APPROACHES TO THE 26–36-YEAR-OLD LITHUANIAN MEN'S SEXUAL FUNCTION

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Abstract

Context. In the year 2003-2004 a circumstantial investigation of young men reproductive health parameters was performed in Nordic and Baltic countries, but sexuality remained undetermined.

Objective. To determine the suitability of the European Male Ageing Study – Sexual Function Questionnaire (EMAS – SFQ) for investigation of sexuality of 26–36 year aged general population and to investigate sexuality of Kaunas participants in the project “The reproductive function of Estonian, Latvian and Lithuanian Young men (2003-2004)” (KELLY), using EMAS – SFQ.

Design. Sixty one 26–36 year aged KELLY men were recaptured from the list of participants in a 2003-2004 study and completed EMAS – SFQ. Their anthropometric characteristics, scores of sexuality (22 parameters from EMAS – SFQ, 3 calculated parameters and 2 parameters consisting from answers to the only question - masturbation and erectile function-for each participant) were analysed, in conjunction with anthropometric, sperm quality and hormone levels of 2003-2004 18–25 year old general population.

Results. Overall sexual functioning and masturbation were higher as compared to all the published data for different age men and different testosterone concentration groups of EMAS study.

Conclusions. KELLY sexuality results, obtained using EMAS – SFQ, would be considered as referral values for young men in countries with generally good reproductive health.

Key words: healthy man, sexuality, reproductive health.

INTRODUCTION

Reproductive health and sexuality are two fundamental and most important cornerstones of masculinity. These parameters are investigated rarely, if at all, in conjoint way. This is the first attempt to perform an investigation of reproductive health in

18–25 years old men from the general population and sexuality in actually 26–36 years old men recaptured from the former mentioned group 9–11 years later.

Meta-analysis, published in 1992, suggested deterioration of semen quality in men (1). This article stimulated the here presented prospective study of male reproductive health. Comprehensive investigation of the reproductive health of 18–25 years men was performed in 1996-1997 and 2003-2004 years in the Nordic and Baltic countries (2, 3), and later – in Finland (4). Other studies appeared from Japan (5), Spain (6), Germany (7), USA (8), Sweden (9), and Faroese (10).

In our original study, anthropometric data, semen quality and hormonal investigations were performed using a protocol of investigation generated by the Department of Growth and Reproduction Rigshospitalet, Copenhagen, Denmark (11).

The results differed in different countries: in Copenhagen and Faroese semen quality was low, in contrast with Southern Sweden (Malmo) and Baltic countries – Latvia, Lithuania and Estonia. Reproductive parameters were invariably high in the Kaunas group of Lithuanians. Testis volume and Inhibin B levels were higher in Lithuanian young men (12).

The sexual function of the original cohort of 18–25 year old men was not investigated because of several constraints. However, at the age of 26–36 years sexual function has fully matured. Thus we decided to investigate the sexual function of young men using the EMAS – SFQ (13). The main advantage of this instrument is the multi-domain evaluation of overall sexual function, not only erectile function. This questionnaire has been used successfully for the investigation of different aspects of sexual function in more than 3000 older men from 8 European countries (14-16).

The aim of present study was to investigate

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the suitability of EMAS – SFQ for investigation of sexuality of 26–36 year aged general population Lithuanian men.

MATERIALS AND METHODS

Subjects and study design

All 61 KELLY men aged 26–36 years were recruited from the list of 326 Lithuanian participants of an international project performed in 2003–2004.

Phone calls were the first approaches to connect with the participants. If the connections were established, EMAS – SFQ and Informed consent were posted to the participants.

If the phone connection was unsuccessful then postal letters were sent to the previously known address with a standard agreement and request to complete the questionnaire. We also searched via an internet portal as well as via Facebook. Modern technologies did not justify our expectations and only minorities were recaptured via this method. Most of the participants were found using the telephone (about 80%).

International project “The reproductive function of Estonian, Latvian and Lithuanian young men”.

This project was a part of the large prospective study performed in Nordic and Baltic countries. The Baltic male cohort was recruited between May 2003 and June 2004 among the participants in a prospective study entitled “Environment and Reproductive Health” (EU 6th FP project QLRT/ 2001/02911) in parallel at three study centres (Tartu, Estonia; Riga, Latvia and Kaunas, Lithuania). The recruitment and phenotyping protocols of the study subjects at the participating countries were identical. Study participation was voluntary and written informed consent was obtained from all subjects. The Lithuanian men (n=326) were recruited to the study at the specialized laboratory of the Institute of Endocrinology, Lithuanian University of Health Sciences.

