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Measurement Invariance of Female Sexual Function Index: A study with heterosexual and lesbian Portuguese women

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Abstract

The Female Sexual Function Index is a powerful screening tool for female sexual dysfunction extensively used across worldwide. Nonetheless, its factorial structure and psychometric properties have been tested almost exclusively with heterosexual samples. Current study aimed to testing the original factorial structure, reliability and temporal stability in two samples of women (heterosexual and lesbian), and to assess the measurement invariance across sexual orientation. An online sample of 752 Portuguese women (376 lesbian women and 376 heterosexual women) recruited between May 2012 and 2013 participated in the study and completed a sociodemographic questionnaire and the FSFI. For temporal stability, 30 Portuguese women were recruited online in May 2017. Confirmatory factor analysis, reliability analysis and temporal stability were assessed independently for each sample. Measurement invariance (configural, metric, and scalar) was also assessed. Main findings for both samples corroborate the six-factor structure and revealed excellent levels of temporal stability, with Cronbach alphas and McDonalds Omega of .95 for heterosexual sample, and .96 for lesbian women sample. Results corroborate measurement invariance (configural, metric, and scalar) across sample type. Overall, the FSFI revealed a good-fit for the six-factor model in both heterosexual and women sample, with excellent levels of reliability and temporal stability, and showed measurement invariance across sexual orientation. These findings support the use of the FSFI with lesbian women.

Key-words: Factorial structure; FSFI; Heterosexual women; Lesbian women; Measurement invariance

Introduction

Over the past two decades, women' sexuality has received particular attention, with emphasis on the remarkable work of Rosemary Basson (2000), strengthening the complexity associated with female sexual response. Research on prevalence about sexual difficulties and sexual dysfunction has also been conducted extensively (e.g., Kammerer-Doak & Rogers, 2021; Madbouly et al., 2021; McCool et al., 2016; McCool-Myers et al., 2018; Nappi et al., 2016) suggesting that sexual difficulties are a relevant health concern, impacting women's quality of life and well-being, as well as sexual and couples' satisfaction (e.g., Abdolmanafi et al., 2018; Nappi et al., 2016; Peixoto & Nobre, 2016; Rosen et al., 2019).

The Female Sexual Functioning Index (FSFI) has been developed by Rosen and colleagues (2000) and is a self-report measure extensively used worldwide, in both research and clinical settings (Meston et al., 2020). It has been translated and validated for Italian language (Filocamo, et al., 2014), Portuguese-European language (Pechorro, et al., 2009), Hungarian language (Hock, et al., 2019), Malay language (Sidi, et al., 2007), Urdu language (Rehman, et al., 2015), Japanese language (Takahashi, et al., 2011), Dutch language (Ter Kuile, et al., 2006), French language (Wylomanski, et al., 2014), and Chinese language (Sun, et al., 2011), among others. The FSFI allows assessing six dimensions from female sexual functioning, namely sexual desire, sexual arousal, lubrication, orgasmic function, sexual satisfaction and sexual pain (Rosen, et al., 2000). A short-version with six-items has been developed and tested, revealing good psychometric properties, and very easily to administered in clinical contexts (Isidori et al., 2010).

Several adaptations have been proposed for the FSFI across the years. Dargis et al. (2012) proposed an adaptation for older women, whereas Burri et al. (2010) proposed an adaptation for assessing life-long sexual functioning, in order to overcome some limitations already discussed,

particularly women who are not sexually active often in the past month. Additionally, given the proliferation of web-based studies, a comparison between web-administration and pencil-paper administration showed no statistical significant differences, supporting the use of the FSFI in web-based studies (Crisp, et al., 2015). Also, psychometric properties have been studied in cancer survivors (Baser et al., 2012), and an adaptation has been tested for breast cancer patients revealed good psychometric properties (Bartula & Sherman, 2015).

