

Characterization of Normal Skin Thickness For Various Body Regions, Ages, and Genders of Yucatan Miniature Swine

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INTRODUCTION

Dermatology is an extremely important field, as the skin of humans and animals plays a lifesparing, protective role. The skin is the largest organ of the body and is metabolically active. It is constantly shedding and regenerating. Skin from various regions of the body may vary morphologically, including in physical thickness. Dermatological studies in miniature swine provide a unique opportunity for risk assessment because of demonstrated similarities to human cutaneous anatomy, biochemistry, and physiology. The Yucatan is a popular miniature swine often used in biomedical research today. Yucatan skin is slate grey-black in color, slightly or moderately pigmented, and contains a sparse haircoat (sometimes called the Mexican hairless miniature swine). The physical thickness of miniature swine skin may impact drug absorption during in vivo or ex vivo studies, or affect wound healing or phototoxicity studies. Therefore, a good understanding of the relative dimensions of each major skin application or collection site is indicated. This study of Yucatan skin was undertaken to better document this area to give researchers more information about the skin thickness of miniature swine. Few citations on porcine or miniature swine skin thickness exist. Eggleston et al. (2000) reported mean \pm SD thickness of the Yucatan miniature swine flank, and dorsal neck epidermis were 68 \pm 34 and 68 \pm -25 μ M, respectively. Thickness of the Yucatan miniature swine skin were closely comparable to the thickness of human epidermis from the face (68 \pm 26 μ M), neck (65 \pm 24 μ M) and arms (68 \pm 21 μ M). The domestic Yorkshire epidermis from seven sites was not as thick (Eggleston et al., 2000). Monteiro-Riviere et al. (1990) reported back skin components of the domestic Yorkshire swine, including a 12.28 \pm 0.72 μ M strateum corneum, 51.89 \pm 1.49 μ M cellular epidermis, and 3.94 \pm 0.13 epidermal cell layers. Grabau et al. (1995) reported on a laboratory histological survey of research animal skin thickness, including a mixed breed domestic farm pig. This study will add additional standard Yucatan miniature swine data to the research database.

MATERIALS AND METHODS

Eight-millimeter punch biopsies of Yucatan miniature swine skin from freshly sacrificed animals were collected, placed into cassettes, and fixed in 10% neutral buffered formalin (Protocol formalin, Fisher Diagnostic). Body surface sites evaluated for 18 animals included: neck, back, flank, and abdomen for all animals except two five-month-old intact males, which also had rump skin collected. Samples were cored down to the hypodermis (fat layer) by gentle turning of the disposable punch biopsy device, eight millimeters in diameter (Miltex, York, PA), then elevating and snipping the underlying fat layer. The subcutaneous fat layer (hypodermis) was not measured. Both genders were represented. Ages varied depending upon availability, but in general ranged from 5.0 to 36.5 months (males) or 3.5 weeks to 10.3 months (females). From the 18 heads examined, sample data were pooled into age categories or groups. Skin samples were also collected from ear, axillary, and inguinal areas, but will not be reported here.

The abdomen sample was taken approximately one to two inches anterior to the umbilicus on the midline. The back or dorsum sample was anterior to the pelvis in the lumbar area off to one side of the spinal column by about one to two inches. The neck sample was taken from the lateral side of the neck about one to two inches anterior to the scapula. The flank sample was collected from the caudal lateral flank three inches anterior to the rear leg. The rump skin was taken caudal to the ilium, anterior to the ishium, and off to one side of the spinal axis.

Following adequate time for fixation, the hairs on the surface of the eight-millimeter-in-diameter skin punch biopsy specimen were counted under an Olympus SZH10 Zoom Stereo Microscope. The skin biopsy was trimmed, processed, embedded in paraffin, sectioned at 4 μ m, and stained with hematoxylin and eosin (H&E).

Two microphotographs (one 20X and the other 40X) were taken from each skin biopsy specimen by using an Olympus DP70 digital camera mounted on an Olympus BX41 microscope. Five thickness measurements of the stratum corneum (s.c.), cellular epidermis, and dermis were randomly taken. All measurements were digitally calculated using an image-analyzing system (Olympus MicroSuiteTM Basic Edition) and were represented as micrometers (µM, microns).

The thickness of the dermis was measured on the 20X microphotographs. The epidermis and stratum corneum were measured on the 40X microphotographs.

The number of cell layers was estimated for the cellular epidermis (excluding the s.c.). Full-thickness epidermis and full-thickness skin calculations were performed by adding the strateum corneum and cellular epidermis values, and the full-thickness epidermis and dermis values, respectively.

