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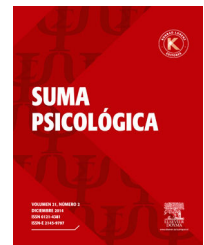
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## Validity and reliability of a set of sexual stimuli in a sample of Colombian heterosexual young women

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### ABSTRACT

Vaginal photoplethysmography is a method for physiological evaluation of sexual arousal in women. This paper undertook to obtain the validity and reliability of a set of sexual stimuli in young heterosexual women. Six six-minute video clips were selected. A total of 34 women aged 18–30 years ( $M = 22.38$ ,  $SD = 2.52$ ) participated in this study. Objective Sexual Arousal, Subjective Sexual Arousal, emotional activation, emotional valence and socio-psycho-sexual information were evaluated. Three of the six sexual stimuli were selected from the scores obtained after the experimental phase. It was observed that the aforementioned video clips produced the most arousal-activation-pleasure, with internally consistent measures. As expected, good indicators of external validity were observed, with statistically significant differences. According to the data obtained, the pooled use of the three stimuli increases the likelihood of obtaining an objective arousal response in healthy young women, thereby minimizing the possibilities of displeasure.

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### Validez y fiabilidad de un set de estímulos sexuales en una muestra de jóvenes mujeres heterosexuales colombianas

#### R E S U M E N

La fotoplethysmografía vaginal es un método para evaluar fisiológicamente la excitación sexual objetiva en mujeres. El objetivo del presente estudio es obtener la validez y fiabilidad de un set de estímulos sexuales en mujeres jóvenes heterosexuales. Se seleccionaron seis videos sexuales de 6 minutos de duración. Un total de 34 mujeres entre los 18 y 30 años ( $M = 22.38$ ;  $SD = 2.52$ ) participaron en este estudio. Se evaluó la Excitación Sexual Objetiva, Subjetiva, la activación y valencia emocional e información sociopsicosexual. Tres de los seis estímulos sexuales se seleccionaron a partir de las puntuaciones obtenidas luego de la

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fase experimental. Se observó que estos fueron los que mayor excitación-activación-agrado produjeron con medidas internamente consistentes. Se observaron buenos indicadores de validez externa con diferencias estadísticamente significativas, como era de esperarse. Según los datos obtenidos, el uso agrupado de los tres estímulos aumentan la probabilidad de obtener una respuesta de excitación objetiva en mujeres jóvenes saludables y minimizan las posibilidades de desagrado.

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According to the sexual response model proposed by Masters and Johnson (1966), changes in vaginal vasoconstriction and lubrication are two physiological reactions that correlate with sexual arousal in women. In addition, these reactions allow the body to become prepared for sexual activity (Levin, 2003, 2004). Vaginal photoplethysmography (VPP) is the method used to evaluate changes in blood flow in the vagina (Prause & Janssen, 2006). These variations can be estimated with the vaginal photoplethysmograph, created in 1965 by Yoram Palti and Bruno Bercovici (Bercovici & Palti, 1967; Palti & Bercovici, 1967), and enhanced by James H. Geer in 1971. The vaginal photoplethysmograph is a tampon-shaped plastic device made of transparent acrylic material (4.5 mm long and 1.2 mm in diameter) for easy insertion into the vagina (Hatch, 1979; Sintchak & Geer, 1975), to keep track of the rapid changes in the volume of blood at the intravaginal level. The acrylic probe contains a red light which is reflected toward the ventral wall of the vagina; thus, only the fraction of the tissue radiated is the part where the recording of reflected light is obtained by a photosensitive cell. Changes in the magnitude of the light reflect changes in vaginal blood flow (Hatch, 1979).

The vaginal photoplethysmograph has been used in several studies involving female sexuality, seeking to identify variables that may affect sexual arousal. There is research which evaluates the influence of variables such as: sexual stimuli (Chivers & Bailey, 2005), child sexual abuse (Bird, Seehuus, Clifton, & Rellini, 2014), instructions of fantasy (Carvalho et al., 2013), asexuality (Brotto & Yule, 2011), lubrication (Dawson, Sawatsky, & Lalumière, 2015), dyspareunia (Brauer, Laan, & ter Kuile, 2006), affection and cognition (Vilarinho et al., 2014), inter alia. Research in this field accounts for the importance of internal and external aspects to achieve adequate sexual arousal; hence the availability of tools – like a set of sexual stimuli – to facilitate a reliable and valid evaluation in women. Marshall (2014) reported the absence of standardized stimuli as an aspect to improve research on the subject. Currently there are several types of stimuli, such as video clips with sexual contact in homosexual individuals (Chivers, Rieger, Latty, & Bailey, 2004), sexual contact in heterosexual individuals (Rellini, McCall, Randall, & Meston, 2005), bonobos mating, masturbation, intercourse (Chivers, Seto, & Blanchard, 2007), inter alia. Thus, diversity in stimuli makes validation – and particularly the study of sexual arousal in women – a difficult task.