The detailed methodology of this study was published previously (11), and the same principles, questionnaire and protocols were used in recently published studies performed in other countries (4–10).

Hormonal investigations were performed at the Department of Growth and Reproduction, Rigshospitalet, Copenhagen, Denmark. Sperm morphology was assessed at both Turku University, Finland and in Lithuanian University of Health Sciences.

EMAS – SFQ

A Lithuanian version of the EMAS – SFQ was used in all the cases (13, 18). Responses to the questionnaire were received by E-mail or standard post.

EMAS – SFQ consists of 3 non-sexual questions and 22 sexuality-related questions. There are three domains defined as Overall Sexual Function (OSF), Sexual-Function-related Distress (SFD) and Change in Sexual Function (CSF). The fourth domain involves a single question on frequency of masturbation (M).

All the calculations were performed exactly as in EMAS group calculations. Results were expressed in sexuality scores (13) or percents of the sexual parameters (14).

Ethics and other permissions

The study was approved by the Regional Ethics Committee of Kaunas, Lithuania (Approval No.13, 2003 and approval No B/2-27 of 07.07.2011 with approved supplement No P1-33-2012 of 07.03.2012).

Statistics

Statistical analysis was performed using IBM SPSS Statistics 20.0. Mann-Whitney U Test and Chi square test were used with significance level of 0.05.

RESULTS

Recapture of study participants

In 2003/2004 the KELLY participants were at the age of 18–25 years with a developing life situation. Most of them were students living in the dormitories with irregular sexual life. They were unmarried with limited financial resources. On the contrary, during next 9–11 years their social, family and financial situations changed and they had undergone full development of their reproductive health and sexual function. Out of the 326 original participants in 2003/2004 study we were able to contact 99 (30.4%). Overall we received 61 completed Questionnaires (18.7%).

Sexual function of KELLY men

The sexual function of KELLY men was evaluated according to EMAS – SFQ analysis (13–16).

Overall sexual function (OSF) in KELLY men was very high (83.6%), sexual-function--related distress was very low (nil or mild in 93.4%), masturbation (M) was frequent in 47.5% or intermediate in 31.1% (total 78.6%). As expected in KELLY men, changes of

sexual activity during the 1 year were minimal. Erectile dysfunction was very low (Table 2).

We report the results of 61 KELLY men with evaluation of the answers to 3 general questions and 22 sexual EMAS questions (Table 2). Maximal frequency in different items of sexuality are underlined and written in bold. The higher the maximal value, the higher the chance of a homogeneous item. Lower maximal values usually mean heterogeneous distribution of parameters. In Table 3 we list hormone levels (A), sperm quality (B) and anthropometric measurements (C), as descriptive statistics for the KELLY men. These are the baseline parameters for which actual sexual function is described.

DISCUSSION

In 2003/2004 a comprehensive international study of male reproductive function which involved 18–25 year old young men from Denmark, Sweden, Finland, Norway, Estonia, Latvia and Lithuania was performed. Results of KELLY cohort from this study have previously been reported in publications concerning different aspects of their reproductive health (12, 17–19).

Here we combine the reports of the reproductive health of young men with our recent investigations into the sexual function of a KELLY cohort from the 2003/2004 study. We investigated the sexual function using EMAS – SFQ. This questionnaire is developed and validated for epidemiologic investigation of middle-aged (40–60-year-old) and elderly (60–80-year-old) men (13, 14). The advantage of this questionnaire is that it does not investigate solely erectile function, but also analyses other domains of sexuality which include overall sexual function, sexual functioning distress, masturbation and changes in sexual function over time.

The questionnaire is suitable for without

any direct contact between doctor and patient. Consequently it may be transmitted using modern communication methods. This is especially important in the investigation of KELLY cohort (26–36 year-old men) who was at the height of their active life in all domains, including that of sexual expression. This cohort was also perhaps limited both in their incentive to respond directly to a questionnaire and (in Lithuania) to participate in a clinical trial without financial reward. Thus the EMAS-SFQ was very suitable – neither too long nor too short.

Calculations were performed in the same ways as in the original EMAS-SFQ study (13, 14). Results of sexual function were expressed using both total scores and a percentage of each sexual domain. It was useful to compare the sexual function between KELLY men and the more mature group of EMAS men.

