

# ‘Bout Time! Renegotiating the Body in Roller Derby

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**Abstract** In this study, we examined the relation of participation in an alternative sport (i.e., Roller Derby) in the U.S. to women’s body image, gender role and self-esteem. Roller Derby ( $n=64$ ) and non-Roller Derby ( $n=129$ ) women participated; the majority of the women (59.4 to 77.7 %) were from Texas though participants also were drawn from 14 other states across the U.S. All the women completed quantitative measures of body esteem, self-esteem, and gender characteristics; the athletes also provided qualitative responses to questions about their Roller Derby persona, self-esteem, dress, and motivation. In both groups, self-esteem was related to endorsing more instrumental characteristics as well as with greater satisfaction with sexual attractiveness, weight, and physical condition. The Roller Derby women’s endorsement of instrumental, as opposed to expressive, characteristics was related significantly to all three dimensions of body esteem. Roller Derby women endorsed more instrumental characteristics and were more satisfied with their weight and physical condition than the non-Roller Derby women; both groups reported generally high and similar levels of self-esteem and did not differ significantly on their satisfaction with their sexual attractiveness. Roller Derby challenges traditional hegemonic notions of masculinity/femininity and negates the idea of the female body as passive sex object. As a sport, Roller Derby may provide an alternate system of body evaluation based on

functionality, rather than appearance. This alternative perspective may empower women who traditionally are seen as overweight and unfeminine in today’s society, thereby instilling a more positive body image and instrumental view of themselves as athletes.

**Keywords** Roller derby · Body image · Gender role · Self-esteem

## Introduction

Sociocultural models, including objectification theory, have been used to explain the body image concerns and psychological distress women may experience in relation to socialization processes and the adoption of traditional gender roles (Cash 2002; Fredrickson and Roberts 1997; Moradi 2010; Moradi and Huang 2008). Objectification theory posits that women and girls often adopt an observer’s perspective of their own body (commonly a sexually objectified view) that is learned through gender socialization and being subjected to sexually objectifying experiences, such as men staring at, or commenting on, their bodies in sexually provocative or demeaning ways (Fredrickson and Roberts 1997; Moradi 2010). Societal appearance-ideals, and expectations about gendered behaviors, also are transmitted via sociocultural channels, such as the media, peers, and family, and it is over time and through consistent exposure to such gender-stereotypical environments that women internalize these ideals as reference points for self-evaluation and learn about the characteristics, roles, and behaviors that are associated with being *feminine* (Cash 2002; Striegel-Moore and Bulik 2007).

Self-objectification is characterized by body surveillance or habitual monitoring of one’s external appearance, which often leads women to feel ashamed of their bodies (because they do

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not measure up to societal body-ideals) and to experience various forms of psychological distress, including anxiety, depression, and low self-esteem (Fredrickson and Roberts 1997; Moradi and Huang 2008; Moradi 2010; Striegel-Moore and Bulik 2007). Further, the internalization of stereotypical gender characteristics and appearance ideals that result from these socialization and objectification experiences may lead women to believe that their attractiveness (and sexual desirability) is contingent upon their appearing dependent, vulnerable, weak, and thin. This view of self only reinforces patriarchal power structures that disempower women in relation to men whose attractiveness is based on being perceived as independent, strong, muscular and powerful. Thus, it is through prolonged exposure to such cultural messages within traditional environments that notions and expectations of *femininity* and *masculinity* are defined and tied to specific physical attributes (Cash 2002).

When girls and women are embedded within social environments that focus on their bodies' functionality (as opposed to simply their appearance), support body types that do not adhere to traditional societal ideals, and promote a broad array of stereotypically *masculine* characteristics as acceptable (even desirable), they may develop broader and healthier perspectives on themselves, their bodies, and their gender roles. Although sport in general may help women exalt their bodies' strength, power, and functionality, many traditional sports (e.g., gymnastics, tennis, volleyball), and media representations of athletes from such sports (Ginsberg and Gray 2006), create environments that undermine female athletes, subjecting them to unique pressures about weight, appearance and the need to not be too unfeminine or too like men (Krane et al. 2004,  $n=21$ , United States) and increasing their risk of being body dissatisfied and engaging in dietary restraint (Reel et al. 2013,  $n=414$ , United States). However, sports such as Roller Derby embody positive aspects of the athletic environment yet extend beyond traditional sport by embracing the nongendered, anti-authoritarian, antihierarchical ethos of alternative cultures, such as the Riot Grrrl Punk Movement that emanated from Third Wave Difference Feminism (Storms 2008). In Roller Derby, women can discover their physical limits, be valued for their bodies' functionality rather than its adherence to traditional feminine appearance ideals, be supported and embraced by other like-minded (and bodied) women, and adopt more instrumental (i.e., *masculine*) characteristics without the threat of being stigmatized. Thus, Roller Derby in the U.S. offers the opportunity to study, via a mixed methods design, how an aggressively-based sport culture that embraces nontraditional gender roles and characteristics may be associated with women experiencing fewer body image concerns and higher levels of self-esteem, and having a broader perspective of gender such that they endorse higher levels of instrumental characteristics than those who are not immersed in this alternative sport environment.

## A Background of Roller Derby

Roller Derby began in Chicago, IL during the 1930s, and by the 1940s female professional skaters dominated the sport (Mabe 2007). Although reaching its peak of popularity in the 1960s and 1970s, Roller Derby has experienced a revival in the 2000s due to Hollywood movies, such as *Whip It*, and the sense of community and support it provides to women who have been marginalized because of their larger than average sized bodies (Donahoe 2010; Krausch 2000,  $n=100$ , United States; Mabry 2010). This renewal of Roller Derby actually began as a form of nostalgia in the southern United States under the guise of *Rollerjam* (Mabe 2007). Although most popular within the U.S., and a part of Team USA Roller Sports, there are over 1500 Roller Derby leagues in more than 40 countries (USA Roller Sports, n.d.).

Roller Derby is a contact sport comprised of mostly White women aged 18 to 44 years (Women's Flat Track Derby [WFTDA] 2012), where the average (and preferred) body is quite large and strong; a body that Krausch (2000, p. 2) described as "full-figured." This body challenges society's notion of the ideal female form by putting a high value on a large, muscular and strong physique. Such a body is an asset for *booty blocking*, slowing, and even knocking down competitors who are behind (and chasing) the jammer (i.e., generally the smallest woman on the team, she works her way through the pack of defenders to lap the track to score points; Carlson 2010,  $n=31$ , United States). Blockers make up the bulk of a Derby team, and are the "heavy hitters" who generally are larger and stronger than the jammer (Mabe 2007, p. 128). The blockers use shoulder- and hip- checks to clear the path for the jammer as she moves through the pack to pass members of the opposing team. At any given time during a bout, each team has only one jammer on the track.