The five readings for each skin category (strateum corneum, epidermis less s.c. [cellular epidermis], dermis) were averaged (\pm SD) for each gender and age group. Number of cell layers, hair counts, and full-thickness calculations was also recorded and averaged (\pm SD). Gender, age, and body region specific means (in μ M), \pm SDs, and observed ranges were reported. Relative ratios of cellular epidermis and dermis to full-thickness measurements were performed. Data were compared to published measurements of adult human and domestic Yorkshire skin, illustrating similarities or differences.

RESULTS

Table 1 presents mean (±SD) Yucatan skin component thickness measurements by biopsy site, gender, and age category. **Table 2** presents full-thickness Yucatan epidermis and full-thickness skin calculations and skin component relative ratios (percentages) of these two total thickness estimates (epidermal, total skin). Minimum and maximum observed (range) values for all parameters measured are presented in **Table 3**. Gender, age, and body-region-specific means (μM), ± SDs, and observed ranges are presented for five inter-follicular skin components (dermis thickness, stratum corneum thickness, cellular epidermis thickness, number epidermal cell layers, and hair count)

 Table 1. Yucatan Miniature Swine Skin Component Thickness and Counts

Site	Gender/N	Group	Age	Fn	Dermis (μM)	Cellular Epidermis (µM)	Stratum Corneum (µM)	# of Epidermal Cell Layers*	Hair Count**	
Neels	Malaa (1 aaa) N=2	۸	E C E ma	Mean	4363.66	65.1	26.38	4.33	7	
Neck	Males (1 cas) N=3	Α	5-6.5 mo	SD	699.7	15.66	5.56	0.82	-	
Neck	Males (cas) N=3	В	22.2-24 mo	Mean	3865.17	62.15	28.98	4.4	2	
HOOK	Wales (oas) 14-0		22.2 24 1110	SD	734.85	16.95	5.61	0.63	1	
Neck	Male (cas) N=1	С	36.5 mo	Mean	5596.73	47.48	22.11	4	1	
				SD	836.28	4.82	2.78	0.71		
Neck	Male (cas) N=1	D	10.3 mo	Mean SD	3757.31 183.93	67.76 9.18	66.39 18.7	4.8 0.84	5	
				Mean	1334.06	54.15	12.97	5.15	19	
Neck	Females N=4	E	3.5 wk	SD	181.62	12.27	4.52	0.93	6	
Nicolo	Famalas N. O	_	4.5.4	Mean	3450.17	75.46	20.07	5.4	5	
Neck	Females N=3	F	4-5.4 mo	SD	843.58	13.95	5.81	0.63	2	
Neck	Females N=2	G	8.9-10.3 mo	Mean	2256.25	54.22	9.77	5	7	
HOOK	Tomaloo N 2		0.0 10.0 1110	SD	1717.83	41.49	7.55	0.82	0	
Back	Males (1 cas) N=3	Α	5-6.5 mo	Mean	4468.01	77.89	24.86	5.2	3	
				SD	169.18	11.16	2.12	0.84		
Back	Males (cas) N=3	В	22.2-24 mo	Mean SD	4343.19 934.18	63.84 15.44	35.34 11.63	4.2 0.56	1	
				Mean	4809.62	67.8	26.71	3.8	2	
Back	Male (cas) N=1	С	36.5 mo	SD	250.21	7.42	8.08	0.45		
D 1		Б	40.0	Mean	3418.45	77.83	23.53	3.6	7	
Back	Male (cas) N=1	D	10.3 mo	SD	216.39	9.47	4.02	0.55		
Back	Females N=4	Е	3.5 wk	Mean	1164.2	77.77	13.72	5.45	21	
Dack	remales N-4	_	3.5 WK	SD	134.49	25.41	3.58	0.94	14	
Back Females N=	Females N=3	F	4-5.4 mo	Mean	3503.94	87.37	23.03	4.6	3	
		G	8.9-10.3 mo	SD	1145.7	20.39	9.03	0.83	3	
Back	Females N=3			Mean SD	3580.52 423.3	92.15 24.96	37.78 6.12	5.4 0.99	2	
				Mean	3872.94	59.59	47.3	4.4	3	
Flank	Males (1 cas) N=3	Α	5-6.5 mo	SD	415.12	15.96	9.61	0.89		
E	M I () NI O	Б	00.0.04	Mean	3990.93	53.51	45.12	3.87	2	
Flank	Males (cas) N=3	В	22.2-24 mo	SD	391.6	8.34	5.81	0.35	0	
Flank	Male (cas) N=1	С	36.5 mo	Mean	5008.9	57.2	32.96	4.8	2	
1 Idilik	Maic (cas) N-1	J	50.5 mo	SD	402.01	6.51	6.22	0.84		
Flank	Male (cas) N=1	D	10.3 mo	Mean	3614.24	48.41	13.95	3.6	3	
				SD	85.61	4.37	2.02	0.55		
Flank	Females N=3	Е	3.5 wk	Mean SD	909.22 230.23	34.72 22.53	11.89 7.82	4.33 0.49	10 4	
				Mean	2698.85	63.47	19.02	4.73	4	
Flank	Females N=3	F	4-5.4 mo	SD	356.83	13.01	5.3	1.1	2	
Flank	Famalas N=2	0	0.0.40.2	Mean	3355.12	72.6	25.4	4.8	3	
Flank	Females N=3	G	8.9-10.3 mo	SD	249.52	30.35	10.08	1.21	1	
Abdomen	Male (1 cas) N=3	Α	5-6.5 mo	Mean	3072.99	61.8	65.3	6.2	3	
	(1 535) 11 5	, ,	0 0.0	SD	593.53	5.57	11.8	1.1		
Abdomen	Male (cas) N=3	В	22.2-24 mo	Mean	2283.02	53.37	35.55	4.2	0	
				SD Mean	216.61 2647.14	8.46 69.99	7.68 33.92	0.41 5	1	
Abdomen	Male (cas) N=1	С	36.5 mo	SD	262.4	5.12	1.35	0.71		
	Male (cas) N=1,			Mean	Not read	38.8	21.75	3.4	0	
Abdomen	except dermis block missing	D	10.3 mo	SD	N/A	3.51	1.9	0.55	•	
Abdomen	Females N=4	Е	3.5 wk	Mean	1020.37	66	19.32	5.15	2	
Abdomen		_	5.5 m	SD	369.67	17.67	8.33	0.81	2	
Abdomen	Females N=3	F	4-5.4 mo	Mean	2343.19	66.75	15.36	4.47	1	
Abdomen	Females N=3	G	8.9-10.3 mo	SD Mean	722.45 2015.31	11.03 61.6	3.56 31.76	0.64 4.67	1	
ADUUITIETT				Mean	2702.54	86.32	23.11	5.3	8.5	
Rump	Males N=2	Н	5 mo	SD	287.05	19.22	6.43	0.82	4.9	
*Cell lavers of	*Cell layers of epidermis; **hairs evident on surface of 8mm (50.24 sq mm or 0.5024 sq cm) biopsy punch. Male (cas) = castrated; Five measurements were									