At the beginning of our study we discussed with the author of the EMAS-SFQ the possibility of applying the questionnaire to younger men. It was suggested that questions about changes do not usually develop in younger men. It was suggested that questions about changes in sexual function over 1 year may be unnecessary, since such changes do not usually develop in younger men over such a short period. Our results perfectly confirm this assumption.

Another possible criticism about the use of a sexual function questionnaire created and validated for middle-aged and elderly men would be that for young men the highest range for Overall Sexual Function may be too low. This criticism is infirmed by actual results - the 95% CI range is 22.9 with maximal score 32, and OSF exceeds 90% CI in only 5 cases.

Comparative results of the sexual function KELLY and EMAS men reflects the high baseline of hormonal, seminal fluid and physical parameters in the group of younger men.

High scores in KELLY men confirm the

Table 1. Descriptive statistics of EMAS – SFQ sexual functioning domains in 26–36-year-aged Lithuanian men, 2003–2004 participants in an international project “The reproductive function of Estonian, Latvian and Lithuanian Young men”.

Score Sexual domain	M ± SD	±95% CI	Median	Mode	Frequency of Mode	Range Min - Max	Lower Quartile	Upper Quartile	Percentile 10	Percentile 90
Overall sexual function	21.4±5.9	19.9–22.9	23	26	9	9–32	18	26	11	27
Sex functioning distress	1.6±2.1	1.1–2.2	1	0	28	0–8	0	3	0	4
Masturbation score	2.46±1.95	1.95–2.97	2	1	13	0–7	1	4	0	5
Changes of sexual functioning	-0.4±1.4	-0.8–0.0	0	0	37	-5–4	-1	0	-2	1

Overall sexual function (1+5 +6 + 13 + 17 {0–33}); sex functioning distress -sexual functioning distress (3+8+11+18+15 {0–20}); M-masturbation (0–7); changes of sexual functioning (4+9+12+16+19+22).

presumption that in a country with good reproductive health, sexual function is also at a high level.

The background information provided by the questionnaire as well as semen parameters and sex hormone levels (Table 3) make it possible to compare these basal indexes of reproductive health with results of earlier studies, performed using the same methodology of investigation (6-12). The hormonal concentrations at least LH, FSH, PRL, Inhibin B and testosterone have an influence on physical appearance and also maintain

the secondary sexual characteristics, the maturation of semen, sexual behaviour in particular and general psyche. Complex interactions within this system are not yet fully understood.

Levels of Inhibin B in KELLY men were exceptionally high when compared with other participating centres. Our hormonal results are reliable since these investigations were performed in 1 centre – Department of Growth and Reproduction, Rigshospitalet, Copenhagen.

Table 2. Detailed percents of answers to sexual questions. Scoring of sexual function items in 26–36-year-aged Lithuanian men, 2003-2004 participants in an international project “The reproductive function of Estonian, Latvian and Lithuanian Young men”.

Questions	Answers	Score	N	%
General 1				
I have been living with my wife		3	40	65.6
I have been cohabitating with my partner		2	10	16.4
I have a sexual partner but we did not live together		1	7	11.5
I did not have a sexual partner		0	4	6.6
General 2				
	Excellent	4	24	39.3
	Very good	3	13	21.3
	Good	2	15	24.6
	Fair	1	0	0.0
	Poor	0	0	0.0
	Missing		9	14.8
In general, would you say that the health of your partner is:				
General 3				
	Very satisfied	4	22	36.1
	Moderately satisfied	3	22	36.1
	About equally satisfied and dissatisfied	2	7	11.5
	Moderately dissatisfied	1	1	1.6
	Very dissatisfied	0	0	0.0
	Missing		9	14.8
How satisfied have you been with your general (non-sexual) relationship with your partner?				
Sexual function				
	Not at all	0	0	0.0
	Once in the last month	1	0	0.0
	2-3 times in the last month	2	1	1.6
1. How often did you think about sex?	Once a week	3	2	3.3
	2-3 times a week	4	10	16.4
	4-6 times a week	5	7	11.5
	Once a day	6	10	16.4
	More than once a day	7	31	50.8
	Very low-none at all	0	0	0.0
2. How would you rate your level of sexual desire?	Low	1	2	3.3
	Moderate	2	23	37.7
	High	3	24	39.3
	Very high	4	12	19.7
	Not at all worried or distressed	0	44	72.1
3. Are you worried or distressed by your current level of sexual drive-desire?	A little bit worried or distressed	1	13	21.3
	Moderately worried or distressed	2	2	3.3
	Very worried or distressed	3	2	3.3
	Extremely worried or distressed	4	0	
	Increased a lot	2	0	0.0
4. Compared with a year ago, has your sexual drive-desire changed?	Increased moderately	1	5	8.2
	Neither increased nor decreased	0	53	86.9
	Decreased moderately	-1	2	3.3
	Decreased a lot	-2	1	1.6