In general society where thinness and a stereotypical feminine appearance is idolized, the Roller Derby environment encourages women to accept, and even embrace, their larger than average-sized bodies and to adopt stereotypical *masculine* characteristics (e.g., strong, independent; Carlson 2010,  $n=31$ , United States; Finley 2010; Krausch 2000; Pavlidis 2012; Sewall 2010). With the appreciation of a larger body and the celebration of its functionality on the track, skaters become more comfortable with their physiques, "without feeling like it makes them less womanly" (Krausch 2000, p. 9). This body acceptance, which runs counter to how female athletes in more traditional sports experience and view their muscular bodies (Krane et al. 2004,  $n=21$ , United States), not only challenges society's body-ideals, but also affects women's self-perception and worth in a culture that equates thinness with beauty and teaches women to always be unhappy with their bodies. Ironically, in Roller Derby, calling a Blocker a *big girl* is a compliment because it confirms her abilities as an athlete (Joulwan 2007).

## Sport, Roller Derby and the Renegotiation of Gender

In the U.S., from the beginning of the 20th century, women were frequently excluded from sports because it was believed that strenuous activity could damage female reproduction; through the 1930s female athletes often were viewed as masculine and thus unattractive, which led to an association in the 1950s between female sport participation and lesbianism (Cahn 1994). Thus, in the U.S., sport historically has been viewed as a masculine endeavor (Cahn 1994; History of Title IX 2014). As sport sociologist Coakley (1990) has noted "... through history, men have controlled sport, used it for their purposes, and shaped it to fit their abilities" (p. 177). Further, women's sports historically have been trivialized and female athletes sexualized and subjected to homophobic reactions (and the need to prove their heterosexuality; Coakley 1990). Research has documented how such experiences can make female athletes feel uncomfortable about their appearance and their bodies even when competing in their sports at a high level of performance (e.g., Krane et al. 2004,  $n=21$ , United States; Steinfeldt et al. 2013,  $n=9$ , United States). For example, in their systematic review of athlete body image studies, Varnes et al. (2013) found that, over the last decade, female athletes in the U.S. and Canada who competed in more traditional sports (e.g., volleyball, gymnastics) have been increasingly sexualized and have succumbed to the belief that they need to be thin and attractive as well as athletic.

Storms (2008) has suggested that Roller Derby participants, like female athletes in general, have been socially stigmatized, particularly because they demonstrate the conventional male characteristics of power, toughness and aggressiveness that are the antithesis of societal feminine ideals. Roller Derby is intentionally aggressive and allows athletes to reconstruct femininity and/or practice "gender maneuvering" (i.e., the breaking of gender rules within a particular social setting; Finley 2010, p. 362). It provides an alternate system of physique evaluation based on how bodies move and function, rather than on women's appearance, body size and shape, and physical attractiveness to others; such a system may empower women who do not fit with societal body and appearance ideals. Although traditionally feminine sports (e.g., figure skating, synchronized swimming) have emphasized the importance of the aesthetic, Roller Derby has embraced a competitiveness and fierceness that typically has been found only in masculine full-contact sports, such as football or rugby (Cahn 1994).

In Roller Derby there is also an established punk/rockabilly dress code (the bout dress) that satirizes and challenges the boundaries of traditional femininity through the use of short skirts, fishnets, bras and panties, tattoos, fake blood, flaunted injuries (e.g., bruises), and aggressive behavior. Through the creation of on-track personas, the skaters renegotiate the meaning of stereotypically sexualized apparel items by

putting a violent or nontraditional sexual spin on them, such as wearing deliberately ripped fishnet stockings or panties emblazoned with antagonistic and/or sexualized messages. Roller Derby names and personas satirize traditional feminine characteristics by implying raw violence and aggression to present themselves as "confusingly feminine" (Carlson 2010, p. 433). Typical personas are caricatures of powerful women (e.g., the super-heroine, the seductress pin-up, the physical dominatrix), allowing Roller Derby participants to approximate their ideal (or fantasy) self (Joulwan 2007). The Roller Derby name is an extension of the persona created through a satirical combination of femininity, sex and violence. Thus, Roller Derby creates an environment in which female athletes are valued for what their bodies can do and are empowered to be themselves and to mock traditional feminine gender roles, behaviors and characteristics; it is an environment where strong, heavy, and sometimes more muscular (i.e., less *feminine*) bodies are normative and where women can be *masculine* without fear of being stigmatized and belittled.

According to social role theory (Eagly and Wood 2012), gender is socially-constructed as boys and girls adopt prescribed roles, attitudes and traits through the socialization they experience within their specific culture. Through these socialization experiences, girls and women are exposed to messages about what are acceptable gendered behaviors, roles, beliefs, and characteristics and ultimately learn that to be *feminine* means being expressively oriented in their identity and in their interactions with others. That is, a socially desirable woman displays the stereotypical ideals of female beauty, emotionality, passivity, and dependence on others, to name a few characteristics (Eagly and Wood 2012; Hawkins et al. 2004; Holstrom 2004; Prentice and Carranza 2002). Women who possess instrumental traits (characteristics, such as independence and assertiveness, which generally are associated with *masculinity*), but less so expressive ones, generally report high levels of psychological well-being (e.g., high self-esteem; see Stake and Eisele 2011 for a review). For example, in a longitudinal study that followed 447 U.S. male and female adolescents from age 12 years into their young adulthood (age 25 years), Barrett and White (2002) found that it was high-level increases in masculinity, but not femininity, which predicted decreases in depressive symptoms over this 16 years timeframe. Sports, particularly alternative ones such as Roller Derby, provide young girls and women the opportunity to develop instrumental characteristics (e.g., aggressiveness, athleticism, competitiveness, self-reliance) that may help them feel more positively about themselves and their bodies. In support of this idea, Greenleaf, Boyer and Petrie (2009,  $n=260$ , United States) found that higher levels of involvement in high school sports was related to increases in instrumentality and greater physical competence among female undergraduates while in college.

