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Study of skin properties of the face and neck of young Taiwanese women

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Synopsis

The skin characteristics of Oriental people have not yet been well studied. In this study, forty-nine young Taiwanese women from 19 to 23 years of age were the subjects of a test using a sebumeter and a corneometer to measure lipid content and moisture content of the facial skin at a temperature of 22–25°C and at a relative humidity of 70–75%. The lipid content was in the range of 4–254 $\mu g cm^{-2}$, and the moisture content was in the range of 23–147 a.u. (arbitrary units).

The results show that the skin can be classified into the following types: oily skin (20%), oil-depleted skin (10%), oily T-zone combination skin (22%), and partially oily combination skin (48%). The moisture content of the skin depends more on the location on the face, rather than on the amount of oil secretion. Thus, the skin type is mainly determined by lipid content.

Both the lipid content and moisture content of the neck were examined in this study. Oily skin types were found to have the highest lipid content, and lipid-depleted skin types had the lowest lipid content for both front and rear regions of the neck.

INTRODUCTION

Most skin-care products in Taiwan are imported from other countries, such as France, the U.S., Germany, Japan, or Italy. Taiwan has become a very important cosmetics market of the world, and mainland China is expected to become an important cosmetics market as well. However, there is not much understanding of the skin properties of Oriental women.

Human skin is a very complex structure that varies very much with age, temperature, humidity, sex, race, ... etc. Even smoking can dramatically affect skin quality (1). A wide range of cosmetic products have been developed to maintain or improve the condition of human skin, including, for example, soapless cleansers and super-fatted soaps.

Usually skin type is divided into dry skin, normal skin, combination skin, and oily skin (2,3). Skin type is indicated by the appearance of pores and facial lines. Oily skin tends to have none or fewer facial lines and enlarged pores, while dry skin tends to have more facial lines and almost invisible pores. A better way to determined the skin type is to measure experimentally the oil secretion. Four squares of thin paper are pressed tightly

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against the forehead, cheek, chin, and the top of the nose separately for five seconds (4). Then the test papers are examined carefully by eye to evaluate the skin type, since the oil residue will make the test papers translucent.

However, oil secretion alone cannot determine the skin type. Both lipid content and moisture content are required. Nogueira and Gabrielle classified skin into six types: oily skin, normal skin, oil-depleted skin, oily dehydrated skin, dehydrated skin, and oil-depleted dehydrated skin (5). However, they ignored the combination skin type.

Other measurements of skin properties are moisture transmission, viscoelastic response, ultrasound properties, electrical properties, and facial line counting (5–12). Changes in these skin properties are very useful in evaluating the effectiveness of skin care products.

Most young Taiwanese women start to apply skin care products around age 20, at which time the skin is supposed to be in its optimum condition. However, there is not much understanding of the skin type of young Taiwanese women, nor of the skin properties of the neck. The purpose of the present research is to study the skin characteristics of face and neck for young Taiwanese women. The results should be helpful for the cosmetic industry in producing skin care products suitable for Oriental people.

EXPERIMENTAL

The lipid content and moisture content of the skin of forty-nine young Taiwanese women, from ages 19 to 23, were measured at a temperature of 22–25°C and a relative humidity of 70–75%. They were required not to apply any cosmetic products before the test. The measurements were made two hours after their faces were washed by water.

Each face was divided into 12 sections and the neck into two sections, as follows:

Sections of the face	
1. Forehead	7. Upper cheek (L)
2. Side of the eye (R)	8. Lower cheek (R)
3. Side of the eye (L)	9. Lower cheek (L)
4. Under the eye (R)	10. Top of the nose
5. Under the eye (L)	11. Under nose/upper lip
6. Upper cheek (R)	12. Chin
Sections of the neck	
13. Fore neck	14. Rear neck

MEASUREMENT OF LIPID CONTENT

The lipid content of each section of face and neck was measured using a sebumeter (Courage and Khazaka Electronic GmbH, Germany). A piece of matted plastic film was pressed against the skin with a force of 4 N for 20 seconds. The measured area was 64 mm^2. Absorption of lipid made the plastic film transparent, which was analyzed by photometry. The results were evaluated by a microprocessor and transferred to a digital instrument so that the final data could be indicated digitally.

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MEASUREMENT OF MOISTURE CONTENT

The moisture content of the skin was determined using a corneometer CM 820 (Courage and Khazaka Electronic GmbH, Germany). A probe was pressed against the skin with a force of 1.5 N for 1 second. The measured area was 49 mm^2. Because the dielectric constants of water differ considerably from those of other substances, the moisture content of the skin could be determined by the change of capacity of the measuring capacitor. The results were recorded digitally in arbitrary units.

RESULTS AND DISCUSSION

LIPID CONTENT OF THE FACE

The lipid content of the face is in the range of 4–254 μgcm^{-2} for young Taiwanese women. Nogueira and Gabrielle defined skin type by different criteria for different parts of the face: a lipid content between 90 and 200 μgcm^{-2} is defined as normal skin for the forehead, between 90 and 160 μgcm^{-2} for the cheek, and between 60 and 100 μgcm^{-2} for the neck (5), because oil secretion is different in different parts of the face and neck. However, the same criteria should be used to determine skin type for different parts. An appearance of oily skin depends on lipid content only, not on location.