5. How many times have you attempted sexual intercourse?	Not at all	0	1	1.6
	Once in the last month	1	1	1.6
	2-3 times in the last month	2	2	3.3
	Once a week	3	4	6.6
	2-3 times a week	4	31	50.8
	4-6 times a week	5	7	11.5
	Once a day	6	4	6.6
	More than once a day	7	2	3.3
	Missing		9	14.8
6. Apart from when you attempted sexual intercourse, how frequently did you engage in activities such as kissing, fondling, petting, etc?	Not at all	0	1	1.6
	Once in the last month	1	2	3.3
	2-3 times in the last month	2	3	4.9
	Once a week	3	4	6.6
	2-3 times a week	4	15	24.6
	4-6 times a week	5	13	21.3
	Once a day	6	6	9.8
	More than once a day	7	8	13.1
	Missing		9	14.8
7. How often did you masturbate?	Not at all	0	11	18.0
	Once in the last month	1	13	21.3
	2-3 times in the last month	2	6	9.8
	Once a week	3	11	18.0
	2-3 times a week	4	10	16.4
	4-6 times a week	5	3	4.9
	Once a day	6	3	4.9
	More than once a day	7	2	3.3
	Missing		2	3.3
8. Are you worried or distressed by the overall frequency of your sexual activities (including intercourse, kissing, and masturbation)?	Not at all worried or distressed	0	38	62.3
	A little bit worried or distressed	1	15	24.6
	Moderately worried or distressed	2	4	6.6
	Very worried or distressed	3	1	1.6
	Extremely worried or distressed	4	1	1.6
	Missing		2	3.3
9. Compared with a year ago, has the overall frequency of your sexual activities changed?	Increased a lot	2	0	0.0
	Increased moderately	1	3	4.9
	Neither increased nor decreased	0	40	65.6
	Decreased moderately	-1	13	21.3
	Decreased a lot	-2	3	4.9
	Missing		2	3.3
10.	Always able to get and keep an erection which would be good enough for sexual intercourse	3	41	67.2
	Usually able to get and keep an erection which would be good enough for sexual intercourse	2	18	29.5
	Sometimes able to get and keep an erection which would be good enough for sexual intercourse	1	1	1.6
	Never able to get and keep an erection which would be good enough for sexual intercourse	0	0	0
	Missing		1	1.6
	Not at all worried or distressed	0	49	80.3
11. Are you worried or distressed by your current ability to have an erection?	A little bit worried or distressed	1	10	16.4
	Moderately worried or distressed	2	1	1.6
	Very worried or distressed	3	1	1.6
	Extremely worried or distressed	4	0	0.0
	Increased a lot	2	0	0.0
	Increased moderately	1	3	4.9
12. Compare with a year ago, has your ability to have an erection changed?	Neither increased nor decreased	0	55	90.2
	Decreased moderately	-1	3	4.9
	Decreased a lot	-2	0	0.0
	Missing		0	0.0