## Body Image, Self-Esteem, and Roller Derby

Body image is considered a multidimensional construct and thought to represent individuals' perceptions of their own physical appearance that are created through self-observation and by noting the reactions of others. Within each country and cultural group, there are visual, olfactory, and vocal cues that define attractiveness and beauty for each gender. And, in each culture, when individuals believe they are discrepant from beauty/appearance ideals, they often try to compensate through a variety of appearance-improving behaviors that they hope will relieve their negative feelings (e.g., depression, shame), boost their esteem, and improve their satisfaction with how they look (Hawkins et al. 2004,  $n=124$ , United States; Moor 2009,  $n=244$ , Israel). In the extreme, such behaviors may include excessive exercising, extreme dieting, purchasing clothing and cosmetics, ingesting body-changing supplements, and undergoing cosmetic surgery.

Women's appreciation of their body is mostly influenced by how they believe important others (e.g., romantic partners, friends) view them (Augustus-Horvath and Tylka 2011,  $n=801$ , United States), and heterosexual women in the U.S. feel particularly compelled to pursue cultural beauty ideals to be perceived as attractive to potential partners. According to Tiggemann and Stevens (1999,  $n=180$ , Australia), women who subscribed to nontraditional views on women's roles were more resistant to the cultural messages that promoted thinness and emphasized physical appearance; women with feminist attitudes also expressed fewer weight concerns. Relatedly, U.S. college women who conformed to traditional gender roles of submissiveness and fertility placed more emphasis on, and were more concerned with, their sexual attractiveness than those who were less traditional (Wade 2000,  $n=225$ , United States).

Self-esteem, defined as an overarching sense of ones' self-worth, captures the attitudes, beliefs, and perceived competencies individuals hold about themselves (e.g., McConnell 2011). Researchers have found that self-esteem is comprised of domain-specific self-concepts, such as body esteem, which are multidimensional, hierarchically organized and feed into a general sense of overall well-being (e.g., Cole et al. 2001,  $n=1920$ , United States). Further, research with female undergraduates has demonstrated a positive association between body satisfaction and self-esteem (Greenleaf et al. 2009,  $n=260$ , United States), suggesting that when women evaluate their physical appearance highly they are likely to think positively about themselves in general. Thus, environments that support a positive body image for women, such as Roller Derby, also would be expected to promote higher levels of general self-esteem.

Roller Derby represents what Harrison and Fredrickson (2003,  $n=426$ , United States) defined as a *nonlean* sport environment where pressures about dieting, appearance, and

body size/shape are minimal, and weight, physical size, and a large (muscular) physique are valued and thought to contribute directly to athletic success. In contrast, lean sport environments emphasize a thin physique, where a lower weight and/or more feminine appearance are viewed as essential for success (e.g., cross-country, gymnastics, figure skating). Sport psychology researchers (e.g., Petrie and Greenleaf 2012; Thompson and Sherman 2010) have suggested that *lean* sport environments may increase female athletes' risk of experiencing body image concerns and general psychological distress (e.g., low self-esteem). For example, in comparing female collegiate athletes from lean and nonlean sports, Petrie (1996,  $n=480$ , United States) found that even though the two groups of athletes were similar in their body composition (i.e., body mass index), the lean sport athletes were more weight preoccupied and concerned about dieting than those in nonlean sports; the nonlean sport athletes also reported feeling more adequate, secure, and worthwhile than did the female nonathletes. Further, among college women who reported a history of organized sport participation, higher levels of instrumentality (defined in part by the masculinity subscale of the Personal Attributes Questionnaire, Spence and Helmreich 1978) were related to more satisfaction with body size and shape and greater overall psychological well-being (Greenleaf et al. 2009,  $n=260$ , United States).

## Purpose and Hypotheses

Roller Derby is thought to provide a sociocultural environment where women can construct new attitudes toward gender and their bodies that lead them to be more accepting of themselves and others and not tied to traditional views of femininity (Carlson 2010; Finley 2010; Joulwan 2007; Stites 2008; Storms 2008). Because body image and psychological well-being are global issues for women that transcend ethnicity and cultural group membership due to the diffusion and acceptance of U.S. body, beauty, and gender ideals that are propagated through international media outlets (e.g., TV, social media; Ferguson 2013,  $n=204$ ; Grabe et al. 2008,  $n=77$ ; Holstrom 2004,  $n=54$ ), understanding the potential effects of being embedded in such environments is necessary for improving women's psychological health and well-being.

Thus, we compared Roller Derby and non-Roller Derby participants along the dimensions of body image, self-esteem, and the adoption of traditional gender role characteristics. Consistent with sociocultural perspectives and Objectification Theory (e.g., Moradi 2010), social role theory (Eagly and Wood 2012), and existing research (e.g., Greenleaf et al. 2009,  $n=260$ , United States), we hypothesized:

**Hypothesis 1** Across both groups of women (Roller Derby and non-Roller Derby), the endorsement of instrumental (but not expressive)

characteristics would be related to higher levels of body esteem (across all three dimensions) and greater self-esteem.

**Hypothesis 2** Roller Derby women would score higher on measures of instrumentality, self-esteem, and body esteem (across all three dimensions), but lower in terms of their endorsement of expressive characteristics than non-Roller Derby women.

**Hypothesis 3** In terms of our qualitative data, the Roller Derby women would report creating a persona that was consistent with typical *masculine* (instrumental) or athletic characteristics, dressing in a manner that reflected their athleticism (as opposed to other perspectives, such as sexualization), participating primarily for reasons of health and athleticism, and elevating their esteem through their involvement.

## Method

### Participants

Although 81 Roller Derby women initially participated, responses from 17 were deemed unusable due to significant missing data (i.e., not completing two or more of the measures); these participants were drawn from six different states in the U.S. (59.4 % were from Texas). The 129 non-Roller Derby women who comprised the control group were drawn from a larger sample of 239 participants who were solicited through a university research website and snowball sampling via social media (e.g., Facebook). These women did not participate in Roller Derby nor in sports at the collegiate level and were drawn from 14 different states in the U.S. (77.7 % were from Texas). We purposefully oversampled the non-Roller Derby women so we could ensure a final sample that would match the Roller Derby women on the demographic variables; we used the SPSS (v. 20) select cases procedure to randomly choose the non-Roller Derby women who would be included in the control sample. See Table 1 for details on the samples' demographics (Chi-square comparisons indicate that the two groups were comparable on all demographics).

