Sexuality in Males With Congenital Adrenal Hyperplasia Resulting From 21-Hydroxylase Deficiency

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Purpose: Although sexuality has been reported to be impaired in females with congenital adrenal hyperplasia (CAH) resulting from 21-hydroxylase deficiency, sexuality in males with CAH so far has remained largely unconsidered.

Patients: One of the largest European male cohorts of patients with CAH in which sexuality in male patients with CAH was assessed.

Methods: Sexuality was evaluated in 91 sexually active male patients with CAH using questionnaires investigating sexual orientation, age at sexual initiation, sexual activity, satisfaction with sex life, and sexual problems, such as fears or dislike of sexual activity, lack or excessive sexual desire, difficulties getting aroused or reaching an orgasm, premature ejaculation, and no or incomplete erection.

Results: Sexuality in male patients with CAH was similar to European reference populations. If sexuality problems were present, they were less frequently reported by the most severely affected CAH males. Adducing a holistic perspective, sexual problems showed substantial association to psychological problems, such as anxiety and depression.

Conclusions: Sexuality in male patients with CAH in general was unaffected and sexuality problems seemed to be associated in particular with psychological problems. Because sexual health is a key factor

Abbreviations: 21OHD, 21-hydroxylase deficiency; CAH, congenital adrenal hyperplasia; DSD, disorder/difference of sex development; HADS, Hospital Anxiety and Depression Scale; QoL, quality of life; SV, simple-viralizing; SW, salt-wasting.

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of general health, we recommend that sexuality as well as psychological issues explicitly should be addressed in health care of patients with a CAH diagnosis, independent of sex.

Freeform/Key Words: congenital adrenal hyperplasia, 21-hydroxylase deficiency, male, hormone concentration, sexuality

Congenital adrenal hyperplasia (CAH) comprises a group of autosomal recessive disorders involving altered steroid biosynthesis. The majority of cases with CAH (>95%) are caused by 21-hydroxylase deficiency (21OHD) [1–3]. 21OHD is clinically classified according to the severity into the salt-wasting (SW) and simple-virilizing (SV) form, both classic CAH, with an incidence of 1:10,000 to 15,000, and nonclassic CAH with an incidence of 1:2500 [4]. The second most frequent cause of CAH, 11-hydroxylase deficiency, has an incidence of 1:200,000, whereas other enzymatic defects affecting adrenal hormone synthesis are very rare [2]. Classic CAH is characterized by cortisol deficiency, aldosterone deficiency in SW, and subsequent androgen excess. Patients with classic CAH therefore require lifelong replacement therapy with glucocorticoids and often also with mineralocorticoids to normalize or suppress the androgen production in the adrenals [5–7].

Sexuality is an integral part of human development involving biological, physical, social, and emotional factors. Biological and physical factors focus on the reproductive function of sexuality, which is mainly influenced by physical development [8]. Social and emotional factors of sexuality can be separated in cultural background and individual social experiences (*e.g.,* being influenced by sociocultural norms, psychological well-being, and individual experiences of attachment and intimacy) [9–12]. A definition of sexuality covers several categories, including sexual orientation, sexual roles, sexual temperament, sexual drive and function, sexual beliefs, values, and roles [9, 13, 14]. Sexual function and quality of life (QoL) are interrelated [15]. If sexual function is impaired by illness, medical therapy, anxiety, or other stress factors, QoL may decline [14]. QoL in male patients with CAH is reported in a few small studies and varies from impaired [3, 16, 17] to equal [18] or better [19] compared with a control population, recently reviewed in Daae *et al.* [20].

The impact of CAH on the development of the biological and social sex characteristics varies substantially between the sexes. Prenatal androgen excess can cause virilization of the external genitalia in females with CAH and is therefore classified as a "disorder/difference of sex development" (DSD). Androgen excess in females can result in altered body, behavior, and sexuality [21–25]. Although the physical effect of (prenatal) androgen excess in male patients with severe 21OHD is not as profound, it might lead to hyperpigmentation of the external genitalia, but not to sex incongruence as seen in females with classic CAH. One study reported no effect of androgen excess on behavior in males with CAH, because no differences in sexual interest and orientation were found compared with healthy controls [23]. Sexual drive and function were studied in a few small studies. Impaired sexual drive, erection, and ejaculation was found in one study of 20 males with CAH [26], whereas two other studies described high rates of erectile dysfunction (41% to 55%) and lower sexual activity, which were linked to limited endocrine control or to oversubstitution with glucocorticoids [3, 18].