13. When you had sexual stimulation, how often did you have the feeling of orgasm or climax?	No sexual intercourse-masturbation	0	1	1.6
	Almost never-never	1	1	1.6
	A few times (much less than half the time)	2	0	0.0
	Sometimes (about half the time)	3	0	0.0
	Most of the time (much more than half the time)	4	7	11.5
	Almost always-always	5	51	83.6
14. How satisfied have you been with your sense of control over the timing of your orgasm?	Missing	1	1	1.6
	Extremely satisfied	4	8	13.1
	Highly satisfied	3	30	49.2
	Moderately satisfied	2	17	27.9
	Slightly satisfied	1	4	6.6
	Not at all satisfied	0	1	1.6
15. Are you worried or distressed by your current orgasmic experience?	Missing	1	1	1.6
	Not at all worried or distressed	0	42	68.9
	A little bit worried or distressed	1	13	21.3
	Moderately worried or distressed	2	3	4.9
	Very worried or distressed	3	1	1.6
	Extremely worried or distressed	4		
16. Compared with a year ago, has the enjoyment of your orgasmic experience changed?	Missing	2	3.3	
	Increased a lot	2	0	0.0
	Increased moderately	1	3	4.9
	Neither increased nor decreased	0	54	88.5
	Decreased moderately	-1	3	4.9
	Decreased a lot	-2	0	0.0
17. How frequently did you awaken with a full erection?	Missing	1	1.6	
	Not at all	0	3	4.9
	Once in the last month	1	7	11.5
	2-3 times in the last month	2	9	14.8
	Once a week	3	6	9.8
	2-3 times a week	4	20	32.8
18. Are you worried or distressed by the frequency of your morning erections?	4-6 times a week	5	11	18.0
	Once a day	6	4	6.6
	More than once a day	7	1	1.6
	Not at all worried or distressed	0	54	88.5
	A little bit worried or distressed	1	4	6.6
	Moderately worried or distressed	2	3	4.9
19. Compared with a year ago, has the frequency of your morning erections changed?	Very worried or distressed	3	0	0.0
	Extremely worried or distressed	4	0	0.0
	Increased a lot	2	1	1.6
	Increased moderately	1	0	0.0
	Neither increased nor decreased	0	50	82.0
	Decreased moderately	-1	9	14.8
20. How satisfied have you been with your overall sex life?	Decreased a lot	-2	1	1.6
	Very dissatisfied	0	1	1.6
	Moderately dissatisfied	1	3	4.9
	About equally satisfied and dissatisfied	2	10	16.4
	Moderately satisfied	3	29	47.5
	Very satisfied	4	17	27.9
21. How worried or distressed have you been about your overall sex life?	Missing	1	1.6	
	Not at all worried or distressed	0	27	44.3
	Slightly worried or distressed	1	23	37.7
	About equally worried-not worried or distressed-not distressed	2	7	11.5
	Moderately worried or distressed	3	2	3.3
	Very worried or distressed	4	1	1.6
22. Compared with a year ago, has your overall sexual satisfaction changed?	Missing	1	1.6	
	Increased a lot	2	1	1.6
	Increased moderately	1	5	8.2
	Neither increased nor decreased	0	47	77.0
	Decreased moderately	-1	7	11.5
	Decreased a lot	-2	0	0.0
	Missing	1	1.6	

Table 3. Hormones (A), sperm parameters (B) and anthropometric measurements (C) in 18–25-year-aged Lithuanian men, participants in an international project “The reproductive function of Estonian, Latvian and Lithuanian Young men” in 2003–2004 (n=325)

	Measurement	Mean $\pm$ SD	Median	95% CI for Mean
(A)	Testosterone (T, nmol/L)	25.9 $\pm$ 8.3	25.3	25.0–26.8
	Inhibin B (pg/mL)	229.5 $\pm$ 81.6	224.0	220.6–238.4
	FSH (IU/L)	3.12 $\pm$ 2.37	2.60	2.86–3.38
	LH (IU/L)	4.08 $\pm$ 1.95	3.87	3.87–4.30
	SHBG (nmol/L)	36.4 $\pm$ 14.7	35.0	34.8–38.0
	Estradiol (pmol/L)	83.8 $\pm$ 23.2	82.0	81.2–86.3
	Inhibin B/FSH	149.7 $\pm$ 813.9	83.3	60.8–238.5
	Inhibin B/T	9.94 $\pm$ 5.46	8.93	9.34–10.53
	(Inhibin B $\times$ TTV)/FSH	180.7 $\pm$ 997.7	100.8	71.7–289.8
	Duration of abstinence (hh)	109.9 $\pm$ 80.4	86.0	101.0–118.9
(B)	Volume (mL)	3.67 $\pm$ 1.62	3.41	3.49–3.85
	Concentration ($\times 10^6$ /mL)	84.5 $\pm$ 71.5	65.8	76.6–92.5
	Total Sperm Count ($\times 10^6$)	293.4 $\pm$ 291.7	219.1	261.5–325.3
	Motility A (%)	22.0 $\pm$ 6.6	22.0	21.3–22.8
	Motility B (9%)	35.8 $\pm$ 6.8	36.0	35.1–36.6
	Motility C (%)	21.7 $\pm$ 5.6	22.0	21.1–22.4
	Immotile (D, %)	20.4 $\pm$ 7.9	19.0	19.5–21.2
	Normal morphology (%)	11.9 $\pm$ 4.2	12.0	11.4–12.4
	Not-normal (%)	89.1 $\pm$ 22.7	88.0	86.5–91.6
	Head defect (%)	72.9 $\pm$ 7.0	73.0	72.2–73.7
	Middle piece defect (%)	29.8 $\pm$ 5.1	30.0	29.3–30.4
	Tail defect (%)	13.9 $\pm$ 3.0	14.0	13.6–14.3
	Cytoplasmic droplets (%)	4.60 $\pm$ 1.97	4.50	4.38–4.82
	Age (years)	21.0 $\pm$ 1.8	20.6	20.8–21.2
	Height (cm)	181.8 $\pm$ 6.5	181.5	181.1–182.5
(C)	Weight (kg)	74.7 $\pm$ 9.5	74.0	73.7–75.8
	BMI (kg/m ²)	22.6 $\pm$ 2.6	22.2	22.3–22.9
	Total Testicular Volume (TTV, mL)	47 $\pm$ 12	47	46–48