Nogueira and Gabrielle also ignored the fact that weather is also a very important factor in oil secretion. Hot weather promotes more oil secretion, while cold weather suppresses it. To exclude the effect of weather, our measurements were taken at a temperature of 22–25°C and a relative humidity of 75%, and oil secretion was allowed to reach equilibrium before the measurements were taken. The same criteria were used to determine skin type for different parts of the face and neck. This criteria was determined by observing the skin of young Taiwanese women in daytime in spring. Their skin surfaces were examined under an image through photofibers. If the lipid content was greater than 100 μgcm^{-2}, the skin was classified as oily. If the lipid content was smaller than 50 μgcm^{-2}, the skin was regarded as oil-depleted. A lipid content between 50 and 100 μgcm^{-2} was taken as normal. The skin types of young Taiwanese women were then classified into six categories, listed in Table I. Twenty percent of the women had oily skin. Only ten percent had oil-depleted skin. Most women (70%) had combination skin

Table I
Skin Type of Young Taiwanese Women

Skin type					
1	2[a]	3[b]	4[c]	5[d]	6
Oily	O/Normal combination	Partially O/N combination	O/oil-depleted combination	Partially O/D combination	Oil-depleted
Percent (%)					
20	16	23	6	25	10

[a] Type 2: oily T-zone/normal combination.
[b] Type 3: partially oily/normal combination.
[c] Type 4: oily T-zone/oil-depleted combination.
[d] Type 5: partially oily/oil-depleted combination.

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Table II
Lipid Content of Each Skin Type (unit: μgcm^{-2})

Skin type	1	2	3	4	5	6
Section 1	152 ± 52	112 ± 15	116 ± 50	137 ± 66	100 ± 66	79 ± 17
Section 2	119 ± 25	66 ± 19	74 ± 29	39 ± 35	31 ± 8	34 ± 8
Section 3	122 ± 33	63 ± 15	75 ± 24	27 ± 20	34 ± 15	42 ± 18
Section 4	124 ± 22	55 ± 22	78 ± 31	32 ± 16	29 ± 17	31 ± 13
Section 5	108 ± 18	63 ± 26	69 ± 23	20 ± 10	25 ± 15	27 ± 9
Section 6	125 ± 49	53 ± 15	72 ± 19	60 ± 49	38 ± 25	34 ± 9
Section 7	126 ± 45	72 ± 13	72 ± 33	48 ± 17	33 ± 23	31 ± 14
Section 8	136 ± 47	80 ± 14	84 ± 37	47 ± 23	28 ± 21	48 ± 22
Section 9	129 ± 39	62 ± 16	77 ± 33	51 ± 42	27 ± 20	47 ± 12
Section 10	135 ± 41	157 ± 30	121 ± 43	139 ± 32	113 ± 40	69 ± 13
Section 11	157 ± 69	150 ± 37	110 ± 30	106 ± 9	89 ± 22	68 ± 5
Section 12	147 ± 51	128 ± 43	95 ± 29	121 ± 8	70 ± 26	62 ± 20

Table III
The Probability of Each Section to Become Oily for Partially Oily Combination Skin Type

	Forehead	Nose	Under nose/upper lip	Chin	Cheek	Area around eyes
Skin type 3	46%	73%	55%	36%	18%	18%
Skin type 5	33%	67%	25%	17%	0%	0%

type. Of those, 22% had oily T-zone/normal or oil-depleted combination skin, and 48% had a partially oily combination.

Usually the T-zone, (i.e., forehead, nose, under nose/upper lip, and chin) has more oil secretion than the other parts of the face. The lipid content of twelve sections of the face is shown in Table II. Sections 1 (forehead), 10 (nose), 11 (undernose/upper lip), and 12 (chin) have a higher lipid content, except for skin type 1.

For partially oily combination skin types (type 3 and 5 in Table II), the probability of each section to have oily skin is listed in Table III. The T-zone is still the most oily area, with the nose having the most tendency to be oily. Eighteen percent of skin type 3 had an oily cheek or oily area around the eyes, which is supposed to be a very dry area.

MOISTURE CONTENT OF THE FACE

The moisture content of facial skin of young Taiwanese women is between 23 and 147 a.u. The moisture content of each skin type is listed in Table IV. Different skin types showed similar values of moisture content, which implies that the moisture content of skin is independent of its lipid content. Apparently, oil has no influence on diffusional water loss in the skin. Almost every Taiwanese woman has low moisture content in the lower cheek (i.e., sections 8 and 9). Since the moisture content depends strongly upon the location on the face, but not on the amount of oil secreted, the skin type is mainly determined by the lipid content.

Nogueira and Gabrielle defined hydrated skin as having a moisture content between 65 and 90 a.u., and very dehydrated skin as having a value below 65 a.u. (5). They ignored

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Table IV
Moisture Content of Each Skin Type (unit: a.u.)