Several limitations in the standardization of stimuli or methodologies were pointed out by Howes (1995) and Marshall, Serran, and Yates (2003). No solution has been found

for these restrictions as yet. According to Marshall (2014), these limitations remain latent in the field of research. Thus, there emerge a number of methodological items (Carvalho et al., 2013; Cerny & Janssen, 2011; Chivers, Seto, Lalumière, Laan, & Grimbos 2010, Trottier, Rouleau, Renaud, & Goyette, 2014) which seek to gradually improve some of these difficulties. Kukkonen (2015) indicates that research in the field of female sexual evaluation would benefit by having an updated, reliable and valid set of stimuli. However, the stimuli used for VPP to date have little psychometric support (Marshall, 2014). Therefore, the objective of this experiment-based instrumental study is to obtain the validity and reliability of a set of sexual stimuli for heterosexual women.

## Method

### Participants

The sample consisted of 34 Colombian women. The following inclusion criteria were established: being over 18 and being exclusively or mainly heterosexual. The age range was 18–30 years ( $M = 22.38$ ,  $SD = 2.52$ ). All participants reported no sexual problems of any kind. The sample was divided into three groups. To ensure that sexual stimuli remained balanced between the three groups of participants group A – with 12 participants – was exposed to sexual stimuli SS1, SS2 and SS3; group B – with 11 participants – was exposed to stimuli SS4, SS5 and SS6; and group C – consisting of 11 participants – was exposed to the three finally selected stimuli.

### Materials

#### Sexual stimuli (SS)

The participants were shown six videos with sexual content and three videos with neutral content, each with a duration of 6 min. The sequences of presentation of SS for each group were balanced, in such a manner that each of the sexual excerpts was presented the same number of times, in each of the positions. Information regarding the selection and editing of the videos can be found in the procedure.

#### Physiological responses

Vaginal Pulse Amplitude (VPA) was evaluated with the MP150 central data acquisition module, and analyzed with the software AcqKnowledge IV, version 4.4.0 (Biopac Systems, Inc., USA).

### Objective Sexual Arousal (OSA)

Only VPA was evaluated, since this is the measure of arousal that has shown highest rates of convergent and divergent validity (Laan, Everaerd, & Evers, 1995; Laan, Everaerd, Van der Velde, & Geer, 1995). VPA was evaluated with a vaginal photoplethysmograph, which is connected to the PPG100C module. The participants were instructed in the use of the photoplethysmograph by way of a replica model of a vagina, in order to ensure the understanding of instructions through modeling and shaping. Thus, the participants would be able to place the photoplethysmograph correctly and independently. Each instrument was properly disinfected under national and international standards of asepsis and antisepsis.

### Scales

#### Sociodemographic and psychosexual questions

A semi-structured interview was used which evaluated sex, age, schooling level and city of residence, among other elements. Bio-psycho-sexual information was evaluated with questions about sexual orientation (Kinsey, Pomeroy, & Martin, 1948), the last sexual contact and frequency of intercourse, the existence of a stable partner, access to videos with erotic content, drug use and/or medicines, and psychological and sexual problems reported by the participant.

#### Self-Assessment Manikin (SAM; Bradley & Lang, 1994)

This is a pictorial scale in which the emotional reaction that people have to the stimuli is evaluated. The version validated in Colombia was utilized in this study (Gantiva Díaz, Guerra Muñoz, & Vila Castellar, 2011). The SAM is answered on a 9-point visual analog scale. Valencia (SAM-V), also known as pleasure, Arousal (SAM-A) and Dominance (SAM-D) are part of the dimensions of this scale. However, only the SAM-A and SAM-V were used for the purpose of this study. High scores were indicative of a high degree of activation and pleasure, respectively.

#### Multidimensional Scale to Assess Subjective Sexual Arousal (MISSA; Mosher, Barton-Henry, & Green, 1988)

The translated Spanish version (Sánchez-Fuentes, Arcos-Romero, Sierra, Moyano, & Granados, 2014) was used for this research; the purpose of this scale is to measure sexual arousal and subjective genital sensations. In this research, we used the sexual arousal and genital sensations dimensions together (ruling out the affective-sexual arousal dimension). Thus, a total of six items were used to evaluate Subjective Sexual Arousal.