This reduces both intra-assay and inter-assay variation.

Inhibin B levels were also very high in comparison with Danish men from the general population (compared with fertile men) and again much higher when compared with men with idiopathic infertility (19).

An important calculated score is that of the Inhibin B/FSH ratio. In KELLY men Inhibin B/FSH ratio (82.41 (95.05–113.77)) was much higher than in a Danish general population 48 (4–241), a group of fertile men 70 (15–203) and men with idiopathic infertility 14 (0–133) (19).

Recently, Jørgensen *et al.* (20) showed that serum Inhibin B levels in fertile men are strongly correlated with low, but not high sperm count.

In the majority of our comparisons the baseline results of Lithuanian KELLY men are high normal (12). Some interesting results also come from Southern Spain (6). Although from a different geographic situation, the data are very similar if viewed from the testicular dysgenesis syndrome (TDS) concept (21–24).

TDS in fact defines the whole male reproductive health landscape, since it includes the prevalence of hypospadias, cryptorchidism, defects of semen quality and the prevalence of testicular cancer (21).

Lithuania probably is a country with low prevalence of TDS.

Our study confirms good overall reproductive health in Lithuania, since the prevalence of hypospadias (25) and cryptorchidism (26) is low, and semen quality and sexual hormone parameters are better when compared with Denmark, Sweden and Norway (11). We also have relatively short time to pregnancy (27) and low prevalence of testicular cancer (28, 29).

In conclusion, the EMAS – SFQ created for investigation of older men is suitable also for the investigation of healthy young men.

The sexual function of 26-36 year-old participants in a 2003/2004 Project “The reproductive function of Estonian, Latvian and Lithuanian young men” from Kaunas, Lithuania is measured for the first time. These results, obtained using the EMAS-SFQ, could be considered as baseline referral values for young men in other countries with generally good reproductive health.

Conflict of interest

The authors did not report any conflict of interest.

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References

1. Carlsen E, Giwercman A, Keiding N, Skakkebaek NE. Evidence for decreasing quality of semen during past 50 years. *BMJ*. 1992;305(6854):609-613.
2. Punab M, Zilaitiene B, Jørgensen N, Horte A, Matulevicius V, Peetsalu A, Skakkebaek NE. Regional differences in semen qualities in the Baltic region. *Int J Androl*. 2002;25(4):243-252.
3. Tsarev I, Gagonin V, Giwercman A, Erenpreiss J. Sperm concentration in Latvian military conscripts as compared with other countries in the Nordic-Baltic area. *Int J Androl*. 2005; 28(4):208-214.
4. Jørgensen N, Vierula M, Jacobsen R, Pukkala E, Perheentupa A, Virtanen HE, Skakkebaek NE, Toppari J. Recent adverse trends in semen quality and testis cancer incidence among Finnish men. *Int J Androl*. 2011; 34(4 Pt 2):e37-e48.
5. Iwamoto T, Nozawa S, Mieno MN, Yamakawa K, Baba K, Yoshiike M, Namiki M, Koh E, Kanaya J, Okuyama A, Matsumiya K, Tsujimura A, Kanetake H, Eguchi J, Skakkebaek NE, Vierula M, Toppari J, Jørgensen N. Semen quality of 1559 young men from four cities in Japan: a cross-sectional population-based study. *BMJ Open*. 2013;29(3(4)). pii: e002222.
6. Fernandez MF, Duran I, Olea N, Avivar C, Vierula M, Toppari J, Skakkebaek NE, Jørgensen N. Semen quality and reproductive hormone levels in men from Southern Spain. *Int J Androl*. 2012;35(1):1-10.
7. Paasch U, Salzbrunn A, Glander HJ, Plambeck K, Salzbrunn H, Grunewald S, Stucke J, Vierula M, Skakkebaek NE, Jørgensen N.

