

Measurements of a 'normal vulva' in women aged 15–84: a cross-sectional prospective single-centre study

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Objective Accurate and detailed description of a 'normal vulva' is rare, even though a few studies have dealt with the topic of normal measurements of parts of the external female genitalia. This leads to a situation with a wide range of existing diagnoses concerning 'normal' vulvar morphology.

Design Cross-sectional prospective single-centre study.

Setting From August 2015 to April 2017, we included 657 women in our gynaecological and uro-gynaecological outpatient clinic of the Cantonal Hospital Lucerne.

Population or sample We recruited white women aged 15–84 years.

Methods Standardised defined measurements were taken of the clitoral gland, distance from the base of the gland to the urethral orifice, length of introitus, length of perineum, length of labia majora, and length and width of labia minora. Furthermore, we recorded baseline characteristics.

Main outcome measures The length of labia minora ($r = -0.364$, $P < 0.001$, $n = 657$) as well as the length of the perineum ($r = -0.095$, $P = 0.014$, $n = 657$) are inversely correlated with age.

A positive correlation between body mass index and the length of the labia majora ($r = 0.150$, $P < 0.001$, $n = 657$) and the length of the introitus ($r = 0.097$, $P = 0.014$, $n = 657$) was found.

Results We provide detailed data on age-related dimensions and description of the external female genitalia in a homogeneous group of white women.

Conclusion With our data, we present a baseline for the appearance of a normal white vulva, which could be used to establish standards for indications for gynaecological cosmetic surgery.

Keywords Anatomy, external female genitalia, measurements, normal vulva, vulva.

Tweetable abstract This study presents data on the standard dimensions of the external female genitalia and is, to our knowledge, the biggest cohort presented on this topic by now.

Linked article This article is commented on by NS Crouch, p. 1662 in this issue. To view this mini commentary visit <https://doi.org/10.1111/1471-0528.15416>

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Introduction

Accurate and detailed descriptions of the external female genitalia are rare and thus reproducible definitions concerning the 'normal' appearance of the vulva are still being debated. Even most medical textbooks lack information of vulvar morphology.¹ In defining a 'normal' appearance today, we are using limited data from the beginning of the 20th century.

In 1924, Maria Bonaparte was the first woman to publish data concerning the dimensions of the anatomy of the female genitalia. Her idea was that the distance between clitoris and vagina affects the likelihood of women experiencing orgasm during sexual intercourse. Under the pseudonym A. E. Narjani, she published her theory of frigidity.^{2–4}

The necessity to set up valid standards concerning definitions of anatomical relations and dimensions of the external

female genitalia is reflected in the published data in recent years. Basaran et al.⁵ showed in a cohort with pre- and post-menopausal women that a wide variation in the appearance of female genitalia exists. He concluded that further studies are needed on the 'normal' appearance of the vulva and clear definitions.

Furthermore, discussions involving women in their reproductive years are indirectly linked to missing standards and definitions of the 'normal' vulva presentation. Genital appearance has raised awareness among young women in the last decade.⁶

Despite the fact that the appearance differs depending on ethnicity, age, weight, hormonal status, and type of skin, young women are seeking a perfect body image.^{5,7} This body image is not seldom influenced by the media, resulting in rising numbers of cosmetic surgery consultations.^{8–10}

The primary purpose of this prospective cohort study was to present standard values concerning the external female genitalia and its appearance among white women. The primary aim was to set up a database that represents reliable standard values of the vulva.

Methods

Women were recruited during outpatient clinics in our gynaecological and our uro-gynaecological department of the Cantonal Hospital Lucerne, Switzerland. The recruitment period was from August 2015 to April 2017. Women were eligible for inclusion if aged between 15 and 84 years, able to speak and to write sufficiently well in the German language, and able and willing to sign an informed consent. We chose to include white women only, to create a homogeneous group of just one ethnicity. Women were excluded if they met one of the following criteria: pregnancy, use of systemic hormone therapy (except contraceptive pill), chronic vulva disease (e.g. Lichen sclerosus), vulvar complaints or any prior surgery of the vulva.