*Cell layers of epidermis; **hairs evident on surface of 8mm (50.24 sq mm or 0.5024 sq cm) biopsy punch. Male (cas) = castrated; Five measurements were taken per skin site for each animal and averaged. Age group averages included the following N animals: C & D = 1; A, B, F & G = 3; E = 4; rump skin include N of 2 intact males. Animal #1289 (female, 10.3 mons) was missing neck block and #2052 missing flank samples; animal #1291 (male castrate, 10.3 mons) abdomen dermis reading was not performed due to lower tissue disruption. Animal #1289 was OVXed; Animals #12913 & #1289 were acute Type 1 alloxan-induced diabetics

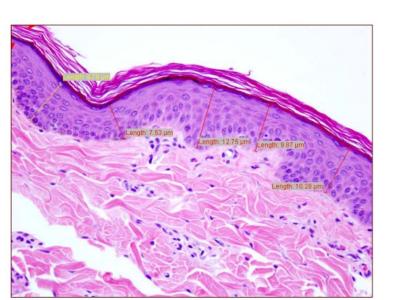


Figure 1. 40X image of Yucatan skin (H&E) illustrating five random measurements of cellular epidermal thickness, with overlying strateum corneum, also a component of the epidermis, and underlying pink, eosinophilic dermis containing abundant collagen and vascular supply.

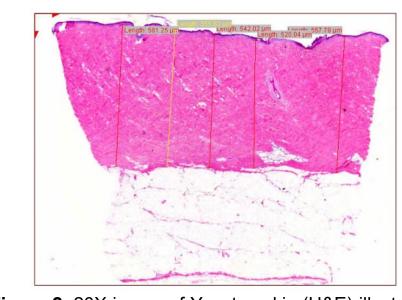


Figure 2. 20X image of Yucatan skin (H&E) illustrating five random measurements of dermis, with overlying epidermis and strateum corneum, and underlying hypodermal fat.