- Semen quality in sub-fertile range for a significant proportion of young men from the general German population: a coordinated, controlled study of 791 men from Hamburg and Leipzig. *Int J Androl*. 2008;31(2):93-102.
8. Mendiola J, Jørgensen N, Andersson AM, Stahlhut RW, Liu F, Swan SH. Reproductive parameters in young men living in Rochester, New York. *Fertil Steril*. 2014; 101(4):1064-1071.
9. Richthoff J, Rylander L, Hagmar L, Malm J, Giwercman A. Higher sperm counts in Southern Sweden compared with Denmark. *Hum Reprod*. 2002;17(9):2468-2473.
10. Halling J, Petersen MS, Jørgensen N, Jensen TK, Grandjean P, Weihe P. Semen quality and reproductive hormones in Faroese men: a cross-sectional population-based study of 481 men. *BMJ Open*. 2013; 3(3). pii: e001946.
11. Jørgensen N, Carlsen E, Nermoen I, Punab M, Suominen J, Andersen AG, Andersson AM, Haugen TB, Horte A, Jensen TK, Magnus Ø, Petersen JH, Vierula M, Toppari J, Skakkebaek NE. East-West gradient in semen quality in the Nordic-Baltic area: a study of men from the general population in Denmark, Norway, Estonia and Finland. *Hum Reprod*. 2002; 17(8):2199-2208.
12. Matulevicius V. Male reproductive capacity, evaluated by testis volume, sperm quality and reproductive hormones as an ethnic characteristic of the population. *Acta Endocrinol (Buc)*. 2014;10(4): 655-665.
13. O'Connor DB, Corona G, Forti G, Tajar A, Lee DM, Finn JD, Bartfai G, Boonen S, Casanueva FF, Giwercman A, Huhtaniemi IT, Kula K, O'Neill TW, Pendleton N, Punab M, Silman AJ, Vanderschueren D, Wu FC. Assessment of sexual health in aging men in Europe: development and validation of the European Male Ageing Study sexual function questionnaire. *J Sex Med*. 2008;5(6):1374-1385.
14. Corona G, Lee DM, Forti G, O'Connor DB, Maggi M, O'Neill TW, Pendleton N, Bartfai G, Boonen S, Casanueva FF, Finn JD, Giwercman A, Han TS, Huhtaniemi IT, Kula K, Lean ME, Punab M, Silman AJ, Vanderschueren D, Wu FC. EMAS Study Group. Age-related changes in general and sexual health in middle-aged and older men: results from the European Male Ageing Study (EMAS). *J Sex Med*. 2010;7(4 Pt 1):1362-1380.
15. Han TS, Tajar A, O'Neill TW, Jiang M, Bartfai G, Boonen S, Casanueva F, Finn JD, Forti G, Giwercman A, Huhtaniemi IT, Kula K, Pendleton N, Punab M, Silman AJ, Vanderschueren D, Lean ME, Wu FC. EMAS group. Impaired quality of life and sexual function in overweight and obese men: the European Male Ageing Study. *Eur J Endocrinol*. 2011;164(6):1003-1011.
16. Tajar A, O'Neill TW, Lee DM, O'Connor DB, Corona G, Finn JD, Bartfai G, Boonen S, Casanueva FF, Forti G, Giwercman A, Han TS, Huhtaniemi IT, Kula K, Lean ME, Pendleton N, Punab M, Purandare N, Silman AJ, Vanderschueren D, Wu FC, McBeth J. European Male Ageing Study Group. The effect of musculoskeletal pain on sexual function in middle-aged and elderly European men: results from the European male ageing study. *J Rheumatol*. 2011;38(2):370-377.
17. Carlsen E, Andersen AG, Buchreitz L, Jørgensen N, Magnus O, Matulevicius V, Nermoen I, Petersen JH, Punab M, Suominen J, Zilaitiene B, Giwercman A. Inter-observer variation in the results of the clinical andrological examination, including estimation of testicular size. *Int J Androl*. 2000; 23 (4):248-253.
18. Matulevičius V, Preikša R.T, Žilaitienė B, Nikulina S, Veličkienė Dž, Lašaitė L, Prakapienė E, Abramavičius S, Adomaitienė V, Verkauskienė R, Sakalauskas R. Translation of European male ageing study sexual function questionnaire (EMAS – SFQ) to Lithuanian and the search for control group of potentially surveyed men *Lietuvos endokrinologija*. 2012;20(1,2,3,4):57-66. (Article in Lithuanian).
19. Andersson AM, Petersen JH, Jørgensen N, Jensen TK, Skakkebaek NE. Serum inhibin B and follicle-stimulating hormone levels as tools in the evaluation of infertile men: significance of adequate reference values from proven fertile men. *J Clin Endocrinol Metab*. 2004;89(6):2873-2879.