The FSFI has been described as a powerful screening tool for female sexual dysfunction (Neijenhuijs et al., 2019), particularly for use in routine gynaecological practice (Nappi, et al., 2008), given its cut-off score empirically established for differentiating between women with and without criteria for sexual dysfunction according to DSM-IV-TR (Wiegel, et al., 2005). Very recently, a study conducted with Columbian women corroborated the findings from Wiegel et al. (2005) study', by presenting empirical data that identify the same cut-off score for differentiating women with and without sexual dysfunction diagnoses according to DSM-5 criteria (Rincón-Hernandez, et al., 2020). Several studies have tested the clinical validation of the FSFI, with women diagnosed with Hypoactive Sexual Desire Disorder (Gerstenberger, et al., 2010; Meston, 2003; Ryding, et al., 2015), with Hypoactive Sexual Desire Disorder in women in pre- and postmenopausal state (Revicki, et al., 2011), with Orgasmic Disorder (Meston, 2003), with Vulvodynia (Masheb et al., 2004).

Despite of being a widespread clinical and research tool, it has been developed and its factorial structure and psychometric properties have been assessed with heterosexual samples. For that reason, several studies which aimed at investigating female sexual functioning according to the FSFI decided to excluded non-heterosexual women (i.e., lesbian and bisexual, or women who have sex with women; Burri et al., 2010; Leiblum & Seehuus, 2009; Rincón-Hernandez, et

al., 2020). Nonetheless, other studies have included non-heterosexual women when assessing female sexual functioning through the FSFI (e.g., Beaber & Werner, 2009), by only testing the scale reliability in the study sample according to Cronbach alpha value, with no information regarding factorial structure confirmation.

The FSFI is the most widely self-report measure for assessing female sexual difficulties used worldwide in clinical and research contexts (Meston et al., 2020; Neijenhuijs et al., 2019). Its psychometric properties and factorial structure have been assessed in several languages (e.g., Filocamo, et al., 2014; Hock, et al., 2019; Rehman, et al., 2015; Sun, et al., 2011; Takahashi, et al., 2011; Wylomanski, et al., 2014), with good outcomes, but exclusively with heterosexual samples. To overcome that limitation, current study aimed to test the original factorial structure of the FSFI and to test reliability and temporal stability in a sample of lesbian women and a sample of heterosexual women with similar sociodemographic characteristics, and to test the measurement invariance across sexual orientation.

Materials and Methods

Participants and Procedures

One-thousand and one-hundred and fifty sexually active Portuguese women (413 lesbian women and 737 heterosexual women) participated in a web-survey about sexual health, between May 2012 and May 2013. The survey (www.limesurvey.org, LimeSurvey™, Fa. Carsten Schmitz/Germany) was advertised on several Portuguese LGBT forums, websites, and social networks, and e-mail invitations were sent by university and sexual-related associations mailing lists. Participants received the link as well as a full explanation about the purpose of the study. After read and agreeing to the informed consent, participants were invited to answer the survey, which took between 25 to 30 minutes to complete. No monetary compensation or other

incentives were given. No IP address was recorded and data collected was located at University server in order to safeguard the privacy and anonymity of participants. The study has been carried out in accordance to the ethical principles for research involving humans and had been approved by the University Ethics Committee. The study followed the Declaration of Helsinki ethical principles for research involving human subjects and the compliance with all ethical regulations. Informed consent was obtained guaranteeing confidentiality, anonymity, and the right to not participate or discontinue participation in the study, at any time.

For assessing temporal stability of the FSFI, 30 Portuguese women were recruited during May 2017. This recruitment was carried out in accordance to the ethical principles for research involving humans and also been approved by a University Ethics Committee. Women were invited to participate, voluntarily, in a project for assessing psychometric properties of FSFI. Potential volunteers were recruited in university context, using mailing lists. Volunteers received a full explanation of study purpose, and women who consent to participate received the link to fulfill the FSFI in two different moments, with 28-days interval. Participants generate a personal code which they were invited to introduce in both completion of the instrument. Likewise, no monetary compensation or other incentives were given, and participation took about five minutes to complete.