### Measures

#### Gender Role Characteristics

The 24-item Personal Attributes Questionnaire (PAQ; Spence et al. 1974) assesses participants' gender characteristics along three dimensions- expressivity (*femininity*), instrumentality (*masculinity*), and androgyny (*masculinity-femininity*). For

**Table 1** Demographics for the Roller Derby ( $n=64$ ) and non-Roller Derby ( $n=129$ ) participants

Variable	Roller Derby	non-Roller Derby	$\chi^2$
Age (years)			
18 to 24	7.8 % ( $n=5$ )	7.8 % ( $n=10$ )	0.034
25 to 34	56.2 % ( $n=36$ )	55.0 % ( $n=71$ )	
35 to 46	31.2 % ( $n=20$ )	32.6 % ( $n=42$ )	
47 to 65	4.7 % ( $n=3$ )	4.7 % ( $n=6$ )	
Race/ethnicity			
White/NonHispanic	92.2 % ( $n=59$ )	96.9 % ( $n=125$ )	2.14
White/Hispanic	7.8 % ( $n=5$ )	3.1 % ( $n=4$ )	
Sexual Orientation			
Heterosexual	84.4 % ( $n=54$ )	79.8 % ( $n=103$ )	1.32
Lesbian	3.1 % ( $n=2$ )	3.9 % ( $n=5$ )	
Bisexual	12.5 % ( $n=8$ )	14.7 % ( $n=19$ )	
Not sure	0.0 % ( $n=0$ )	1.6 % ( $n=2$ )	
Marital Status			
Single	29.7 % ( $n=19$ )	34.1 % ( $n=44$ )	1.47
Married	46.9 % ( $n=30$ )	46.5 % ( $n=60$ )	
Domestic Partnership	10.9 % ( $n=7$ )	10.1 % ( $n=13$ )	
Divorced	12.5 % ( $n=8$ )	8.5 % ( $n=11$ )	
Widowed	0.0 % ( $n=0$ )	0.8 % ( $n=1$ )	
Educational Level			
High School	3.1 % ( $n=2$ )	1.6 % ( $n=2$ )	1.17
Some College	18.8 % ( $n=12$ )	17.1 % ( $n=22$ )	
Bachelor's Degree	32.8 % ( $n=21$ )	37.2 % ( $n=48$ )	
Master's Degree	29.7 % ( $n=19$ )	28.7 % ( $n=37$ )	
Ph.D./Other Doc.	3.1 % ( $n=2$ )	4.7 % ( $n=6$ )	
Associate's Degree	12.5 % ( $n=8$ )	10.9 % ( $n=14$ )	

Degrees of Freedom for the Chi-square analyses are 3 (Age), 3 (Sexual Orientation), 4 (Marital Status), 5 (Educational Level), and 1 (Race/ethnicity). All comparisons were non-significant ( $p$ 's > .14)

each characteristic, the women rated themselves by associating more closely with one end of the characteristic or the other (e.g., *not at all aggressive* or *very aggressive*). The total score for each dimension is the mean of the respective items and can range from 0 (*low on that dimension*) to 4 (*high on that dimension*). Among high school, college and adult women (Helmreich et al. 1981), Cronbach alphas have ranged from .73 to .79 (expressiveness), .71 to .77 (instrumentality), and .61 to .65 (androgyny); alphas from the current study were .74 (expressiveness), .74 (instrumentality), and .63 (androgyny). The PAQ is considered a valid instrument for assessing gender role characteristics (Spence and Helmreich 1978; Helmreich et al. 1981), and has been used extensively with women (e.g., Johnson and Petrie 1995,  $n=178$ , United States).

#### Body Image

Twenty-six items from the Body Esteem scale (Franzoi 1994; Franzoi and Shields 1984) were used to assess body image

esteem along three dimensions: sexual attractiveness (satisfaction with facial attractiveness and sexuality), weight concerns (satisfaction with weight as evidenced through attitudes toward specific body parts, such as thighs, stomach, and butt), and physical condition (satisfaction with stamina, energy, strength, and agility). For each item, such as *chest/breasts*, *legs*, and *muscular strength*, the women responded from 1 (*have strong negative feelings*) to 5 (*have strong positive feelings*). Total score for each dimension is the mean of the respective items and can range from 1 (*low esteem/satisfaction*) to 5 (*high esteem/satisfaction*). Franzoi and Shields (1984) have reported Cronbach's alphas of .78 (sexual attractiveness), .87 (weight concerns), and .82 (physical condition) among female undergraduates; alphas from the current study were .82 (sexual attractiveness), .90 (weight concerns), and .86 (physical condition). Franzoi and colleagues (Franzoi 1994; Franzoi and Herzog 1986; Franzoi and Shields 1984) have established the validity of each dimension of body esteem.

### Self-Esteem

The 10-item Rosenberg Self-Esteem Scale (RSE; Rosenberg 1965) assesses personal judgments of overall worth. On items such as *I am satisfied with myself*, the women rated their agreement from 1 (*low*) to 5 (*high*). Total scores range from 10 (*low esteem*) to 50 (*high esteem*). Cronbach's alphas have ranged from .72 to .88 (Gray-Little et al. 1997); alpha from the current study was .89. Extensive evidence of the scale's construct validity has been provided (Robinson and Shaver 1973).

### Demographics

The participants provided information on their involvement with Roller Derby (i.e., lifestyle, hobby, other, or no involvement), their race/ethnicity, age, educational level, marital status, and sexual orientation. Roller Derby participants also responded to four open-ended questions: (a) What is the role of Roller Derby in your life? (b) How would you best describe your Roller Derby persona? (c) How does your choice of bout dress (clothing worn to Roller Derby competitions) reflect this persona? (d) What was your motivation for joining a Roller Derby team?

### Procedure

Following approval from the researchers' Institutional Review Board, we conducted a Google search for Roller Derby leagues that revealed more than 100 active leagues in the U.S.; nine in Texas were contacted and informed about the survey. The manager of the leagues distributed the link for the survey to the teams, asking the athletes to participate in an anonymous study on the gender roles and body image of female Roller Derby athletes. Non-Roller Derby participants

were solicited from undergraduate and graduate courses in merchandising and psychology and through colleagues and friends of the researchers who posted the survey link on social media outlets (e.g., Facebook); these postings solicited the involvement of women ages 18 to 65 years who were not members of Roller Derby (or collegiate athletic) teams to participate in a study of gender roles and body image. These procedures allowed for a large, diverse community-based sample of women that could be matched to the Roller Derby participants. The non-Roller Derby participants anonymously completed the same web-based survey except for the qualitative questions. All participants provided consent prior to beginning the survey questionnaire.