						Epidermis to Dermis	Full- Thickness Skin
Neck	Male (1 cas) N=3	Α	6.5 mo	91.47	4455.13	0.021	0.979
Neck	Male (cas) N=3	В	22.2-24 mo	91.14	3956.31	0.024	0.977
Neck	Male (cas) N=1	С	36.5 mo	69.59	5666.32	0.012	0.988
Neck	Male (cas) N=1	D	10.3 mo	134.15	3891.46	0.036	0.966
Neck	Females N=4	E	3.5 wk	67.12	1401.18	0.05	0.952
Neck	Females N=3	F	4-5.4 mo	95.53	3545.7	0.028	0.973
Neck	Females N=2	G	8.9-10.3 mo	63.99	2320.25	0.028	0.972
Back	Male (1 cas) N=3	Α	6.5 mo	109.72	4274.39	0.026	0.974
Back	Male (cas) N=3	В	22.2-24 mo	99.18	4442.37	0.023	0.978
Back	Male (cas) N=1	С	36.5 mo	94.51	4904.13	0.02	0.981
Back	Male (cas) N=1	D	10.3 mo	101.36	3519.81	0.03	0.971
Back	Females N=4	Е	3.5 wk	91.49	1255.7	0.079	0.927
Back	Females N=3	F	4-5.4 mo	110.4	3614.34	0.032	0.969
Back	Females N=3	G	8.9-10.3 mo	129.93	3710.45	0.036	0.965
Flank	Male (1 cas) N=3	Α	6.5 mo	102.72	3962.27	0.027	0.974
Flank	Male (cas) N=3	В	22.2-24 mo	98.63	4089.56	0.025	0.976
Flank	Male (cas) N=1	С	36.5 mo	90.15	5099.06	0.018	0.982
Flank	Male (cas) N=1	D	10.3 mo	62.36	3676.6	0.017	0.983
Flank	Females N=3	Е	3.5 wk	46.6	955.83	0.051	0.951
Flank	Females N=3	F	4-5.4 mo	82.48	2781.33	0.031	0.97
Flank	Females N=3	G	8.9-10.3 mo	98	3453.12	0.029	0.972
Abdomen	Male (1 cas) N=3	Α	6.5 mo	108.31	3391.61	0.033	0.968
Abdomen	Male (cas) N=3	В	22.2-24 mo	88.92	2371.94	0.039	0.963
Abdomen	Male (cas) N=1	С	36.5 mo	103.91	2751.05	0.039	0.962
Abdomen	Male (cas) N=1, except dermis not read	D	10.3 mo	60.55	N/A	N/A	N/A
Abdomen	Females N=4	Е	3.5 wk	85.32	1105.7	0.084	0.923
Abdomen	Females N=3	F	4-5.4 mo	82.11	2425.31	0.035	0.966
Abdomen	Females N=2	G	8.9-10.3 mo	93.36	2108.67	0.046	0.956
Rump	Males N=2	Н	5 mo	109.43	2811.97	0.04	0.961

*Strateum corneum plus cellular epidermis = Epidermis thickness **Epidermis plus dermis = Skin thickness