From the original sample of 1150 women, 37 lesbian women and 24 heterosexual women were excluded to control for the validity of the data (i.e., women completing the questionnaire in an unreasonably short time, women not meeting the questions of the FSFI, women whose age did not match their educational level). After checking for validity of the data, 376 lesbian women and 713 heterosexual women met criteria to be included in the study. From the 713 heterosexual women, 376 were randomly selected using the software IBM SPSS version 26.0 from the

original data-base, in order to match the sociodemographic characteristics of the 376 lesbian women sample. Descriptive analyses were performed and mean age for the lesbian women sample was 26.37 (SD = 7.99), ranging from 18 to 62 years old, whereas mean age for the heterosexual women sample was 26.05 (SD = 7.07), ranging from 18 to 62 years old. The sociodemographic characteristics of the sample are presented at Table 1. For test–retest reliability assessment, 30 Portuguese women consent to participate (15 lesbian women and 15 heterosexual women), and fulfill the FSFI, with 28-days interval. Mean age for lesbian women sample was 29.07 (SD = 8.80), 86.7% were single, 53.3% completed more than 13 years of education and 46.7% completed 12 years of education. Mean age for heterosexual women sample was 22.47 (SD = 2.47), 73.3% were single, 46.7% completed 12 years of academic education, whereas 40.0% completed more than 13 years.

TABLE 1 HERE

Self-report Measures

Socio-demographic Information

Socio-demographic characteristics were evaluated by several questions about personal information (age, education, marital status). Regarding sexual orientation, participants answered to the following question "*How would you define your sexual orientation?*", according to a *Likert* scale (from 1 - *Exclusively homosexual* to 7 - *Exclusively heterosexual*).

The Female Sexual Function Index (FSFI)

The FSFI (Rosen et al. 2000) is a 19-item measure, easily administered and scored, providing detailed information on the major dimensions of sexual function. A principal

component analysis identified six factors: sexual interest/ desire, sexual arousal, lubrication, orgasm, sexual satisfaction and sexual pain. The measure presents accept- able test–retest reliability (r = .79 to .86), internal consistency (Cronbach's alpha values of .82 and higher), and validity (demonstrated by significant mean difference scores between a clinical and a control group; Rosen et al. 2000). The measure allows the calculation of specific indexes for each dimension as well as a sexual function index, with higher scores indicating greater levels of sexual functioning. In both versions, the term "intercourse" was removed, and "sexual activity" was the concept that remains. The Portuguese version also presented good psychometric properties with Cronbach's alpha values ranging between .88 and .93 (Pechorro et al. 2009).

Statistical analysis

Adequate sample size for a medium effect size (effect size = 0.3), with a desirable statistical power level of 0.8, at a statistical significance of $p < .05$ was calculated, and a recommended minimum sample size of 177 participants was proposed (Soper, 2021). For assessing the factorial structure of the FSFI, normality of data was assessed according to Mardia's coefficient, with critical ratio over 1.96 being revealing non-normal multivariate data. Confirmatory Factor Analysis (CFA) were performed using the IBM SPSS Amos 18, according to the Unweighted Least Squares method, with both samples. The following fit indexes were considered: (a) Goodness of Fit Index (GFI); (b) Adjusted Goodness of Fit Index (AGFI); (c) Non-Normed Fit Index (NNFI); (d) Relative Fit Index (RFI). As rules of thumb, we considered values of GFI, AGFI, NNFI, and RFI values higher than .95 as indicative of satisfactory model fit (Arbuckle, 2013). The scale and subscales reliability was assessed through internal consistency according to Cronbach's alpha values, and values equal to or greater than .70 were considered satisfactory (Bland & Altman, 1997; Streiner, 2003). Additionally, McDonald's

Omega coefficient was also computed in order to assess internal consistency and to compare values with Cronbach's alpha values (Green & Yang, 2015; Peters, 2014). To estimate the instrument temporal stability, test–retest reliability was assessed through the intraclass correlation coefficient (ICC). ICC values equal to or greater than .75 were recommended for continuous scales (Streiner & Norman, 1995). A Multigroup Confirmatory Factor Analysis was performed using the IBM SPSS Amos 18 to test the invariance of the factorial model across sample type (lesbian women vs. heterosexual women). Measurement invariance was analysed by testing configural (structure equivalence), metric (factorial loadings equivalence) and scalar invariance (intercept equivalence) (Horn & McArdle, 1992). The Chi-square difference test (ΔX^2) and the Comparative Fit Index difference test (ΔCFI) (Cheung & Rensvold, 2002) were analysed. The ΔX^2 is sensitive to sample dimension, so to overtake this constraint, the ΔCFI was used since it is not affected by the model specification (Cheung & Rensvold, 2002). To assume the measure invariance, ΔCFI value smaller or equal to 0.01 are considered (Cheung & Rensvold, 2002).