Baseline characteristics (age, height, weight, parity, and type of delivery) were sampled by a physician during outpatient clinics. Body mass index (BMI) was calculated as height in meter divided by weight in kg squared and categorised in one of the following four groups according to the World Health Organization classification: underweight ($<18.5 \text{ kg/m}^2$), normal range ($18.5\text{--}24.99 \text{ kg/m}^2$), overweight ($25\text{--}29.99 \text{ kg/m}^2$), and obese ($>30 \text{ kg/m}^2$).

According to the women's age, they were matched in one of the following seven subgroups (decades): decade I aged between 15 and 24 years, decade II aged between 25 and 34 years, decade III aged between 35 and 44 years, decade IV aged between 45 and 54 years, decade V aged between 55 and 64 years, decade VI aged between 65 and 74 years, and decade VII aged between 75 and 84 years.

The aim was to include 650 women. In decades I–VI, there were 100 women in each group and in decade VII, 50 women.

Measurements of the external female genitalia were performed in lithotomy position using a disposable paper measure. Analysis was performed for each site: width of the clitoral gland, clitoral length, distance from the base of the gland to the urethral orifice, length of introitus, length of perineum (posterior fourchette to anterior anal margin), length of labia majora, length of labia minora (from clitoris to the lower margin of the labia), width of labia minora (from the sulcus infralabialis to the margin of the labium minora, not stretched). All values are visualised in Figure 1.

An educational period of teaching the accurate measurements was initiated before the start of the inclusion period. The study coordinator performed a one-on-one instruction lecture for each investigator and supervised the first five measurements to reduce inter-observer variability. A total of 12 gynaecologists, approved by the ethic committee, performed the examinations.

Analysis of data was performed using STATA (Version 14.2, StataCorp, College Station, TX, USA) by LD (Dirk Lehnick). Descriptive statistics were calculated for basic patient characteristics. A two-tailed P -value < 0.05 was considered the threshold of statistical significance; results are presented as means \pm standard deviation.

Human Research Ethics approval was obtained for this study from the 'Ethikkommission Nordwest- und Zentralschweiz (EKNZ)'. The commission accepted this study on 28 July 2015 (EKNZ 2015-222).

Core outcome sets and patient involvement were not used and the study was unfunded.

Results

During 20 months of the period from August 2015 to April 2017, a total of 657 women were recruited.

Mean age of the women was 47.27 ± 18.5 years. Women varied in height from 142 to 186 cm (mean 165 ± 6.79 cm) and weight from 35 to 136 kg (mean 68.8 ± 14.6). Body mass index ranged from 13.7 to 51.8 kg/m^2 ($25.4 \pm 5.3 \text{ kg/m}^2$). Regarding parity, 245 women were nulliparous and 412 parous; 56 of these had had a caesarean section, 331 a vaginal delivery, and 25 both a caesarean section and vaginal delivery. Baseline characteristics are summarised in Table 1.

Average measurements of the vulva incorporating the whole cohort are demonstrated in Table 2. Asymmetry of right- and left-side measurements of the labia majora and labia minora was not statistically significant. Standard values concerning the external female genitalia for each cohort