Skin type	1	2	3	4	5	6
Section 1	102 ± 6	97 ± 6	91 ± 11	95 ± 3	99 ± 9	93 ± 10
Section 2	113 ± 12	104 ± 5	98 ± 15	107 ± 2	105 ± 12	104 ± 11
Section 3	109 ± 6	104 ± 5	100 ± 113	97 ± 8	106 ± 3	107 ± 9
Section 4	114 ± 4	104 ± 8	100 ± 16	100 ± 8	112 ± 10	103 ± 10
Section 5	111 ± 6	108 ± 9	104 ± 13	101 ± 8	111 ± 5	103 ± 11
Section 6	107 ± 7	102 ± 8	96 ± 15	96 ± 9	103 ± 8	101 ± 14
Section 7	104 ± 8	106 ± 5	97 ± 12	95 ± 13	110 ± 6	95 ± 60
Section 8	62 ± 26	66 ± 22	70 ± 19	76 ± 9	70 ± 33	69 ± 80
Section 9	55 ± 28	57 ± 19	71 ± 27	73 ± 9	68 ± 28	71 ± 15
Section 10	90 ± 11	84 ± 11	90 ± 11	83 ± 10	93 ± 10	83 ± 13
Section 11	105 ± 11	100 ± 11	106 ± 16	97 ± 12	94 ± 23	98 ± 13
Section 12	103 ± 9	98 ± 8	100 ± 13	100 ± 11	104 ± 6	94 ± 8

Table V
The Probability of Dehydration in Different Sections of the Face

Skin type	1	2	3	4	5	6
Dehydrated						
Section 1	0%	0%	9%	0%	8%	0%
Sections 3&5	0%	0%	9%	0%	0%	0%
Sections 6&7	0%	0%	9%	0%	8%	20%
Section 8	10%	25%	36%	33%	66%	40%
Section 9	20%	38%	45%	33%	75%	40%
Section 10	20%	25%	9%	0%	33%	20%
Section 11	0%	0%	0%	33%	0%	0%
Very Dehydrated						
Sections 8&9	50%	38%	18%	33%	0%	0%

the effect of weather. We chose somewhat different criteria: that dehydrated skin has a moisture content between 50 and 80 a.u. and that very dehydrated skin has a value below 50 a.u. at a temperature of 22–25°C and a relative humidity of 75%. The criteria were determined by a panel of ten members who observed the skin of young Taiwanese women in daytime in spring. The probability of dehydration for each part of the face is listed in Table V for each skin type. The lower cheek (sections 8 and 9 in Table V) is the driest area of the face. Surprisingly, some young women's noses (about 20%, the average of section 10) are also a dehydrated area. Since we mentioned above that the nose is usually very oily, it is thus not true that oil can seal moisture in the skin (2).

LIPID CONTENT AND MOISTURE CONTENT OF THE NECK

Compared with the face, the skin of the neck is an area of lower lipid content. The experimental results are listed in Table VI. Note that the more oily the face, the higher the lipid content of the neck. Oily skin types (type 1) have the highest lipid content, and oil-depleted skin types (type 6) have the lowest value. Comparing the front of the neck with the rear, the lipid content is slightly higher, except for skin type 6. The mois-

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Table VI
Lipid Content and Moisture Content of the Neck

Skin type	1	2	3	4	5	6
Lipid content (unit: μgcm^{-2})						
Section 13	96 ± 30	58 ± 15	61 ± 16	54 ± 14	29 ± 22	17 ± 10
Section 14	77 ± 36	45 ± 20	46 ± 15	43 ± 24	24 ± 14	33 ± 17
Moisture content (unit: a.u.)						
Section 13	169 ± 10	102 ± 8	105 ± 8	96 ± 5	97 ± 19	102 ± 10
Section 14	82 ± 10	98 ± 10	99 ± 16	94 ± 13	85 ± 23	91 ± 10

ture content of the front of the neck was also found to be slightly higher than that of the rear neck. On the other hand, the moisture content of the neck was independent of skin type. Similar values of moisture content were found, as shown in Table VI.

CONCLUSIONS

1. The lipid content of the face is in the range of 4–254 μgcm^{-2} for young Taiwanese women. There are six skin types, including oily skin (20%), oil-depleted skin (10%), and oily T-zone combination skin (22%).
2. For partially oily combination-skin type, the T-zone is still the most oily area. The nose has the greatest tendency to be oily. Eighteen percent of women of skin type 3 have oily cheeks or an oily area around the eyes.
3. The moisture content of the face is between 23 and 147 a.u. Different skin types have a similar value. The lower cheek gives the lowest value of moisture content. Thus, the moisture content depends on the particular area of the face, not on the amount of oil secretion. Therefore, skin type is mainly determined by lipid content.
4. Some young Taiwanese women (about 20%) had a dehydrated nose, which is usually a very oily area. This is evidence that oil has no influence on diffusional water loss in the skin.
5. The lipid content of the neck is lower than that of the face, but a more oily face is associated with a higher lipid content of the neck. Different skin types have similar moisture contents for the neck. A comparison was made between the front and rear of the neck. It showed that both the lipid content and the moisture content of the front were slightly higher than those of the rear neck, except for the lipid content of one skin type (the delipided skin type).

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