### Process

#### Selection of stimuli

The selection of sexual stimuli was carried out at various stages:

In the first phase, two researchers from SexLab KL – who claimed to be at least mainly heterosexual, chose 21 videos with heterosexual sexual content between a male and a female, from commercial websites categorized as “woman-friendly” (centered on pleasure for women). In addition, a criterion was adopted whereby the videos had to have a

heterosexual encounter between a man and a woman, in which the following practices were shown: “foreplay”, oral sex from him to her (cunnilingus), oral sex from her to him (fellatio) and intercourse. In addition, the recommendations suggested by Laan, Everaerd, Van Bellen and Gerrit Hanewald (1994) and Laan and Both (2008) were taken into account when choosing the videos, as follows: (a) the sexual contact should be initiated and controlled by the woman; (b) the sexual interaction should focus on her pleasure; (c) before starting the sexually explicit content, there should be a context of emotional development between the actors; (d) genital targeting is used, but more emphasis is placed on the romantic relationship between the actors; (e) verbal, facial and body expressions of the actors should be natural. Furthermore, variability was sought in regards to the characteristics of the videos in order to increase the likelihood that women would be exposed both to positive and negative emotional reactions. The latter feature facilitates discrimination of the physiological states of arousal and non-arousal (Laan & Everaerd, 1995; Peterson & Janssen, 2007).

The second phase consisted in choosing the six best videos. To this effect, four women evaluators who reported being at least mainly heterosexual rated subjectively all of the videos on a scale of one to ten, according to the following criteria: level of sexual arousal, time to reach arousal, level of sexual pleasure, pleasure with the appearance of the actors, pleasure with the situation or context, desire to participate, interest caused by the video and comfort level. The six videos with the highest scores were chosen for the study.

Subsequently, the videos chosen were edited using the program Sony Vegas Pro 12 ©, with an HQ 1920x1080-24p – 35Mbps VBR output, adjusting them to a duration of 6 min. The clips should contain the scenes in the following order: 1 min of scenes with non-genital erotic content – with emotional involvement – 1 min of cunnilingus, 1 min of fellatio and 3 min of vaginal penetration. These criteria were applied to the six videos (SS1, SS2... SS6). The first minute of emotional involvement was included because according to Janssen, Carpenter, and Graham (2003) relating to the narrative structure (storyline) or the interaction between the actors might be important in predicting sexual arousal in women. Furthermore, the fragment that focus on vaginal penetration was the largest because according to Suschinsky, Bossio, and Chivers (2014) the women have significantly greater genital responses to the penetrative sex relative to the oral sex and also the women are less sensitive to sexual stimuli than men are, and that women would need stronger and longer stimuli to reach a comparable level of genital arousal (Laan & Janssen, 2007). The length of the stimuli were chosen having into account that 5 or 6 min is usually the time required to generate sexual arousal in women (e.g. Gerritsen et al., 2009; Laan, Everaerd, & Evers, 1995).

The three neutral stimuli used (NS1, NS2 and NS3) also had a duration of 6 min. These videos portrayed images of plants, flowers and rivers, accompanied by relaxing sounds. These videos were presented at the beginning of the sequence and between each sexual stimulus. The presentation of the NS after the end of each SS was intended to normalize the physiological response produced by the presentation of the sex videos.

## Experimental design

The SS were assigned to the first two groups of participants, in accordance with the score they obtained in the preliminary evaluation. Thus, group A was exposed to SS1, SS2 and SS3; and group B was exposed to SS4, SS5, SS6. Group C watched the set of videos SS1, SS2 and SS3, i.e. the set of videos which generated the most arousal-activation-pleasure after ranking them. Both groups watched the same NS.

Each participant watched a total of six stimuli (three SS and three NS) in a previously established sequential order (i.e. NS1-SSx-NS2-SSx-NS3-SSx). All sequences were previously balanced so that all SS would have the same opportunity of being watched the same number of times at each position. Thus, six types of sequences were created for each group, and two participants from each group watched one of those sequences (Vallejo-Medina, Soler, Gómez-Lugo, Saavedra-Roa, & Marchal-Bertrand, 2016).

## Responses evaluated

OSA was recorded by means of VPA. Subjective Sexual Arousal was evaluated by means of the MISSA scale. The items appeared on the monitor, after the presentation of each of the SS and NS. The items of the SAM-V and SAM-A appeared on the monitor every time the SS and NS finished.

Firstly, the analysis of physiological data entailed filtering any signal obtained from each participant's OSA to 1.0Hz in the Low and High Pass. Secondly, it was necessary to obtain the amplitude of each vaginal pulse (i.e. VPA). After this, we proceeded to calculate VPA averages of the baseline, the NS and the SS, as well as their respective standard deviation per participant. Means and standard deviations of each total SS were obtained and comparisons were made.