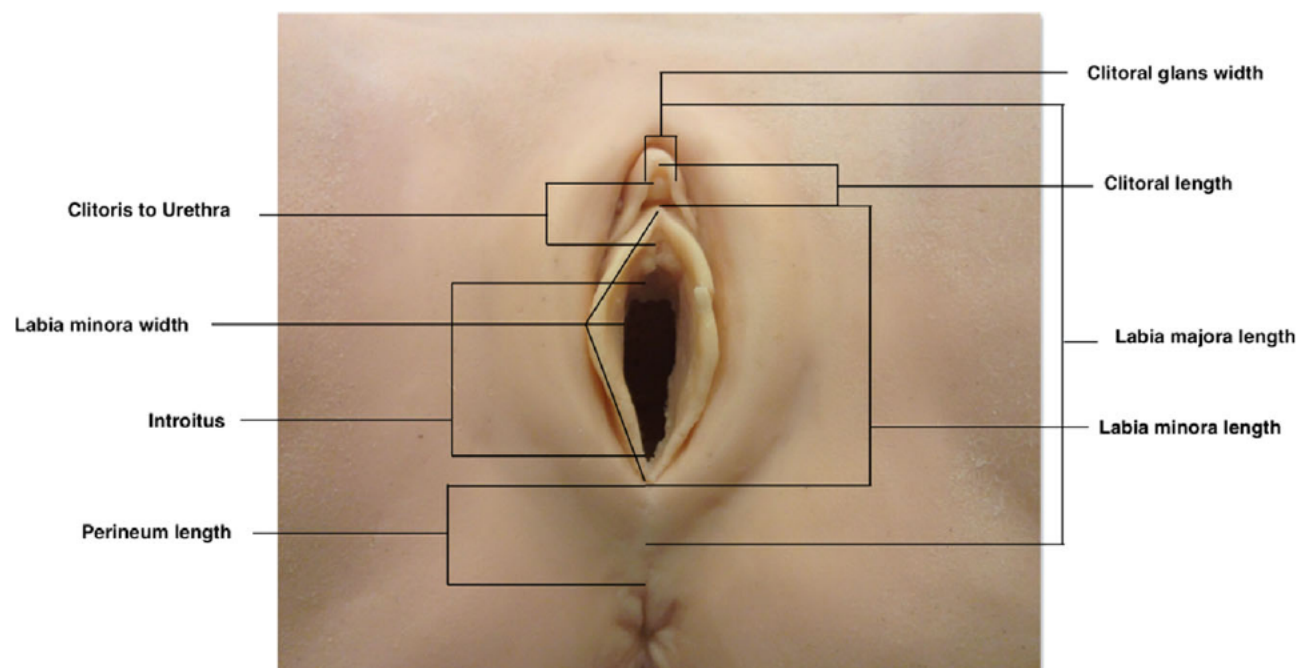


Figure 1. Standard measurements of the external female genitalia.

Table 1. Patient distribution and basic patient characteristics

Age in years	Number in total	Mean age in years	Mean BMI
15–24	100	21.31	22.86
25–34	100	29.41	23.43
35–44	102	39.46	25.41
45–54	104	48.93	25.41
55–64	100	59.07	27.1
65–74	100	69.62	26.61
75–84	51	78.53	27.13
Overall	657	47.27	25.42

according to decades are summarised separately in Table 3. The results for each cohort are visualised as boxplots (Supporting Information Figures S1–S11) and percentile (Supporting Information Figures S12–S22).

In a further step, we analysed correlations between baseline characteristics and the obtained measurements.

Statistically significant negative correlation between the age and the following parameters was seen: the length of the clitoris ($r = -0.169$, $P < 0.001$, $n = 657$), the distance of the clitoris to the urethra ($r = -0.283$, $P < 0.001$, $n = 657$), the length of labia minora ($r = -0.364$, $P < 0.001$, $n = 657$), and the length of the perineum ($r = -0.095$, $P = 0.014$, $n = 657$).

Positive correlation was found between the BMI of the patient and the length of the introitus ($r = 0.097$,

Table 2. Genital measurements (whole cohort)

	Mean (in mm)	Standard deviation	Minimum (in mm)	Maximum (in mm)
Width of clitoris	4.62	2.538	1	22
Length of clitoris	6.89	4.965	0.5	34
Distance clitoris – urethra	22.63	7.661	3	65
Introitus opening	27.91	10.36	6	75
Length of perineum	21.34	8.544	3	55
Length of labia majora (right)	79.71	15.25	12	180
Length of labia majora (left)	79.99	15.44	20	180
Length of labia minora (right)	42.1	16.35	6	100
Length of labia minora (left)	42.97	16.29	5	100
Width of labia minora (right)	13.4	7.875	2	61
Width of labia minora (left)	14.15	7.643	1	42

$P = 0.014$, $n = 657$) and the length of the labia majora ($r = 0.150$, $P < 0.001$, $n = 657$).