Table 3.	Minimum an	d Maximum	Observed	Values	(Ranges)	by Paramete

Tubic o. William	Indin and Maximum	CDSCIV	ca values (Italie	Jes, by i c	ilametei				
Site	Gender	Group	Age	Fn	Dermis (µM)	Cellular Epidermis (µM)	Stratum Corneum (µM)	# of Epidermal Cell Layers	Trichogram/ # of Hairs
				Min	3298.86	50.26	17.96	3	7
Neck	Male (1 cas) N=3	Α	6.5 mo						
				Max	5644.62	97.86	37.95	6	16
Neck	Male (cas) N=3	В	22.2-24 mo	Min	2701.39	40.31	20.14	4	1
TTOOK	maio (cao) it o		22.2 2 1 1110	Max	5334.3	89.8	38.69	6	2
Neck	Male (cas) N=1	С	36.5 mo	Min	4648.91	42.97	18.54	3	1
Neck	Male (cas) N-1	C	30.3 1110	Max	6741.67	55.09	26.26	5	
		_	40.0	Min	3583.02	54.84	45.37	4	5
Neck	Male (cas) N=1	D	10.3 mo	Max	3960.42	76.6	88.13	6	
				Min	1004.53	36.88	6.96	4	13
Neck	Females N=4	Е	3.5 wk	Max	1709.38	76.17	25.21	7	24
				Min	2273.1	44.02	12.27	4	3
Neck	Females N=3	F	4-5.4 mo		5171.68		30.95	6	
				Max		96.48			7
Neck	Females N=2	G	8.9-10.3 mo	Min	2758.67	57.39	8.5	4	7
				Max	4630.6	108.46	18.64	6	7
Back	Male (1 cas) N=3	Α	6.5 mo	Min	3809.76	55.25	21	4	3
Baok	Wale (1 646) 11 6	, ,	0.0 1110	Max	4734.14	108.83	48.47	6	12
Pook	Mala (aga) N=2	В	22.2-24 mo	Min	3452.87	47.89	23.81	3	0
Back	Male (cas) N=3	Б	22.2-24 1110	Max	5760.75	99.01	59.92	5	2
- .		_	~~ -	Min	4619.45	59.27	19.7	3	2
Back	Male (cas) N=1	С	36.5 mo	Max	5243.75	76.62	38.46	4	
				Min	3203.23	64.58	17.27	3	7
Back	Male (cas) N=1	D	10.3 mo	Max	3739.79	89.33	28.28	4	,
				Min	917.68	40.72	8.14		5
Back	Females N=4	Ε	3.5 wk					4	
				Max	1499.23	123.93	19.3	7	39
Back Females N	Females N=3	F	4-5.4 mo	Min	1895.92	56.17	11.58	3	0
				Max	5042.04	131.91	41.18	6	5
Back	Females N=3	G	8.9-10.3 mo	Min	2866.41	56.64	30.74	4	1
Baok	1 omalos 14 o	G	0.0 10.0 1110	Max	4198.78	133.66	54.22	7	5
Flank	Male (1 cas) N=3	Α	A 6.5 mo	Min	3419.29	39.12	16.67	4	3
FIAIIK	Iviale (1 cas) IV-3	A	0.5 1110	Max	4419.6	109.27	55	6	13
-		_	00 0 04	Min	3429.74	37.93	35.49	3	2
Flank	Male (cas) N=3	В	22.2-24 mo	Max	4663.8	70.19	51.66	4	2
				Min	4621.77	49.28	25.9	4	2
Flank	Male (cas) N=1	С	36.5 mo	Max	5594.97	63.91	39.31	6	
				Min	3484.49	44.12	11.22	3	3
Flank	Male (cas) N=1	D	10.3 mo	Max	3723.17	54.5	16.38	4	O .
				Min	673.36	37.71	10.56	4	6
Flank	Females N=3	Е	3.5 wk						
				Max	1421.45	82.18	21.6	5	14
Flank	Females N=3	F	4-5.4 mo	Min	2010.24	47.41	9.84	3	2
				Max	3285.78	92.08	26.86	7	5
Flank	Females N=3	G	8.9-10.3 mo	Min	2977.41	34.92	12.45	3	2
TIGHK	1 ciliales 14–0	J	0.0 10.0 1110	Max	3740.91	140.93	40.24	7	4
Abdomon	Mala (1 aga) N=2	۸	6 E ma	Min	2240.34	43.17	31.08	3	2
Abdomen	Male (1 cas) N=3	Α	6.5 mo	Max	4357.65	94.1	85.48	7	4
		_	00.0.4	Min	1685.41	36.73	24.17	4	0
Abdomen	Male (cas) N=3	В	22.2-24 mo	Max	2604.82	69.6	46.69	5	1
Abdomen		С	36.5 mo	Min	2216.06	61.59	32.58	4	1
	Male (cas) N=1			Max	2881.34	75.18	36.15	6	
Abdomen	Male (cas) N=1, except dermis not read	D	10.3 mo	Min	No Block	32.8	20.23	3	1
				Max	No Block	41.01	25.04	4	1
Abdomen	Females N=4	Е	3.5 wk	Min	587.29	33.84	6.23	4	0
	. 3111013011 1		0.0 WK	Max	1867.56	101.34	32.5	6	5
Abdomen	Females N=3	F	4-5.4 mo	Min	1518	52.55	9.18	4	1
ADGOTTOTT	i dilidios it-su	,	1 0.7 1110	Max	3656.93	87.16	24.42	6	2
Abdomor	Famalas N=2	G	Q 0 10 2 ma	Min	1275.55	35.52	17.61	3	0
Abdomen	Females N=2	G	8.9-10.3 mo	Max	2925.31	113.78	53.4	6	2
<u> </u>	MAIL NI C		-	Min	2233.41	50.58	15.85	4	5
Rump	Males N=2	Н	5 mo	Mass	2427.04	440.50	20.24	^	40