## Experimental session

Each of the participants was scheduled for an appointment at the laboratory, considering their available schedules, so as to not interfere with their daily activities. The equipment was thoroughly prepared before the arrival of the participants, and the vaginal photoplethysmograph was placed in the experimental room.

Before starting with the experimental session, the participants were shown around the laboratory. The SexLab KL consists of two rooms; a control room with computers that record the information of the measurements taken in the session. The second room is the experimental room, and features a desk with a monitor to present stimuli and scales, a comfortable chair and the vaginal photoplethysmograph. The rooms are separated by a door which can be manipulated only by the participant upon the beginning of the session; there are have appropriate – both natural and artificial – lighting conditions, and the room is isolated from any external noise that could potentially hamper the session. Temperature conditions were monitored during all sessions, seeking measures ranging from 20 °C and 25 °C. Communication between the two rooms was performed using an intercom located in the experimental area and a microphone in the control area.

When the participants entered the control room, they were informed as to the purpose of the study. In addition, the participants were explained the procedure and were asked to sign an

informed consent whereby their intention to participate and continue in the study is expressed. Once in the experimental room, the participants were given an explanation as to the correct way to place and remove the vaginal photoplethysmograph with a silicone replica of a vagina.

The experiment began when the participant claimed to be prepared. A period of 3 min was used in order to set the baseline. Subsequently, the participant was instructed to launch the task. At the end, the researchers provided feedback to each participant; it must be mentioned that no advice or clinical diagnosis were given. All the participants who were exposed to three stimuli did not have any sexual problems.

## Instructions

The instructions, the stimuli and the questionnaires appeared on the monitor, as programmed by the Open-Sesame software (Mathôt, Schreij, & Theeuwes, 2012). The first instruction was to watch the video clips; the second instruction was to answer the questions that appeared at the end of the videos.

## Ethical considerations

All protocols for disinfection and cleaning of equipment and instruments used were followed in pursuance of local, national and international standards of health institutions. After the evaluation of each of the participants, a high-level disinfection procedure was conducted on the vaginal photoplethysmograph.

The informed consent was kept throughout the study, respecting the privacy of the participants. Each participant was given a copy of the consent, after information was provided on the objectives and procedure. In addition, the participants were explained the procedure and any doubts were addressed; pursuant to the principle of autonomy, the participants were asked about their interest to continue to participate and sign the consent. The participants were also informed about the possibility to withdraw at any time they wished without any repercussions whatsoever.

The first 60s of – non-genital – erotic content of each SS were used for each participant to evaluate the possibility of withdrawing from the study, on account of the fact that the audiovisual material could cause discomfort in the participants. An independent ethics Institutional review board revised and approved the project associated to this work (2014-003 n° 95103141).

## Results

Table 1 shows the results of the four variables for the six SS. Said variables are: OSA (Vaginal Pulse Amplitude; VPA), subjective arousal response (MISSA), emotional activation (SAM-A) and level of pleasure to the stimulus (SAM V). A ranking was created (see Table 2) to select the SS that generate the highest levels of arousal-activation-pleasure by comparing the measurements obtained from groups A and B. All variables had the same weight when preparing the ranking. The videos that obtained the highest score in a variable were assigned six points; five points to the next, and so on. Stimuli 1, 2 and 3 generated the most arousal-activation-pleasure, and consequently were presented to subsample C.



**Table 1 – Descriptives for sexual stimuli.**

Stimuli	VPA M (SD)	Subjective Sexual Arousal M (SD)	SAM-A M (SD)	SAM-V M (SD)
SS1	0.0115 (0.008)	26.70 (3.71)	6.80 (0.91)	6.90 (1.52)
SS2	0.0094 (0.007)	27.00 (3.12)	7.30 (1.05)	6.40 (2.36)
SS3	0.0110 (0.008)	26.40 (3.92)	6.90 (1.00)	6.60 (1.57)
SS4	0.0091 (0.006)	26.58 (7.00)	6.08 (2.10)	6.92 (2.00)
SS5	0.0104 (0.005)	23.25 (6.78)	5.08 (1.83)	6.17 (2.12)
SS6	0.0099 (0.005)	25.16 (8.56)	6.08 (2.19)	6.83 (1.74)

Note. SS1, SS2...SS6 are sexual stimuli; M = media; SD = standard deviation; VPA = Vaginal Pulse Amplitude; SAM-A = Self-Assessment Manikin, Arousal; SAM-V = Self-Assessment Manikin, Valence; **In bold**: the stimuli selected.

