nonhuman Skin

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The skins of mice, rats, rabbits, sheep, guinea pigs, and dogs were cultured for *Propionibacterium acnes*. Only the sebaceous regions (perianal gland) of guinea pigs harbored a significant *P. acnes* population. Analysis of the lipid from this region revealed a significant percentage of triglycerides, compounds lacking in the sebum of the other animals.

Propionibacterium acnes has long been associated with sebaceous regions (2), but only recently has the role of sebum in *P. acnes* metabolism been considered. Marples and co-workers (3) established that *P. acnes* lipase is responsible for the cleavage of sebaceous triglycerides (TG) into glycerol and fatty acids. Rebello and Hawk (7) demonstrated an inverse correlation between skin surface glycerol levels and *P. acnes* populations. More recently, we have provided evidence that *P. acnes* populations are controlled by the rate of sebum excretion (5); therefore, *P. acnes* may require one or more sebaceous component for nourishment. Since *P. acnes* produces copious amounts of lipase in vivo, it is possible that TG-derived glycerol is the component of sebum which facilitates *P. acnes* growth.

The presence of TG in sebaceous secretions is not common to all animals. Dogs and cats have no detectable TG in their skin surface lipid, and sheep, goats, hamsters, mice, guinea pigs, and rabbits have very low concentrations (6, 8).

To investigate the role of TG in *P. acnes* ecology, we studied the carriage of *P. acnes* in animals with TG-deficient sebum.

Five adult individuals of each of the following animals were cultured for *P. acnes*: C3H/HEJ mice, white rats, New Zealand white rabbits, guinea pigs, sheep, and dogs. No animals were receiving antimicrobial treatment, and all were in frequent contact with humans. Cotton swabs moistened with 0.1% Triton X-100 in 0.05 M phosphate buffer (pH 7.0) were vigorously rubbed over the abdomens and backs of the animals. A moistened swab was also inserted and rubbed in the guinea pig perianal gland cavity. Swabs were vigorously eluted in tubes containing 1.8 ml of sampling fluid, after which serial dilutions were performed and then plated on brain heart infusion agar (Difco Laboratories) containing 0.1% Tween 80. Cultures were incubated for 7 days at 37°C in GasPak (BBL Microbiology Systems) anaerobic systems. All bacteria displaying characteristic propionibacterial morphology were identified as previously described (4, 5). The lipid content and the composition of material expressed from the guinea pig perianal gland were analyzed by thin-layer chromatography, using the method of Downing (1).

Neither *P. acnes* nor *Propionibacterium avidum* was isolated from the skin of any of the animals. One mouse carried low levels of *Propionibacterium granulosum* (10^1 colony-forming units). A second culturing of this group failed to grow any propionibacteria, indicating the transient status of the initial isolate. All guinea pig perianal gland cultures grew large numbers of *P. acnes* (geometric mean, 2.66×10^6 colony-forming units).

Analysis of the neutral lipids of the guinea pig perianal gland revealed the presence of 14.62% TG, 23.16% squalene, 38.88% wax and sterol esters, 3.28% sterols, and 20.06% undefined components.

Nicolaides and co-workers (6) and Sharaf and co-workers (8) have studied the sebaceous composition of many animals. They found that only humans produce sebum containing significant amounts of TG. The data reported in this paper indicate that the large sebaceous organ in the guinea pig anal region also produces sebum containing a large percentage of TG.

We have found a striking correlation between the presence of TG in sebum and the colonization of *P. acnes*. Since all of the animals in this study were in frequent contact with humans, who are sources of *P. acnes*, and since none of the animals had been recently treated with antimicrobial agents, their failure to maintain resident skin populations can only be attributed to the unfavorability of their skin for growth of *P. acnes*. This unfavorability could be due to an absence or a low level of TG in skin lipids.

The localization of *P. acnes* to TG-producing glands on guinea pigs supports the contention that TG is an important factor for colonization by *P. acnes*.

LITERATURE CITED

1. **Downing, D. T.** 1968. Photodensitometry in the thin layer chromatographic analysis of neutral lipids. J. Chromatogr. **38**:91-99.
2. **Kligman, A. M., J. J. Leyden, and K. J. McGinley.** 1976. Bacteriology. J. Invest. Dermatol. **67**:160-168.
3. **Marples, R. R., D. T. Downing, and A. M. Kligman.** 1971. Control of free fatty acids in human skin surface lipids by *Corynebacterium acnes*. J. Invest. Dermatol. **56**:127-131.
4. **McGinley, K. J., G. F. Webster, and J. J. Leyden.** 1978. Regional variations of cutaneous propionibacteria. Appl. Environ. Microbiol. **35**:62-66.
5. **McGinley, K. J., G. E. Webster, M. R. Ruggieri, and J. J. Leyden.** 1980. Regional variations in density of cutaneous propionibacteria: correlation of *Propionibacterium acnes* populations with sebaceous secretion. J. Clin. Microbiol. **12**:672-675.
6. **Nicolaides, N., H. C. Fu, and G. R. Rice.** 1968. The skin surface lipids of man compared with those of eighteen species of animals. J. Invest. Dermatol. **51**:83-89.
7. **Rebello, T. J., and L. M. Hawk.** 1978. Skin surface glycerol levels in acne vulgaris. J. Invest. Dermatol. **54**: 48-52.
8. **Sharaf, D. M., S. J. Clark, and D. T. Downing.** 1977. Skin surface lipids of the dog. Lipids **12**:786-790.