In contrast, a negative correlation between the BMI and the length ($r = -0.170$, $P < 0.001$, $n = 650$) as well as the width of the labia minora ($r = -0.133$, $P < 0.001$,

Table 3. Genital measurements (each cohort separately)

	15–24 years	25–34 years	35–44 years	45–54 years	55–64 years	65–74 years	75–84 years
Width of clitoris	4.73	4.69	4.52	4.58	4.99	4.38	4.33
5th Percentile	2	2	2	2	2	2	2
50th Percentile	4	4	4	4	4	4	4
95th Percentile	10.95	9.95	9	10	10.95	8.95	11.6
Length of clitoris	7.86	7.27	7.47	6.75	6.83	6.04	5.17
5th Percentile	2	2	3	2.25	3	3	1.6
50th Percentile	6	6	6	5	5	5	4
95th Percentile	21.9	19.85	19.85	14	17.95	13.85	17
Distance clitoris – urethra	24.78	25.8	24.27	21.58	20.94	19.92	19.69
5th Percentile	15	14	12.15	11.25	11	10	7.2
50th Percentile	25	25	24	20	20	20	20
95th Percentile	39.9	40	40	35	34.85	30	33.2
Introitus opening	27.07	27.75	28.53	28.12	29.38	27.79	25.55
5th Percentile	13.03	14	14	14	12	10	11.6
50th Percentile	25	26	28.5	26	30	26	25
95th Percentile	44	47.85	45	46.75	45	49.9	40
Length of perineum	21.39	21.13	22.71	22.57	22.27	19.73	17.71
5th Percentile	10.1	10	10	10	10	8.1	6.2
50th Percentile	20	20	22	20	20.5	20	18
95th Percentile	35	37	37.55	40.5	35	35	32
Length of labia majora (right)	74.03	77.81	84.82	83.72	81.13	79.31	74.14
5th Percentile	55	60	65	60.75	60	55.15	41.2
50th Percentile	74	79.5	81.5	81	80	80	70
95th Percentile	99.75	100.95	112.55	105	100	109.75	103.2
Length of labia majora (left)	74.17	78.29	85.24	83.46	81.69	79.3	75.24
5th Percentile	55	60	64.15	63.5	55.15	50.05	44.8
50th Percentile	74	80	85	80.5	80	80	75
95th Percentile	99.75	100.95	112.55	105	109.5	110	103.2
Length of labia minora (right)	45.87	45.26	50.18	46.42	36.63	32.55	31.33
5th Percentile	25	25	23	20.5	20	15	6
50th Percentile	46	45	50	44.5	31	30	30
95th Percentile	70	69.85	82.55	82.25	70	55	62
Width of labia minora (right)	13.29	14.03	15.1	14.98	11.59	11.65	11.98
5th Percentile	4	5	5	4.25	3	3	0
50th Percentile	11.5	12	14	15	10	10	11
95th Percentile	26.95	33.8	27.85	29.75	28.9	24.85	30
Length of labia minora (left)	45.97	46.39	51.1	48.23	37.32	32.37	33.53
5th Percentile	22.15	25	28.15	22.5	17.05	18.05	9
50th Percentile	45.5	48	50	45.5	35	30	30
95th Percentile	70	70.95	82.55	84.5	65	55	67
Width of labia minora (left)	13.27	14.96	16.06	15.87	12.99	11.9	12.84
5th Percentile	4	5	5	6	4	3	0
50th Percentile	12	15	15	15	10	10	12
95th Percentile	25	30	27.85	30	29.95	25	30.8

$n = 650$) and the length of the clitoris ($r = -0.078$, $P = 0.048$, $n = 650$) was found.

A positive correlation was detected between vaginal delivery and the length of the introitus ($r = 0.136$, $P < 0.01$, $n = 546$) and the length of labia majora ($r = 0.133$, $P < 0.01$, $n = 546$). A negative correlation was seen in the distance of the clitoris to the urethra ($r = -0.241$, $P < 0.001$, $n = 546$) for women with vaginal

delivery. In women with caesarean section, no significant differences were found.

Discussion

Main findings

Concerning the size and appearance of the external female genitalia, we were able to reveal correlation based on our

analysis. The correlation between length of the labia majora and the BMI of the patient, already described by Cao et al.¹¹ in 2015, is confirmed with these results. This supports the assumption that uniform thresholds concerning the size of the vulva for diagnoses of vulvar diseases are inappropriate. Measurements of the external female genitalia in women are of great value in setting up diagnoses but must be interpreted on an individual basis rather than used as irrefutable diagnostic criteria. This is also underlined by the finding that vaginal delivery, the length of the introitus, and the length of the labia majora are positively correlated. Measurements should be standardised and used with caution, as previous studies have presented very different means of vulvar structures, suggesting a population-based and observer-based bias.^{5,7} We consciously chose white origin as an inclusion criteria to create a large homogeneous group of women without ethnic diversity.