**Table 2 – Final ranking in accordance with the variables taken into account.**

Sexual stimuli	Scores	Final score
SS1	6+5+4+5	20
SS2	2+6+6+2	16
SS3	5+3+5+3	16
SS4	1+4+3.5+6	14.5
SS5	4+1+2+1	8
SS6	3+2+3.5+4	12.5

Note: SS are sexual stimuli. Scores obtained in the ranking correspond to VPA, Subjective Sexual Arousal, SAM-A y SAM-V, respectively.

Upon identification of the three best SS, their validity and reliability were evaluated with a total of 23 data entries from the participants of group A and C. Thus, comparisons were made between the NS and SS of the OSA and the SAM-VPA was measured in millivolts (mV) – correspondingly. Table 3 shows the differences between the means for each variable stimulus (i.e. neutral and erotic stimuli).

Reliability of the SS obtained was calculated using Cronbach's alphas. Thus, stimuli obtained an alpha of 0.96 in VPA and an alpha of 0.79 for OSA.

## Discussion

Accurate evaluation and the use of validated instruments or tools is key insofar as there is a potential impact on clinical, legal or research-related decisions – in this case, the welfare of women. Sexual arousal is an important area of women's

sexual health which is widely studied by photoplethysmography (Brauer et al., 2006; Brotto & Yule, 2011; Dawson et al., 2015) as in the case of sexual victimization (Bird et al., 2014; Schacht et al., 2007). Thus, having stimuli that significantly increase the probability of generating sexual arousal in women without causing discomfort is important in order to conduct future studies with basic guarantees.

Validating a set of sexual stimuli in pursuance of the procedure proposed by Vallejo-Medina et al. (2016) not only reduces subjectivity of researchers when selecting SS, but also provides reliability in obtaining arousal response in heterosexual women within a controlled setting. In this case, the use of pooled stimuli (i.e. the three SS grouped together) is necessary. A total of three stimuli were obtained from an initial group of 21 stimuli which – at least in young and healthy women – significantly increase Objective Sexual Arousal, Subjective Sexual Arousal, and Emotional Arousal. In turn, these stimuli are as pleasant for these women as were the neutral stimuli presented. Similarly, the three stimuli finally selected in this study have proven consistent through various indicators. As a result, albeit the presentation of the three stimuli altogether does not in itself guarantee sexual arousal, it does significantly increase the chances that there is a positive, activating and affective reaction to the stimuli, and that the latter in turn increase Objective Sexual Arousal and Subjective Sexual Arousal. If any researcher would use the current stimuli, they could contact us and after paying for the whole videos we will be pleased to provide them a copy of the excerpts used in this study. Now, the field of female sexual evaluation has an updated, reliable and valid set of stimuli (Kukkonen, 2015).

This study is not without limitations. The main one is that participants are not randomly sampled from the population,

**Table 3 – Comparisons between measurements of NS vis-a-vis SS according to VPA, SAM-A and SAM-V.**

	Neutral M (SD)	Sexual M (SD)	Contrast
VPA S1	0.0075 (0.0048)	0.0128 (0.0090)	$t(22) = 4.64; p < .01; d = 0.73$
VPA S2	0.0087 (0.0048)	0.0123 (0.0095)	$t(22) = 3.03; p < .01; d = 0.47$
VPA S3	0.0091 (0.0049)	0.0126 (0.0085)	$t(22) = 3.79; p < .01; d = 0.50$
Mean VPA	0.0084 (0.0046)	0.0126 (0.0086)	$t(22) = 3.95; p < .01; d = 0.60$
SAM-A	2.95 (2.00)	6.33 (1.21)	$t(21) = 7.59; p < .01; d = 2.04$
SAM-V	6.55 (1.75)	6.33 (1.49)	$t(20) = 0.60; p = .13$

Note. M = mean; VPA = Vaginal Pulse Amplitude; SD = standard deviation; S = stimuli; SAM-A = Self-Assessment Manikin Arousal; SAM-V = Self-Assessment Manikin Valence.

limiting the generalizability of findings, for example the small sample size and the low mean age ( $M = 22.38$ ,  $SD = 2.52$ ). Besides this, the volunteers for sex research usually are more sexually experienced compare to the nonvolunteers and tend to have more positive sexual attitudes, less sexual inhibition, greater masturbatory experience (Morokoff, 1986), are more interested in sexually explicit materials and less worried about their sexual performance (Wolchik, Braver, & Jensen, 1985). Although this was a homogeneous group of young, healthy women – ergo suitable for the instrumental purpose of this study, reliability of the stimuli should be tested in other clinical samples and with different ages. In the future, another set of stimuli should be validated in homosexual women.

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