### Data Coding

The first author acted as the primary coder in this study. After examining the data, the initial coding framework was developed through an inductive process (Grounded Theory), thereby creating new and original categories rather than relying on already existing coding schemes (Corbin and Strauss 1990). Phrases and terms that summarized participant responses for each open-ended question were then compiled. The summary phrases and terms were then reduced in a second phase of coding whereby duplications were crossed out and categories collapsed. These resulting categories were then compared with descriptions of each issue from existing literature on Roller Derby, which the first author had compiled prior to coding. For example, the literature on Roller Derby often describes personas as hyper-feminine, comical, punk, or masculine (Carlson 2010; Finley 2010; Joulwan 2007; Pavlidis 2012; Storms 2008). A third phase of coding reduction was completed when the first author combined the codes created from open coding with the terms and phrases used in the literature, thereby resulting in a final coding scheme (see Table 2). Sample quotes for each coding category are presented in Table 2.

A second year graduate student who had assisted in this project was given the responses from the open-ended questions and final coding scheme after a 2 h training session on coding. The first author clarified the categories and the graduate student then independently coded the participants' responses. The reliability of the coding process was calculated for this study using Cohen's Kappa. Two of the 27 coded items were of moderate reliability ( $\kappa=0.41-0.60$ ). The inter-coder reliability for the remaining 25 coded items ranged from *good/substantial agreement* ( $\kappa=0.61-0.80$ ) to *very good/almost perfect agreement* ( $\kappa=0.81-1.00$ ; Altman 1991; Landis and Koch 1977). The final reliability measures for all items ranged between  $\kappa=0.55$  and  $\kappa=1.00$ . Specific inter-coder reliabilities along with the frequencies for each coded item are reported in Table 5.

**Table 2** Coding categories, descriptions, and sample codes

Category	Thematic category	Definition and/or key terms for coding (examples)
Q1. How would you best describe your roller derby persona?		
P1	No persona	The participant states that they have no Roller Derby persona (e.g., “I don’t have a ‘persona’”)
P2	Feminine/expressive traits	Campy, sassy, sexy, flirty, femme fatale (e.g., “Sassy, flirty, and outgoing”)
P3	Masculine/instrumental traits	Mean, tough, strong, aggressive, fierce, intimidating, competitive (e.g., “Mean and most feared. I really enjoy making girls cry”)
P4	Morbid and dark	Gothic, frightening, cadaverous, macabre, dead, bloody (e.g., “I am a Muertas Locas girl. Therefore I am glittery and dead”)
P5	Athletic	The participant describes their persona a participant in a sport. (e.g., “[S]erious athlete”)
P6	Other	The participant provides a response that does not fit into one of the categories above. (e.g., “Nerdy- it’s a reference to a Harry Potter character”)
P7	Not answered	The participant did not provide a response.
Q2. How does your choice of bout dress reflect your persona?		
D1	Bad girl	Dress reflects aggressiveness and power, confidence, sexual assertiveness, S&M, rebelliousness. (e.g., “My team is The Holy Rollers- the baddest bullies in the Sacred Heart Schoolyard, so we dress like Catholic schoolgirls”)
D2	Feminine	(e.g., “I like to dress feminine”)
D3	Athletic	Dress is described as utilitarian for participation in a sport or as a uniform. (e.g., “My bout dress is comfortable and athletics”)
D4	Body focus	Dress is described as showing off the body or celebrating injuries. (e.g., “To show off the body roller derby has given me”)
D5	Other	The participant provides a response that does not fit into one of the categories above. (e.g., “I wear what I want based on how I feel that day”)
D6	Not answered	The participant did not provide a response.
Q3. What was your motivation for joining a Roller Derby Team?		
M1	Athleticism, exercise, fitness	The participant joined in order to lose weight, tone the body, or participate in a sport. (e.g., “To stay in shape and challenge myself physically”)
M2	Socialization, friendship	The participant joined in order to meet other people or to belong to a social group. (e.g., “I wanted to find a group of women who were willing to be daring and had formed a community”)
M3	Outlet for competitiveness & aggression	The participant views Roller Derby as a socially acceptable venue for releasing aggression on other people and being competitive. (e.g., “When I saw my first bout I knew that skating plus competitive aggression were the perfect combination for me”)
M4	Fun	Participation is motivated by the desire for entertainment. (e.g., “It’s super duper fun”)
M5	Personal challenge	The participant says that they joined in order to try something new or different. (e.g., “I wanted to do something different”)
M6	Self-esteem and empowerment	The participant says that they chose to participate in Roller Derby because it is empowering and to enhance their self-concept. (e.g., “It’s so empowering”)
M7	Other	The participant provides a response that does not fit into one of the categories above.
M8	Not answered	The participant did not provide a response.
Q4. Has your self-concept/self-esteem changed since participating Roller Derby?		
S1	Improvement	The participant states that their self-esteem has improved. (e.g., “Absolutely. Roller Derby has given me so much confidence and self-esteem”)
S2	Has worsened	The participant states that their self-esteem has been negatively affected since participating in Roller Derby. (e.g., “Roller Derby has given me another area in my life in which I feel I am underachieving...”)
S3	No change	The participant states that their self-esteem has not improved. (e.g., “Not really”)
S4	Change in fitness-not self-esteem	The participant notes a change in the self that is not related to self-esteem, but rather to physicality, (e.g., fitness). (e.g., “Yes, in that my fitness and health have improved”)
S5	Other	The participant provides a response that does not fit into one of the categories above.
S6	Not answered	The participant did not provide a response.

### Roller Derby Persona Coding

The first open-ended question asked the participants, “How would you best describe your Roller Derby persona?” The initial inductive categories were compared to descriptors of Roller Derby personas in existing literature (Carlson 2010; Finley 2010; Joulwan 2007; Murray 2012), as well as to descriptors of masculinity (instrumentality) and femininity (expressiveness) traits in the PAQ (Spence et al. 1974). For example, the response “I am very competitive, controlling, and aggressive” was coded as *masculine* because *competitive* and *aggressive* appear as *masculine* items in the sex role instrument. Other participants used adjectives such as *sassy* and *sexy* to describe their personas. These sorts of responses were coded as *feminine* because they were often used in existing literature to describe the emphasized femininity of Roller Derby (Carlson 2010; Finley 2010; Joulwan 2007; Murray 2012). After final reduction, the first coder created seven possible classifications for the participants’ responses (*no persona*, *feminine*, *masculine*, *morbid & dark*, *athletic*, *other*, and *no answer*).