The data on sexuality in males with CAH are thus scarce and derived from studies with small sample sizes in a single center or country. Our aim is to describe sexuality and factors related to subjective health status, anxiety, and depression in males with CAH in a large European, multicenter cohort.

1. Subjects and Methods

A. Subjects

The study cohort was recruited and examined within the collaborative international European study dsd-LIFE [27]. This study involved 14 medical recruitment centers specialized in treatment of DSD located in France (n = 4), Germany (n = 4), Poland (n = 2), Sweden (n = 1), the Netherlands (n = 2), and the United Kingdom (n = 1). Between February 2014 and September 2015, 1040 current and former patients with a diagnosis of DSD were recruited [27]. In addition to the patients with DSD, 121 male patients with CAH were recruited. This group faces similar problems as patients with DSD, such as infertility or sex hormone imbalances, but they do not fit into the DSD classification. We subsequently excluded 30 males with CAH [median age, 21; interquartile range (IQR), 17.8-33.3; range, 16-64) in this study from further analysis because they were not sexually active and/or used testosterone preparations or had *CYP11B1* mutations. Thus, 91 males with CAH were included in the current study. Ethical approvals were obtained for each participating center. All participants gave written informed consent. Study participation implied filling out digital patient-reported outcome questionnaires and answering medical questionnaires, whereas medical examination was optional. Participants were examined at their local DSD center. All medical data were pseudonymized and reviewed on data quality for accuracy of statements. Theoretical and methodological details of the framework of dsd-LIFE have been published elsewhere [27].

B. General Patient Characteristics

General patient characteristics included age, height, body mass index, severity of disease, medication use and control, education level, and hormone concentrations. Severity of disease was classified both clinically and genetically. The phenotype of 21OHD was classified into SW, SV, or nonclassic CAH. The genetic classification of 21OHD was performed according to the severity of the mutation of the least affected allele reflecting the enzymatic defect (disease severity), ranging from genotype "0" for the most severe defects to genotype "C" the least severe defects [28, 29]. Current glucocorticoid and mineralocorticoid replacement therapy formulations were registered. Hormonal control was assessed by a subjective rating of the local examining physician at study inclusion using the following scores: poor, moderate, good, excellent, or unknown. The patients' educational levels were established according to the EU classification as low, medium, and high as described elsewhere [30]. The following hormones were measured in blood samples taken during daytime, mostly in the morning, before intake of the glucocorticoid medication [27]: androstenedione, total testosterone, LH, and FSH. The values were assessed by the study centers according to the local reference ranges as "below reference range," "within reference range," "above reference range up to twice the upper limit," and "more than twice the upper limit of the reference range." To increase the number of patients per category, we combined the latter two categories into the category "above reference range." The serum androstenedione/testosterone ratio was calculated and divided into previously described ranges: <0.5 (normal, interpreted as testosterone mainly of testicular origin), ≥ 0.5 and <1 (substantial fraction of testosterone is of adrenal origin), and ≥ 1 (testosterone mainly of adrenal origin) [31].

C. Sexuality

Sexual orientation was administered using an adapted Kinsey scale [24, 25]. We defined the following categories: homosexual ("exclusively to men without desire for women," "primarily to men, occasionally to women"), bisexual ("equally to men and women," "primarily to women, but also regularly to men," "primarily to men, but also regularly to women"), heterosexual ("primarily to women, but occasionally to men," "exclusively to women, without desire for men"), and other ("primarily to an intersex/transgender/genderqueer/other person") and "to no one." Participants were asked to indicate if they had sexual experience at all, such as intercourse and/or oral sex, and

were asked on their age of sexual debut. Sexual activity within the past 12 months was divided into categories: "no sexual activity or once/twice a year," "once to twice a month," and "once/twice a week or nearly daily." The World Health Organization QoL-BREF item "How satisfied are you with your sex life?" [32] was used to address sexual satisfactions within the past 12 months, using a 5-point Likert scale. To increase the number of participants within each group, we combined the groups very (dis)satisfied with (dis)satisfied. We assessed psychosexual issues, including lack of or excessive sexual desire; in getting aroused or in reaching orgasm, fears or dislike of sexual activity or contact, or premature ejaculation and no or incomplete erection, by asking participants if they experienced these problems of not.