Results

Preliminary analysis

The FSFI did not contain missing values or outliers in both lesbian and heterosexual women samples. According to Mardia's coefficients, which were significant on both samples (critical ratios were over 1.96 for several items), data were considered non-normally distributed.

CFA was conducted according to Unweighted Least Squares method, and the six-factor model for the lesbian women sample reached the following fit indexes: GFI = .99, AGFI = .98, NNFI = .99, and RFI = .99, standardized loadings ranging from .47 (item 15) to .97 (item 18), and all latent variables presented positive correlations. For the heterosexual sample, the six-

factor model reached the following fit indexes: GFI = .99, AGFI = .98, NNFI = .99, and RFI = .99, standardized loadings ranging from .52 (item 15 and item 16) to .99 (item 1), and all latent variables presented positive correlations.

Reliability analyses

Internal consistency was assessed through Cronbach's alpha values for total score and for each subscale of the FSFI. For total score Cronbach's alpha for the lesbian women sample was .96; for sexual desire subscale it was .82, for sexual arousal subscale it was .96, for lubrication subscale was .97, for orgasmic subscale it was .94, for overall satisfaction subscale it was .76, and for sexual pain subscale it was .96. Additionally, Cronbach's alpha values for total score for the heterosexual women sample was .95, for sexual desire subscale it was .85, for sexual arousal subscale it was .94, for lubrication subscale was .95, for orgasmic subscale it was .92, for overall satisfaction subscale it was .78, and for sexual pain subscale it was .90. McDonald's Omega coefficient was computed with Omega macro for IBM SPSS by Hayes & Coutts (2020) for global scale for lesbian sample ($\omega = .96$), and for global scale for heterosexual sample ($\omega = .95$).

Test-retest reliability was assessed through two administrations of the FSFI, with 4-weeks interval. For the lesbian women sample, results showed statistically significant correlations for the FSFI Total Scale, $r = .98$, $p < .001$, for the sexual desire subscale, $r = .74$, $p = .002$, for the sexual arousal subscale, $r = .97$, $p < .001$, for the lubrication subscale, r = .99, $p < .001$, for the orgasmic subscale, $r = .90$, p < .001, for the overall satisfaction subscale, $r = .97$, $p < .001$ and for the sexual pain subscale, $r = .98$, $p < .001$. Likewise, for the heterosexual women sample, results showed statistically significant correlations for the FSFI Total Scale, $r = .95$, $p < .001$, for the sexual desire subscale, $r = .75$, $p = .002$, for the sexual arousal subscale, $r = .83$, $p < .001$, for the lubrication subscale, $r = .82$, $p < .001$, for the orgasmic subscale, $r = .91$, $p < .001$, for the

overall satisfaction subscale, $r = .90$, $p < .001$, and for the sexual pain subscale, $r = .99$, $p < .001$.

Measurement Invariance

FSFI measurement invariance was tested across sexual orientation (Table 2). The six-factor model showed a good adjustment to heterosexual and lesbian women simultaneously (X2/df = 3.79; RMSEA = .064; CFI = .95; TLI = .93), revealing configural invariance. The ΔX2 and the ΔCFI revealed metric (ΔX2 (3) = 4.02, $p = .885$) and scalar invariance (ΔX2 (3) = 22.95, $p = .088$). These overall results corroborate the presence of measurement invariance across sexual orientation.

TABLE 2 HERE

Discussion

Current study examines measurement invariance of FSFI across sexual orientation, in particular, heterosexual and lesbian women. Main findings revealed that FSFI, which is used extensively worldwide, in both research and clinical settings (Meston et al., 2020), was invariant across sexual orientation, suggesting that as a self-report measure can be used with Portuguese lesbian and heterosexual women.