118.52

36.31 6 12

DISCUSSION

It is well-recognized that skin thickness varies from one body region to another, and the density of hair follicles varies greatly by region. The Yucatan miniature swine is no exception. Full-thickness skin includes the strateum corneum, cellular epidermis, and dermis. The dermis makes up the majority of the thickness of Yucatan skin (92% to 99%). The Yucatan epidermis (strateum corneum plus cellular epidermis) makes up 1.0% to 8.0% of full-thickness skin. The full-thickness epidermis ranged from 62.36 micrometers (μ M) on a 10.3-month-old castrate male flank to 134.15 microns on the neck of the same castrate male. Group mean full-thickness skin ranged from 955.83 microns (μ M) (0.95 mm) on the back of 3.5-week-old females to 5,666.32 microns (μ M) (5.6 mm) on the neck of a 10.3-month-old castrate male. Cellular epidermis ranged from 32.80 (abdomen) to 140.93 (flank) microns (μ M). Strateum corneum ranged from 6.23 (abdomen) to 88.13 (neck) microns (μ M). The dermis ranged from 587.29 (abdomen) to 6,741.67 (neck) microns (μ M).

The thickness of the horny layer (strateum corneum) influences the resistance of the skin to physical and chemical trauma [McGrath et al., 2004], and potentially to transdermal drug delivery. The thickness of the strateum corneum and epidermis plays a significant role in the absorption of percutaneous applied drugs, as the near-surface vascular supply underlies the epidermis between the epidermal rete pegs (downward invaginations) in the uppermost dermis. The thickness of the dermis may also have an impact on dermal absorption, as the dermis depths contains hair follicles, apocrine sweat glands, and the subcutaneous layer (adipose, blood vessels, nerves, and the beginnings of skeletal muscle).

The skin of the younger animals was thinner and that of older animals thicker, as expected. The abdominal skin was the thinnest of the four primary sites evaluated, primarily due to reduced thickness of the dermis. The rump skin was thinner than the back for both animals tested. This reduction in rump thickness was also due primarily to a decrease in the dermis thickness for the rump area. The number of epidermal cell layers ranged from three to seven layers, and the trichogram count ranged from 0 to 39 hairs counted on the surface of the 8 mm (50.24 sq mm or 0.5024 sq cm) round biopsy plug of skin. The female gender had readily evident thinner dermis and skin from examination of the data. The small sample sizes for some groups, and the variations in ages, could account for a lack of other differences.

COMPARISON TO HUMAN AND YORKSHIRE SWINE

Human skin varies from 0.5 mm (500 microns) in the thinnest regions to 4 mm (4,000 microns) on the palms and soles (Fridman, 2001). The skin thickness of the Yucatan miniature swine in this study compared well to published values for humans. Swindle (2008) reported that Yucatan skin was similar in thickness to human skin. Monteiro-Riviere and Riviere (1996) reported on the thickness of weanling female 15-to-20-kg domestic Yorkshire skin. The Yorkshire dermis component was generally thinner than that observed here in the Yucatan miniature swine, as well as that published for humans. Human epidermal thickness reported by Sandby-Moller et al. (2003) shows similarity to findings in our young adult Yucatan miniature swine.

CONCLUSIONS

These data support the premise that young adult Yucatan miniature swine skin thickness is similar to human skin thickness. The differences in thickness for various Yucatan body sites is predominantly due to differences in dermis thickness, as the dermis makes up 92% to 98% of full-thickness skin. Across the 18 individual animals and all biopsy sites, the dermis averaged 3,305.33 μ M, the cellular epidermis 69.34 μ M, and the strateum corneum 29.10 μ M. Observed minimum and maximum values for measured components included dermis (587.29 μ M, 6,741.67 μ M), cellular epidermis (32.80 μ M, 140.93 μ M), and strateum corneum (6.23 μ M, 88.13 μ M). Rump skin was thinner than back skin for the two samples analyzed. Female skin was thinner than castrate male skin. Abdomen skin was generally thinner than the other sites evaluated. The cellular epidermis number of cell layers varied from three to seven layers (mean 4.64 layers) and the trichogram from 0 to 39 hairs (mean 5.27 hairs), counted per 50.24 sq mm (8 mm diameter biopsy punch). Future efforts will include skin thickness measurements of other body sites.

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