D. Psychological Parameters

Self-perceived (subjective) health status was measured by the European Social Survey item "How is your health in general," using a 5-point Likert scale. Mental health conditions that are likely to affect sexuality are anxiety and depression [33–36]. Therefore, we used the Hospital Anxiety and Depression Scale (HADS), a widely used short self-rating and screening instrument [37]. The HADS contains two scales about anxiety (seven items) and depression (seven items), each with a 4-point Likert scale [37]. Cutoff points established by the authors of the scale for self-reported anxiety or depression were: 0 to 7 "normal" (below clinical cutoff), 8 to 10 "borderline abnormal" (borderline range), and ≥11 "abnormal" (above clinical cutoff).

E. Statistics

Statistical analysis was performed using IBM SPSS Statistics 25. Descriptive analyses were performed for all variables. Depending on normality, mean and 95% CIs or median and IQRs were calculated. Patients with and without sexuality problems were compared and ORs with 95% CIs were calculated if at least five cases were present in both subgroups. Missing data were evaluated for each variable and the total number of participants in a particular analysis is reported. Data resources can be requested from the Steering Committee and the coordinator of the project dsd-LIFE.

2. Results

Table 1 shows the basic characteristics of 91 sexually active men with 21OHD. Median age was 30 years. Most of the participants had the classical form of CAH, the SW (58.2%), or SV (35.2%) forms, whereas 5.5% had nonclassical CAH. Patients were also classified genetically into genotype 0 (19.8%), A (27.5%), B (28.6%), C (3.3%), or could not be classified (20.8%). The majority of participants used only hydrocortisone as glucocorticoid treatment (58.2%). Prednisone or prednisolone was used by 25.3% of the participants, whereas 11.0% used dexamethasone alone or in combination with hydrocortisone. No intake of glucocorticoid replacement at all was reported by 3.3% of the participants. Educational background was of intermediate level for 54.4% of the participants, whereas 26.7% had high and 8.9% had low educational level, and 10.0% were classified as other. Testosterone concentrations were within normal reference range for 77.3% of the cohort, 17.3% were below and 5.3% above the reference range. The majority of the cohort estimated their health status as very good (25.3%) or good (51.6%). Furthermore, the majority of participants scored below the clinical cutoff level for mental health problems as depression (92.3%) and anxiety (74.7%) (*i.e.,* did not have mental health problems). Still, one-fourth of the cohort scored above the clinical cutoff level for anxiety.

We analyzed all variables mentioned in the "Patients and Methods" section, but we only present in detail the data that differed between the analyzed groups (no overlap in confidence intervals). In the following sections, we present data regarding sexuality in males with CAH.

Table 1. Cohort Description of Sexually Active Male Patients With 21-Hydroxylase Deficiency (N = 91)

Parameter	Cohort Results
Median age (IQR; range)	30 y (23–41; 16–68)
Height, mean (95% CI), n = 90	170.8 cm (169.3–172.4)
BMI, median (IQR), n = 90	25.6 kg/m^2 (22.6–29.9)
Severity of the disease, n = 91	
Clinical classification	
Classic: SW	53 (58.2%)
Classic: SV	32 (35.2%)
Nonclassic	5 (5.5%)
No clinical classification	1 (1.1%)
Genetic classification	
0	18 (19.8%)
A	25 (27.5%)
B	26 (28.6%)
C	3 (3.3%)
No mutation reported or not classified	19 (20.8%)
Medication, n = 91	
Hydrocortisone	53 (58.2%)
Prednisone or prednisolone[a]	23 (25.3%)
Dexamethasone or hydrocortisone and dexamethasone[b]	10 (11.0%)
Fludrocortisone in addition to any of the glucocorticoid combinations here	62 (68.1%)
Fludrocortisone alone	2 (2.2%)
No medication reported	3 (3.3%)
Education, n = 90	
High	24 (26.7%)
Intermediate	49 (54.4%)
Low	8 (8.9%)
Other	9 (10.0%)
Total testosterone concentrations, n = 85	
Above reference range	4 (5.3%)
Within reference range	58 (77.3%)
Below reference range	13 (17.3%)
Subjective health status, n = 91	
Bad	5 (5.5%)
Fair	16 (17.6%)
Good	47 (51.6%)
Very good	23 (25.3%)
HADS-anxiety, n = 91	
Normal	68 (74.7%)
Borderline abnormal	7 (7.7%)
Abnormal	16 (17.6%)
HADS-depression, n = 91	
Normal	84 (92.3%)
Borderline abnormal	2 (2.2%)
Abnormal	5 (5.5%)

Abbreviation: BMI, body mass index.
[a]Eleven patients were on prednisolone, 11 on prednisone, and 1 on prednisone retard.
[b]Dexamethasone was used combined with hydrocortisone in 3 patients, whereas 7 patients were on dexamethasone.