Strengths and limitations

The small number of elderly women (decade VII: 75–84 years) is justified due to substantially lower numbers of women being eligible for inclusion or willing to participate.

We also acknowledge that we are presenting only limited data because of our inclusion of only white women. Further studies are needed to present data of heterogeneous groups of women and different ethnicities.

Interpretation

The individual analysis of measurements of the external female genitalia becomes even more important in the field of highly elective cosmetic surgeries such as labioplasty. Over the last decade, there has been a raised awareness among young women of their genital appearance. Subsequently, this has led to increasing numbers of consultations for cosmetic surgery as young women seek information especially concerning vaginal tightening and labial reduction.^{6,8,12,13}

However, the dimensions of labia minora being used have been based only on small studies and there is no consensus in the literature concerning classification and definition of hypertrophy of the labia minora.¹⁴ Clerico et al.¹⁵ defined the normal size for labia minora with a length of 20–30 mm and a width of 15 mm. Conventionally, labial hypertrophy is defined as maximal width exceeding 5 cm.^{16,17} In contrast, Rouzier et al.¹² proposed 4 cm and Munhoz et al.¹³ 3 cm as threshold for plastic surgery. The current study provides additional data about mean labial dimensions and the factors that are associated with variations in size. Furthermore, with the presented values for each cohort and decade, it could be possible to interpret values on a more objective basis.

Conclusion

This cross-sectional study presents the largest cohort on demographic data concerning the normal size of the external female genitalia. Despite the fact that these data are solely from white women, we are convinced this study will pave the way for further studies publishing data on different ethnicities and heterogeneous groups of women around the world.

Nevertheless, with our data, we present a baseline for the appearance of a normal white vulva and set up standards for indications for gynaecological cosmetic surgery and other applications. In combination with measurements of the vulva in patients with diagnosed vulvar diseases, these data have the potential to set valid international guidelines.

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Disclosure of interests

None declared. Completed disclosure of interests form available to view online as supporting information.

Contribution to authorship

Conception and design of the work: AK, AG, IV. Data collection: AK, IV, FS, RB, CC. Data analysis and interpretation: AK, FO, AG. Drafting the article: AK, FO, AG, CC. Critical revision of the article: AK, IV, FO, FS, RB, CC, AG. Final approval of the version to be published: AK, IV, FO, FS, RB, CC, AG.

Ethics approval

This study was approved by the 'Ethikkommission Nordwest- und Zentralschweiz' on 28 July 2015 (EKNZ 2015-222).

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Figure S1. Width of clitoris distinguished by decades.

Figure S2. Length of clitoris distinguished by decades.

Figure S3. Length of perineum distinguished by decades.

Figure S4. Distance clitoris–urethra distinguished by decades.

Figure S5. Length of introitus distinguished by decades.

Figure S6. Length of labia majora (right) distinguished by decades.

Figure S7. Length of labia majora (left) distinguished by decades.

Figure S8. Length of labia minora (right) distinguished by decades.

Figure S9. Length of labia minora (left) distinguished by decades.

Figure S10. Width of labia minora (right) distinguished by decades.

Figure S11. Width of labia minora (left) distinguished by decades.

Figure S12. Width of clitoris distinguished by decades.

Figure S13. Length of clitoris distinguished by decades.

Figure S14. Length of perineum distinguished by decades.

Figure S15. Distance clitoris–urethra distinguished by decades.

Figure S16. Length of introitus distinguished by decades.

Figure S17. Length of labia majora (right) distinguished by decades.

Figure S18. Length of labia majora (left) distinguished by decades.

Figure S19. Length of labia minora (right) distinguished by decades.

Figure S20. Length of labia minora (left) distinguished by decades.

Figure S21. Length of labia minora (left) distinguished by decades.

Figure S22. Width of labia minora (left) distinguished by decades. ■

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