20. Jørgensen N, Liu F, Andersson AM, Vierula M, Irvine DS, Auger J, Brazil CK, Drobnis EZ, Jensen TK, Jouannet P, Overstreet JW, Redmon JB, Sparks A, Toppari J, Wang C, Skakkebaek NE, Swan SH. Serum Inhibin-B in fertile men is strongly correlated with low but not high sperm counts: a coordinated study of 1,797 European and US men. *Fertil Steril*. 2010;94(6):2128-2134.
21. Jacobsen R, Bostofte E, Engholm G, Hansen J, Olsen JH, Skakkebaek NE, Møller H. Risk of testicular cancer in men with abnormal semen characteristics: cohort study. *BMJ*. 2000;321(7264):789-792.
22. Skakkebaek NE, Rajpert-De Meyts E, Main KM. Testicular dysgenesis syndrome: an increasingly common developmental disorder with environmental aspects. *Hum Reprod*. 2001;16(5):972-978. 10.1093/humrep/16.5.972.
23. Jørgensen N, Rajpert-De Meyts E, Main KM, Skakkebaek NE. Testicular dysgenesis syndrome comprises some but not all cases of hypospadias and impaired spermatogenesis. *Int J Androl*. 2010;33(2):298-303.
24. Edsgård D, Dalgaard MD, Weinhold N, Wesolowska-Andersen A, Rajpert-De Meyts E, Ottesen AM, Juul A, Skakkebaek NE, Skøt Jensen T, Gupta R, Leffers H, Brunak S. Genome-wide assessment of the association of rare and common copy number variations to testicular germ cell cancer. *Front Endocrinol (Lausanne)*. 2013;4:2.
25. Gričius K, Valentinas J, Malcius D, Plukas I, Norkus M., Matulevičius V. Birth incidence of subsequently operated hypospadias in Lithuania during 1966-1990. *Acta medica Lituanica*. 1996;3(2):91-93.
26. Preiksa RT, Zilaitienė B, Matulevicius V, Skakkebaek NE, Petersen JH, Jørgensen N, Toppari J. Higher than expected prevalence of congenital cryptorchidism in Lithuania: a study of 1204 boys at birth and 1 year follow-up. *Hum Reprod*. 2005;20(7):1928-1932.
27. Zilaitienė B, Dirzaukas M, Preiksa RT, Matulevicius V. Cigarette smoking and waiting time to pregnancy: results of a pilot study. *Medicina (Kaunas)*. 2007;43(12):959-963. <http://medicina.lsmuni.lt/med/0712/0712-07e.htm>.
28. Verhoeven RH, Gondos A, Janssen-Heijnen ML, Saum KU, Brewster DH, Holleczek B, Crocetti E, Rosso S, Hakulinen T, Aareleid T, Brenner H; EUNICE Survival Working Group. Testicular cancer in Europe and the USA: survival still rising among older patients. *Ann Oncol*. 2013;24(2):508-513.
29. Juska A, Ulys A, Kairevicius L, Smalyte G, Stankevicius E, Jančiauskienė R, Jievaltas M. Survival of patients with testicular cancer in Lithuania during 1999-2002. *Medicina (Kaunas)*. 2011;47(1):52-56. <http://medicina.lsmuni.lt/med/1101/1101-08e.pdf>.