A. Sexuality

Heterosexuality was reported in 90.1%, homosexuality in 3.3%, and bisexual orientation in 1.1%. Furthermore, 2.2% of the participants reported to be attracted to the category "other" and 3.3% reported not to be sexually attracted (Table 2). Median age of sexual initiation was 17 years. More than one-half of the participants (58.4%) reported to be sexually active weekly or monthly and satisfaction with sex life was expressed to be neutral to satisfying. Sexual problems, including fear of sexual activities (4.4%), dislike of sexual activities (4.4%), lack of

Table 2. Sexuality in Sexually Active Male Patients With 21-Hydroxylase Deficiency

		Normal Population		
Parameter	**Cohort Result**	**Results**	**Details**	**Reference**
Sexual orientation, n = 91				
Heterosexual	82 (90.1%)	94.2%	Males and females	[38]
Homosexual	3 (3.3%)	0.9%	from the UK, >16 y	
Bisexual	1 (1.1%)	0.5%		
Other	2 (2.2%)	0.5%		
To no one	3 (3.3%)	No response: 3.2%		
Age at sexual debut, median (range), n = 80	17 y (16–18)	Mean: 16.5 y	Males and females from the EU, 16–20 y	[41]
Sexual activity, n = 91				
Nearly daily and 1–2/wk	37 (44.3%)	Study 1: 1.4/wk	Males from SE, 18–60 y	[42]
1–2/mo	24 (22.6%)	Study 2: 1.9/wk	Males from FR, >35 y	[43]
1–2/y and no sexual activity in past y	7 (6.6%)			
No sexual partner	28 (26.4%)			
Satisfaction with sex life, n = 91[a]	3.5 ± 1.1	3.7 ± 1.31	Males from SE, 18–60 y	[42]
Fears of sexual activities, n = 91	4 (4.4%)			
Dislike of sexual activities, n = 91	4 (4.4%)			
Lack of sexual desire, n = 91	16 (17.6%)	Study 1: 11.97%	Males from EU, 40–80 y	[44]
		Study 2: 11.7%–15.7%	Males from ES and DE, 55 y	[49]
Excessive sexual desire, n = 91	21 (23.1%)	5%–10%	Males from SE, 18–60 y	[42]
Difficulties getting aroused, n = 91	11 (12.1%)			
Difficulties reaching an orgasm, n = 91	10 (11.0%)			
Premature ejaculation, n = 91	23 (25.3%)	Study 1: 20.2%	Males from EU, 40–80 y	[44]
		Study 2: 20%–20.3%	Males from IT and DE, 41.6 y	[51]
		Study 3: 25%–40%	Males (global), all ages	[52]
		Study 4: 3%–30%	International: all ages	[33, 53]
No or incomplete erection, n = 91	17 (18.7%)	Study 1: 12.5%	Males from EU, 40–80 y	[44]
		Study 2: 12%	Males from DE, UK, FR, 52.6 y	[50]
		Study 3: 17.4%	Males from IT, ES, 20–75 y	[49]
		Study 4: 23%	Males from DE, 18–79 y	[48]

Abbreviations: DE, Germany; ES, Spain; EU, European Union; FR, France; IT, Italy; SE, Sweden; UK, United Kingdom.

[a]Self-reported satisfaction with sexual life rated on a 5-point Likert scale from very dissatisfied (1) to very satisfied (5).

sexual desire (17.6%) or excessive sexual desire (23.1%), difficulties in getting aroused (12.1%), difficulties reaching an orgasm (11.0%), premature ejaculation (25.3%), and no or incomplete erection (18.7%), were reported.

B. Influencing Parameters on Sexuality in Males With CAH

The frequency of sexual activity was associated with genotype, medication control, and depression (Table 3). Participants with genotype 0 were less likely to have monthly sexual activity than participants with genotype A (OR, 0.125; 95% CI, 0.016 to 0.999). Participants with genotype A were less likely to have monthly (OR, 0.111; 95% CI, 0.016 to 0.778) or weekly (OR, 0.167; 95% CI, 0.030 to 0.917) sexual activity than participants with genotype B. Participants with moderate compared with good subjective therapy (glucocorticoid) control were more likely (OR, 4.1; 95% CI, 1.0 to 16.4) to have weekly sexual activity than monthly sexual activity. Weekly was less common compared with monthly sexual activity for