### Dress Choice

The second open-ended questions asked the participants, “How does your choice of bout dress reflect your persona?” Categories included, *bad girl*, *feminine*, *athletic*, *body focus*, *other*, and *no answer*. Initial codes again were derived from inductive coding for this particular category and then compared to dress and gender descriptions in existing literature in order to establish the final coding scheme (Carlson 2010; Finley 2010; Joulwan 2007; Parnavelas 2012; Pavlidis 2012; Pearson 2010; Sewall 2010; Spence et al. 1974; Stites 2008). For example, the *bad girl* category was based on descriptions of sexual assertiveness, misfit behavior, power, and aggressiveness, which have been used to emphasize the *manly* or *unladylike* behaviors of Roller Derby participants (Carlson 2010; Finley 2010; Joulwan 2007; Pavlidis 2012; Pearson 2010; Sewall 2010; Stites 2008). The *feminine* characterization was based on the *feminine/expressive* items from the PAQ (Spence et al. 1974). The *body focus* category was developed based on women’s responses that emphasized showing off or displaying their bodies.

### Motivation

The third open-ended question asked the participants, “What was your motivation for joining a Roller Derby team?” Based on the existing literature (Carlson 2010; Parnavelas 2012; Pavlidis 2012; Pearson 2010; Sewall 2010; Stites 2008; Storms 2008), the following categories were established for coding: *athleticism/exercise/fitness*, *socialization/ friendship*, *competitiveness/aggression*, *fun*, *personal challenge*, *self-*

*esteem/empowerment*, *other*, and *no answer*. For example, the *athleticism/exercise/fitness* category was derived from responses that focused on the importance of being physically active and exercising. Some participants made direct references to the competitive nature of Roller Derby and how they sought an outlet for competitive behaviors.

### Self-Esteem

The codes for “Has your self-concept and/or self-esteem changed since participating in Roller Derby?” were based solely on intuitive deduction. The first author reviewed the responses and developed the following categories: *improvement*, *has worsened*, *no change*, *change in fitness-not self-esteem*, *other*, and *not answered*.

### Data Overview

The 193 surveys from the Roller Derby and non-Roller Derby women that were included in the final sample were screened for missing values using the Missing Values Analysis (MVA) module in SPSS (v. 20), and found to be missing completely at random; missing values represented fewer than 1.8 % of all cases across any specific item. Missing data were replaced using the expectation maximization (EM) imputation procedure (Schlomer et al. 2010). Total scores were computed and data were checked for any violations of distributional normality; skewness and kurtosis were within acceptable ranges and there were no significant outliers (Tabachnick and Fidell 2013).

## Results

### Hypothesis 1

To address our first hypothesis, which was that the endorsement of instrumental (but not expressive) characteristics would be related to higher levels of body esteem (across all three dimensions) and greater self-esteem, we computed Pearson product–moment correlations among all the dependent measures separately for Roller Derby and non-Roller Derby participants. The correlations among the measures are presented in Table 3 separated by group. Across both groups, endorsing more instrumental characteristics was related to higher levels of self-esteem, which supported our prediction. For the Roller Derby women, the endorsement of instrumental characteristics was related significantly and positively to all three dimensions of body image esteem with the exception of sexual attractiveness, which was partially consistent with our hypothesis. For the non-Roller Derby women, endorsement of instrumental characteristics was associated primarily with being more satisfied with



**Table 3** Correlations for the continuous variables for the Roller Derby ( $n=64$ ) and non-Roller Derby ( $n=129$ ) participants

Variables	1	2	3	4	5	6	7
1. PAQ-M	–	-.19	.56	.22	.11	.39	.40
2. PAQ-F	.24	–	-.44	.14	-.03	-.16	-.04
3. PAQ-MF	.52	-.19	–	.21	.10	.25	.36
4. BES-Sex Att.	.17	.07	.35	–	.31	.29	.33
5. BES-Weight	.45	-.07	.50	.40	–	.47	.37
6. BES-Physical	.39	-.20	.48	.31	.80	–	.48
7. Self-Esteem	.58	.09	.51	.33	.57	.47	–

PAQ Personal Attributes Questionnaire, M Masculinity (also referred to as Instrumentality), F Femininity (also referred to as Expressiveness), MF Masculinity-Femininity (also referred to as Androgyny); BES Body Esteem Scale-Sexual Attractiveness, Weight Satisfaction, and Physical Condition; Self-Esteem (Rosenberg self-esteem scale)

Correlations for roller derby participants are presented below the diagonal (correlations  $>.31$  are significant at  $p<.01$ ); correlations for women who did not participate in roller derby are presented above the diagonal (correlations  $>0.22$  are significant at  $p<.01$ )

their physical condition, and secondarily with their sexual attractiveness; these findings partially supported our prediction. As hypothesized, expressive characteristics were unrelated to any dimension of body esteem and to the measure of general self-esteem in both groups of women (Table 3).

### Hypothesis 2

For our second hypothesis, which was that Roller Derby women would score higher on measures of instrumentality, self-esteem, and body esteem (across all three dimensions), but lower in terms of their endorsement of expressive characteristics, we compared the two groups of women through a series of univariate and multivariate ANOVAs, examining each set of dependent variables (e.g., body esteem scales) separately. For the gender role characteristics, the MANOVA was significant, Wilks' Lambda = .961,  $F(3, 189) = 2.59$ ,  $p < .05$ , partial  $\eta^2 = .039$ . As predicted, Roller Derby women reported greater endorsement of instrumental,  $F(1, 191) = 4.73$ ,  $p = .031$ , partial  $\eta^2 = .024$ , and androgynous,  $F(1, 191) = 7.09$ ,  $p = .008$ , partial  $\eta^2 = .036$ , characteristics than did the non-Roller Derby women. Contrary to our hypothesis, the two groups did not differ significantly in their endorsement of expressive characteristics,  $F(1, 191) = 0.75$ ,  $p = .388$ , partial  $\eta^2 = .004$ .