Tests of measurement invariance confirmed the factor structure across sample type (heterosexual vs. lesbian women sample), with configural (structure equivalence), metric (factorial loadings equivalence) and scalar invariance (intercept equivalence) (Horn & McArdle, 1992) being confirmed. This finding is of utmost relevancy for women' sexuality field research, has it may allow to use the FSFI in research and clinical settings with lesbian women. Further

studies should replicate current findings in order to establish an empirical support to FSFI as a reliable measure for assessing female sexual functioning regardless of sexual orientation.

Reliability was assessed by the calculation of Cronbach's alpha value and by the McDonald's Omega coefficient, and both values for FSFI global scale for lesbian women sample were excellent, as well as both values for heterosexual women sample (equal or superior of .95). Concerning subscales, Cronbach's alpha values for the lesbian sample range between .76 (sexual satisfaction subscale) and .97 (lubrication subscale), and for the heterosexual women sample range between .78 (sexual satisfaction subscale) and .95 (lubrication scale). Overall, all values from Cronbach alpha values were over .70, which are considered satisfactory (Bland & Altman, 1997; Streiner, 2003), sustaining the reliability of the FSFI in both heterosexual and lesbian women samples.

The FSFI also revealed good to excellent temporal stability, with coefficient values for the lesbian sample ranging from .74 (sexual desire subscale) to .98 (lubrication subscale), with .98 for the global scale, with similar results for the heterosexual sample, with coefficient values of .95 for the global scale, and values ranging from .75 (sexual desire subscale) to .99 (sexual pain subscale). Women's sexual desire is possibly the dimension from response cycle with more oscillation due to mood fluctuations, hormonal influences, and psychosocial impacts (Fahs, Swank, & Shambe, 2020).

Nonetheless, current study has some limitations that suggest that results should be interpreted carefully. A significant limitation is related with timing of data collection, which occur eight years ago. Nonetheless, and considering the purpose of the study, which was to examine of the FSFI constitutes an invariant measure for lesbian and heterosexual women, we believe that current data is still update and represents reliable information for clinicians and

researchers in women's health. In addition, the sample has been collected through web-based questionnaires, nevertheless previous data support the reliability and validity of web administrations of the FSFI (Crisp, et al., 2015). Additionally, overall mean age for both samples was around 26 years old, which is a very young adult sample, so future studies should propose to replicate current findings with older samples. Also, current study only examines factorial structure, reliability (stability and temporal) and measurement invariance, future studies should examine convergent and discriminant validity of the FSFI with non-heterosexual samples. Finally, this study only compared heterosexual women with lesbian women. Further studies should study the factorial structure, psychometric properties and measurement invariance across samples of bisexual women, and women who have sex with women.

In summary, the present study provides empirical evidence for the measurement invariance of the FSFI across sexual orientation in a sample of Portuguese heterosexual and lesbian women. It demonstrates good to excellent reliability and temporal stability, supporting the use of the FSFI as a self-report instrument to assess sexual functioning among Portuguese heterosexual and lesbian women.

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Data availability statement: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Table 1 – Sociodemographic characteristics of the sample (N = 752)

	Lesbian women (n = 376)	**Heterosexual women (n = 376)**
	n (%)	**n (%)**
Marital Status		
Single within an intimate relationship	299 (79.5)	284 (75.5)
Married/cohabitation	64 (17.3)	79 (21.3)
Divorced/Separated	13 (3.2)	13 (3.2)
Educational Level		
9 years	10 (2.4)	10 (2.4)
12 years	125 (33.2)	103 (27.4)
+13 years	241 (64.4)	263 (70.2)

Table 2 – Measurement invariance of FSFI (N = 752)

		X^2	df	RMSEA	CFI	TLI	ΔCFI
Sexual orientation	Configural invariance	72.08	19	.064 [.060-.068]	.95	.93	__
	Metric invariance	76.10	21	.063 [.060-.067]	.94	.94	.01
	Scalar invariance	95.03	21	.064 [.060-.067]	.94	.93	.01

Note: $\chi 2$ – Chi-Square; df – degrees of freedom; CFI - Comparative Fit Index; TLI - Tucker-Lewis Index; RMSEA - Root Mean Square Error of Approximation.