Table 3. Parameters Associated With Sexuality in Sexual Active Male Patients With 21-Hydroxylase Deficiency

Characteristics		Outcome		OR
Frequency of sexual activity				
Genotype		Monthly	NA	Null vs B: 0.125
	Null	3 (33.3%)	6 (66.6%)	(0.016–0.999);
	A	4 (30.8%)	9 (69.2%)	A vs B: 0.111
	B	8 (80%)	2 (20%)	(0.016–0.778)
		Weekly	NA	0.167 (0.030–0.917)
	A	12 (57.1%)	9 (42.9%)	
	B	16 (88.9%)	2 (11.1%)	
Medication control		Weekly	Monthly	
	Moderate	16 (84.2%)	3 (15.8%)	4.1 (1.0–16.4)
	Good	21 (56.8%)	16 (43.2%)	
HADS-depression		Weekly	Monthly	
	Borderline abnormal	1 (20%)	4 (80%)	0.102 (0.011–0.979)
	Normal	44 (71%)	18 (29%)	
Lack of sexual desire		Yes	No	
Phenotype	SW	5 (9.4%)	48 (90.6%)	0.266 (0.080–0.885)
	SV	9 (28.1%)	23 (71.9%)	
Excessive sexual desire				
Phenotype	SW	8 (15.1%)	45 (84.9%)	0.296 (0.105–0.837)
	SV	12 (37.5%)	20 (62.5%)	
HADS-anxiety	Abnormal	6 (85.7%)	1 (14.3%)	28.0 (3.1–254.5)
	Normal	12 (17.6%)	56 (82.4%)	
HADS-anxiety	Abnormal	6 (85.7%)	1 (14.3%)	26.0 (2.2–304.7)
	Borderline abnormal	3 (18.8%)	13 (81.3%)	
Difficulties getting aroused				
Phenotype	SW	4 (7.5%)	49 (92.5%)	0.122 (0.016–0.960)
	NC	2 (40%)	3 (60%)	
Difficulties reaching an orgasm				
Phenotype	SW	2 (3.8%)	51 (96.2%)	0.170 (0.032–0.901)
	SV	6 (18.8%)	26 (81.3%)	
HADS-anxiety	Abnormal	3 (42.9%)	4 (57.1%)	12.0 (2.0–73.0)
	Normal	4 (5.9%)	64 (94.1%)	
Premature ejaculation				
HADS-anxiety	Borderline abnormal	7 (46.7%)	8 (53.3%)	3.6 (1.1–11.6)
	Normal	13 (19.7%)	53 (80.3%)	

Presentation of data that differed between groups (no overlap in CIs); associations are presented through ORs.
Frequency of sexual activity: NA (1–2 times per y and none), monthly (1–2 times per mo), weekly (1–2 times per wk and nearly daily).
Abbreviations: NA, not applicable; NC, nonclassic CAH; SW, salt-wasting CAH; SV, simple-virilizing CAH.

participants with "borderline abnormal" depression scores compared with "normal" scores (OR, 0.102; 95% CI, 0.011 to 0.979). Satisfaction with sex life was not associated with any of the variables tested. Both lack (OR, 0.266; 95% CI, 0.080 to 0.885) and excessive (OR, 0.296; 95% CI, 0.105 to 0.837) sexual desire were associated with phenotype, with SV being more affected with these issues compared with men with SW CAH. Excessive sexual desire was more likely to be observed in participants with clinical anxiety scores compared with "normal" scores (OR, 28.0; 95% CI, 3.1 to 254.5) and compared with "borderline abnormal" anxiety scores (OR, 26.0; 95% CI, 2.2 to 304.7). Participants with SW CAH had more difficulties getting aroused (OR, 0.122; 95% CI, 0.016 to 0.960) compared with participants with non-classic CAH, and more difficulties reaching an orgasm (OR, 0.170; 95% CI, 0.032 to 0.901) compared with participants with SV CAH. Participants with "abnormal" anxiety scores also had more difficulties reaching an orgasm compared with participants with "normal" scores (OR, 12.0; 95% CI, 2.0 to 73.0). Furthermore, participants with "borderline abnormal" anxiety scores also reported premature ejaculation more often compared with participants with

"normal" scores (OR, 3.6; 95% CI, 1.1 to 11.6). No associations were found between no or incomplete erection and any of the variables tested. None of the tested hormones nor the androstenedione/testosterone ratio were associated with sexuality.