For the body esteem scales – sexual attraction, weight satisfaction, and physical condition – the MANOVA was significant, Wilks' Lambda = .910,  $F(3, 189) = 6.24$ ,  $p < .0001$ , partial  $\eta^2 = .090$ . As hypothesized, Roller Derby participants were more satisfied with their weight,  $F(1, 191) = 11.07$ ,  $p = .001$ , partial  $\eta^2 = .055$ , and more satisfied with their physical

condition,  $F(1, 191) = 14.86$ ,  $p = .0001$ , partial  $\eta^2 = .072$ , than the non-Roller Derby women. Contrary to our prediction, the two groups of women did not differ significantly in terms of their satisfaction with their sexual attractiveness,  $F(1, 191) = 0.00$ ,  $p = .995$ , partial  $\eta^2 = .000$ .

Regarding self-esteem, the ANOVA was not significant,  $F(1, 191) = 0.71$ ,  $p = .402$ , partial  $\eta^2 = .004$ . Contrary to our prediction, the two groups of women reported feeling comparable levels of overall self-worth. See Table 4 for means and SDs of all comparisons.

### Hypothesis 3

The descriptive results for the content analysis of the four open-ended questions are discussed below. The comprehensive results for all coded items are summarized in Table 5.

#### Question One: How Would you Best Describe Your Roller Derby Persona?

As hypothesized, most respondents (62 %) indicated that they did have a Roller Derby persona; 21 % of the entire sample said their persona embodied traditionally masculine characteristics of toughness and aggression and 15 % described themselves as *athletic* (“Athletic with a little sparkle and flare”). Some of the women provided their derby names, which they said represented their personas (e.g., Obscene-Alina, Krimebag). Still, over one-third (36 %) of the women reported not having a persona related to their roller derby participation.

**Table 4** Means and standard deviations of the Roller Derby ( $n=64$ ) vs. non-Roller Derby ( $n=169$ ) participants

Variables	Roller Derby		non-Roller Derby		F
	M	SD	M	SD	
PAQ-M	2.77	0.62	2.57	0.58	4.73*
PAQ-F	2.86	0.59	2.94	0.48	0.75
PAQ-MF	2.13	0.62	1.90	0.55	7.09*
BES – Sex	3.56	0.60	3.56	0.58	0.00
BES – Weight	3.20	0.85	2.76	0.85	11.07**
BES – Physical	3.56	0.85	3.10	0.75	14.86**
Self-Esteem	40.18	7.16	39.31	6.66	0.71

PAQ-M, F, & MF (Personal Attributes Questionnaire - Masculinity, Femininity and Masculinity-Femininity scales [scores range from 0, low, to 4, high]; BES-Sex, Weight, & Physical (Body Esteem Scale-Sexual Attractiveness, Weight Concerns, and Physical Condition [scores range from 1, low, to 5, high satisfaction]); Self-Esteem (Rosenberg self-esteem scale – scores range from 10, low, to 50, high). Degrees of freedom for all the F-values are 1, 191

\*  $p < .05$ , \*\*  $p < .001$

**Table 5** Measure of inter-coder reliability, frequency and percentage of sample

Category	Thematic category	Percent agreement	Cohen's kappa	Frequency/percentage
P1	No persona	83.9 %	0.66	22 (36 %)
P2	Expressive traits	98.4 %	0.849	3 (5 %)
P3	Instrumental traits	90.3 %	0.69	13 (21 %)
P4	Dark, frightening, morbid	100 %	1	1 (2 %)
P5	Athletic	96.8 %	0.86	9 (15 %)
P6	Other	93.5 %	0.76	12 (20 %)
P7	Not answered	96.8 %	0.65	1 (2 %)
D1	Bad girl	100 %	1	4 (26 %)
D2	Feminine	100 %	1	7 (11 %)
D3	Athletic	87.1 %	0.78	34 (55 %)
D4	Body focus	96.8 %	0.73	4 (6 %)
D5	Other	91.9 %	0.61	13 (21 %)
D6	Not answered	n/a	n/a	0
M1	Athleticism, exercise, fitness	95.9 %	0.90	29 (37 %)
M2	Socialization, friendship	93.8 %	0.81	18 (23 %)
M3	Outlet for competitiveness & aggression	99 %	0.94	9 (12 %)
M4	Fun	87.6 %	0.55	10 (13 %)
M5	Personal challenge	100 %	1	9 (12 %)
M6	Self-esteem and empowerment	95.9 %	0.58	3 (4 %)
M7	Other	n/a	n/a	0
M8	Not answered	n/a	n/a	0
S1	Improvement	88.7 %	0.76	40 (67 %)
S2	Has worsened	100 %	1	2 (3 %)
S3	No change	100 %	1	3 (5 %)
S4	Change in fitness, not self-esteem	90.3 %	0.75	15 (25 %)
S5	Other	98.4 %	0	0
S6	Not answered	100 %	1	1 (2 %)

*Question two: How Does Your Choice of Bout Dress Reflect Your Persona?*

Consistent with our prediction, the majority of the respondents (55 %) reported that they dressed in a manner that primarily affirmed their athleticism and the legitimization of Roller Derby as a sport (“I dress modestly and sporty. This is a true athletic sport and I want people to believe this”).

Although not directly describing their dress/attire as athletic, 12 % of the women dressed in clothing that they described as reflecting their *aggressiveness* or that showed off the muscularity and strength of their bodies. Only 11 % of the women dressed in a manner that was considered *feminine*.

*Question Three: What was Your Motivation for Joining a Roller Derby Team?*

Although Roller Derby served as a social outlet for some of the women (23 %), a larger number (37 %) indicated that exercise and fitness were the leading motivators for their

participation, which was in line with our hypothesis. For example, one participant responded: “Getting into shape, and participating in a female contact sport that requires not only physical stamina but mental stamina as well”. The women also participated in Roller Derby because it was a challenge (12 %), they considered it to be fun (13 %), and it provided an outlet for their competitiveness (12 %).

*Question Four: Has Your Self-Concept and or Self-Esteem Changed Since Participating Roller Derby?*

Consistent with our hypothesis, the majority of the women (67 %) said that their self-esteem/self-concept improved as a result of participating in Roller Derby. As one participant stated: “Roller Derby has given me so much confidence and self-esteem. I am so less critical of my appearance and less obsessive of my weight”. Another 25 % of the women reported improvements in their physical condition, though did not specifically indicate a change in self-esteem as a result (“Although I considered myself somewhat athletic and

fit prior to joining the league, roller derby has helped me develop additional strength and endurance”). See Table 5 for a complete list of response frequencies.