3. Discussion

Studies on sexuality in males with CAH have been scarce. This study describes sexuality in a large international cohort of males with CAH. In general, we found that sexuality in males with CAH is comparable to available reference populations as discussed below.

Sexuality in our cohort was assessed using a number of different parameters. The vast majority of our males with CAH were heterosexual and the distribution of sexual orientation was similar to UK males and females [38], although seemingly a slightly higher proportion of homosexuality and bisexuality was observed in our cohort. This is somewhat in contrast to previous studies of males with CAH, which did not observe differences in sexual orientation compared with control groups [23, 39, 40]. The age of sexual debut was similar to reported European reference populations [41], which is in line with other reports [39]. The frequency of sexual activity in the general population was on average 1.4 times a week in Sweden [42] and 1.9 times a week in France [43]. Although we did not have data to calculate the average number of sexual activities per week, we showed that more than one-half of the males with CAH with a sexual partner had nearly daily or at least one to two sexual activities per week. A substantial frequency number of the "other half" of sexually active males within the cohort could not be shown (one to two times per month, per year, or none at all). A previous study found that frequency of intercourse was similar in males with CAH and matched controls [39]. The males in our study were generally satisfied with their sex life, with a comparable score to reference population [32, 42]. A minority of males with CAH reported sexual problems. Only four participants reported fears or dislike of sexual activities. However, lack of sexual desire as well as excessive sexual desire were present in about one-quarter of the participants. These sexual problems were more prevalent in our males with CAH compared with the European male reference cohort (lack of sexual desire) [42, 44], which supports the findings of Dudzinska *et al.* [26]. Ten percent of our cohort also experienced difficulties getting aroused or reaching an orgasm; however, no reference data were available. The frequency of premature ejaculation problems in our cohort was slightly higher compared with European reference data (25% vs 20%); also, erectile dysfunctions was found to be slightly more prevalent in males with CAH (18.7% vs 16.2%), supporting the findings of Dudzinska *et al.* [26], Arlt *et al.* [3], and Falhammar *et al.* [18]. In conclusion, our cohort of males with CAH diagnosis, which was recruited through highly specialized European centers, showed mostly good hormonal control and similar sexuality compared with European reference populations. In general, sexual problems were not frequently reported, although sexual desire problems appeared to be more frequent in males with CAH compared with European reference studies.

Data from our cohort indicate that genotype were associated with the frequency of sexual activity, meaning that being more severely affected was associated with lower frequency of sexual activity. In contrast, having moderate therapy control, as opposed to good control, was associated with more frequent sexual activity. A negative association between depression and sexual activity was also observed, indicating that when people experience depressive symptoms, they engage less in sexual activities. However, frequency of sexual activity is dependent on a variety of factors, such as willingness of both partners. These factors were not included in our dataset, which makes it difficult to interpret our univariate analyses regarding sexual frequency. CAH phenotype was associated with sexual problems regarding sexual drive. Participants with SW CAH were less likely to report lack of sexual desire, difficulties in reaching an orgasm, and difficulties in sexual arousal. This is similar to other reports [18, 26]. Psychological problems can have a major impact on sexuality. We showed that participants with anxiety more often had excessive sexual desire, difficulties reaching an orgasm, and premature ejaculation. This may confirm that anxiety is one of the main

determinants of erectile function disorders in men, or that men with erectile function disorders might show more anxiety [33, 45–47].

Sexuality is an essential part of human life involving physical and herewith biological and hormonal as well as psychological and emotional factors. As such, it can affect general well-being and overall QoL. This is also true for chronic diseases, such as CAH, because chronic diseases influence everyday life and self-perception of patients. Looking at the large cohort of dsd-LIFE, we can conclude that sexual problems of this group mainly seemed to be associated with psychological problems. Still, sexual problems were associated with the severity of the CAH diagnosis.

A. Limitations

Despite this being a large study describing sexuality in male patients with CAH, it had some limitations. Subgroup analysis resulted in low numbers of participants, especially those with aberrant values regarding psychological symptoms. Serum hormone concentrations were not measured centrally but were determined in each treatment center with different assays and different reference ranges. Accounting for this, only range variables were used in the data analyses. Furthermore, sexuality is an integral part of human identity and is influenced by many aspects, such as sociocultural norms, psychological well-being, and individual experience of attachment and intimacy [9–12]; although we tried to include as much information as possible, we did not have information on sexual self-esteem or on relationship satisfaction that would have given a much more complete picture on sexual QoL [47].

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