## Discussion

Since the 1970s, women increasingly have focused on physical activity, sport participation, and the pursuit of muscularity as signs of psychological health and well-being (e.g., Cahn 1994; Greenleaf et al. 2009). The popularity of female athletes and the frequency of muscular women in contemporary media also have created a new ideal for women to pursue (e.g., Krane et al. 2004,  $n=21$ , United States; Varnes et al. 2013). In Roller Derby, which represents a nontraditional, non-lean sport environment that is available to women in more than 40 countries, skaters are comfortable exposing their body regardless of its shape and size, and their hyperfeminized, yet campy, dress helps to juxtapose the perceived lack of femininity that is culturally associated with a larger body size. This paradoxical mix of femininity and aggression challenges traditional hegemonic notions of masculinity and femininity and negates the idea of the female body as a passive sex object (Carlson 2010). Roller Derby appears to create an alternative environment for socialization and competitive sport that promotes female empowerment in terms of increased feelings of instrumentality and satisfaction with weight and physical condition. Moradi (2010) stated that non-dominant cultural standards of attractiveness (i.e., cultures that are more accepting of larger female bodies) may reduce the internalization of societal beauty ideals and serve as buffers to self-objectification. Thus, consistent with theory (Cash 2002; Eagly and Wood 2012; Fredrickson and Roberts 1997; Striegel-Moore and Bulik 2007), we expected that participation in Roller Derby would be associated with higher levels of general and body esteem, and a stronger endorsement of instrumental, but not expressive, characteristics. Our results partially supported our hypotheses.

The Roller Derby participants displayed higher levels of instrumental traits than the non-Roller Derby women and were more satisfied with their weight and physical condition, which is consistent with past research (Miller and Levy 1996,  $n=145$ , United States; Steinfeldt et al. 2011,  $n=143$ , United States). For example, female collegiate athletes scored higher than nonathletes on the traditional masculine norms of winning and risk taking (Steinfeldt et al. 2011,  $n=143$ , United States). Further, researchers have found that female athletes report higher levels of physical, athletic or sport competence than nonathletes and feel empowered by and proud of their athletic accomplishments and strong physiques (e.g., Krane et al. 2004,  $n=21$ , United States; Miller and Levy 1996,  $n=145$ , United States). Being involved in sport, including less traditional outlets such as Roller Derby, may influence

positively women’s perceptions of themselves as strong, independent, powerful, and capable and help them feel more satisfied with their body size/shape and physical condition.

Contrary to our hypothesis the women reported similar levels of satisfaction with their sexual attractiveness regardless of whether they participated in Roller Derby. Both groups, on average, scored above the midpoint on this scale suggesting that they were more satisfied than not with how sexually attractive they perceived themselves to be. Further, women in both groups who endorsed instrumental characteristics (either on the PAQ-M or M-F subscale) were more satisfied with their sexual attractiveness; the endorsement of expressive characteristics was unrelated to any dimension of the women’s satisfaction with their bodies (i.e., sexual attractiveness, weight, and physical condition). Our findings are consistent with past research on benevolent sexism and body image (Forbes et al. 2004,  $n=194$ , Poland and United States), which suggests that women who are interested in attracting men to take care of them are more concerned about their weight and body shape than women who do not have this interest. Although women who conform to traditional feminine (expressive) characteristics, such as submissiveness, are the ones who emphasize being sexually attractive to others (Franzoi and Shields 1984,  $n=623$ , United States), in our study it was the women who endorsed instrumental (masculine) characteristics who actually were more satisfied with their sexuality.

The Roller Derby women did report that their participation had a positive effect on their overall self-worth, yet the two groups of women reported relatively high levels of esteem and did not differ significantly from each other on our quantitative measure. The women’s overall self-esteem also was related to higher levels of body esteem across all three dimensions, which supports the idea of self-esteem as a multidimensional construct (Harter 1990; Marsh and Shavelson 1985). The Roller Derby environment, which emphasizes the importance of instrumental characteristics (e.g., independence, aggressiveness, physicality) and the acceptance of larger, nontraditional female body sizes, appears to engender a healthy view of self and body (in particular body weight and physical condition) among its female participants. The Roller Derby environment also supports the disruption of traditional gender norms and allows participants to create and experience alternative gender relations. Roller Derby provided many of the participants with an outlet for aggression, their desire to cause pain, and an expression of their athleticism, traits that are traditionally aligned with masculinity and often stigmatized by society at large when engaged in by women (Storms 2008).

Our study was limited in terms of the scope of our Roller Derby sample, the composition of our control group, our lack of assessment of the women’s overall levels of physical activity, and our reliance on self-report measures. Even so, our study represents a step forward in understanding how involvement in nontraditional sport environments may contribute to

women developing more instrumental characteristics, which are associated with various indices of psychological health, including higher self-esteem and fewer concerns about body image (Greenleaf et al. 2009,  $n=260$ , United States). In future studies, researchers might examine changes in body image and psychological well-being over time within Roller Derby participants as well as examining other variables related to women's physical and psychological health, such as drive for thinness, perfectionism, and satisfaction with life. Also, more in-depth qualitative studies of Roller Derby athletes may shed light on their motivation for becoming (and staying) involved and what aspects of the environment contribute directly to their body esteem and overall well-being. Finally, comparisons to other groups of more traditional female athletes (e.g., tennis players) may illuminate how different sport environments may affect women's psychological health and well-being.

Roller Derby provides women with an alternative (and somewhat subversive) athletic environment where they can experience a sense of belonging as well as acceptance of their bodies and instrumental characteristics. The appreciation of all body types and physical skill levels inevitably may contribute to higher reported levels of body satisfaction and general self-esteem among the participants. This acceptance and support within Roller Derby allows women to not only be comfortable within their bodies but also with their gender identity and sexual assertiveness in a society that advocates a heterofemininity through the media and even in traditional sports where women are often marginalized and still expected to be physically weaker and inferior to men. Participants' choice in dress to reflect a Derby persona, or lack of, further demonstrates the hyperbolic focus on athleticism and the contradiction of traditional hetero-normative gender behaviors. The hyperfeminine (and choreographed) Roller Derby spectacle of the past has been revitalized as a strategic sport for women seeking athletic competition and camaraderie and an environment in which they can be proud of themselves and their bodies.

**Compliance with Ethical Standards** This research study has been reviewed and approved by the University of North Texas Institutional Review Board (IRB). Informed consent was obtained from all human subjects included in the study.

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