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Relationship Between Body Habitus and Aggression Subtypes Among Healthy Young Adults from the American Midwest

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Abstract

This study examined associations between body habitus and functions of aggression, in a sample of 474 college students from the Midwestern region of the United States (age range = 18–25y; 73% Caucasian). Two instruments of aggression, the Reactive-Proactive Aggression Questionnaire from Dodge & Coie 1987 (DC) and Raine et al. 2006 (RPQ) were given as self-assessments. Body habitus measures standardized by age and gender specific weight and height were collected. Subjects considered to have a large body habitus in our study had both weight and height measures above the 75th percentile. Large body habitus was positively correlated with both proactive and reactive functions of aggression among adult males but not females; however, regression analyses

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Disclosure of Interest

Samantha Hartin, Waheeda Hossain, Ann Manzardo, Shaquanna Brown, Paula Fite and Merlin Butler declares that they have no conflicts of interest to report.

Ethical Standards and Informed

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation [institutional and national] and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants included in the study.

indicated that body habitus was most strongly and robustly associated with proactive aggression. Findings suggest that even in a healthy homogeneous population, large body size in males is associated with aggression, particularly proactive aggression including bullying rather than retaliatory aggression. The presence of a large body physique may reinforce aggressive behavioral traits acquired through life experiences and activities evoking physical dominance. Alternatively, the relationship may reflect neurological processes related to size influenced by genetic factors and hormones leading to antisocial behaviors requiring future research on the role of genes for aggression.

Keywords

height; weight; body habitus; proactive and reactive aggression; healthy young adults

The objective of our study was to analyze body habitus size with measures of reactive and proactive aggression in 240 healthy, young adult males and 244 healthy, young adult females attending a public university in the American Midwest. A widely used definition of aggression in human research is any behavior with a goal of harming objects and/or people against their wishes (Dodge, 1991; Geen, 2001). This definition covers harm implicitly defined as hurting someone physically (hitting, kicking or damaging property) and socially (humiliation or malicious gossiping). Aggressive behavior is associated with many negative outcomes including substance use (Fite et al., 2012a), risky sexual behavior (Fite et al., 2016) and mental illness (Vitaro et al., 1998; Fite et al., 2012b). These associations are often not consistent across the types of aggression and are thought to be multifaceted with aggressive acts characterized by their function, specifically reactive and proactive aggression (Dodge & Coie, 1987; Vitaro & Brendgen, 2011; Fite et al., 2012b). Proactive aggression is goal-oriented aggression representing a gain or advantage for the perpetrator (e.g., bullying), while reactive aggression is aggression in response to a perceived threat by an individual (e.g., defending oneself) (Fite et al., 2012b; Geen, 2001). While both functions of aggression have been linked to externalizing symptoms, proactive aggression is more strongly related to conduct disorder and antisocial characteristics in contrast to reactive aggression (Dodge, et al., 1997; Fite et al., 2012a; Vitaro & Brendgen, 2011; Vitaro et al., 1998). Alternatively, reactive aggression, not proactive aggression, is associated with internalizing symptoms, including depression and anxiety (Fite et al., 2012a; Vitaro & Brendgen, 2011).

Research regarding associations between physical size and dominance or aggression has shown that size is correlated with dominance in preschool children (Pellegrini et al., 2007). Felson (1996) also found a positive association in adults with physical size and the likelihood that the person has attacked another. Hence, in male humans, size and strength are positively correlated with physical aggression and dominance during elementary age (Pellegrini et al., 2007; Raine et al., 1998), adolescence (Tremblay et al., 1998), and adulthood (Archer & Thanzami, 2007; Felson, 1996; Ishikawa, Raine, Lencz, Bihrlé, & LaCasse, 2001; Sell, Tooby & Cosmides, 2009). This could be due to larger people being able to intimidate others more so than their smaller counterparts (Raine et al., 1998), possibly enhancing aggressive behavior based on prior successes in intimidation. Increased

body size may also indicate neurobiological processes that lead to antisocial behaviors (Pine et al., 1997).

Despite the growing body of evidence that has consistently demonstrated that size and strength are associated with higher levels of physical aggression among males throughout their lifespan, several gaps in the literature remain. First, the functions of aggression (i.e., reactive and proactive aggression) are not widely studied in light of theoretical and empirical research showing that reactive and proactive aggression are differentially associated with a range of correlates (Card & Little, 2006; Raine et al., 2006; Vitaro et al., 1998). It is important to examine whether body habitus might more strongly relate to one function of aggression over the other. An understanding of this process might help inform intervention and prevention efforts. Another limitation of the existing research is the traditional focus on patterns in males; females and males have reported comparable levels of reactive and proactive aggression in some samples (Connor et al., 2003). As such, we might be missing opportunities to learn more about the unique correlates of aggression, particularly functions of aggression, among females by focusing only on males. The current study aims to address the noted gaps in the existing literature by examining the associations between body habitus and reactive and proactive aggression among a sample of healthy male and female young adults using two instruments of aggression, the Reactive–Proactive Aggression Questionnaires from Raine et al. 2006 (RPQ) and from Dodge & Coie 1987 (DC) given as self-assessments.

Method

Participants

The study sample comprised 240 healthy, young adult males and 244 healthy, young adult females (aged 18–25 years; ~ 73% Caucasian) enrolled at a mid-sized public university of approximately 28,000 students located in the American Midwest. Participants were recruited from psychology classes using SONA (www.sona-systems.com), an experiment tracking software system that permits students to enroll in eligible studies. Students were awarded three research credits and received \$5.00 for participating in the study. The project protocols were approved by the affiliated Institutional Review Board and all participants of this study gave written informed consent before participating and examinations undertaken.

Instruments

Given that body habitus might differentially relate to physical acts of reactive and proactive aggression as measured by the Dodge and Coie (1987) instrument and physical and relational acts of reactive and proactive aggression measured by the Raine et al. (2006) instrument, both measures of proactive and reactive aggression were included in the current study.

Procedures

Phenotypic data collection.—Growth parameters were obtained to correlate with behavioral data and body habitus measures standardized by age and gender. Standing height was measured to the nearest 0.254cm using a standard stadiometer (SECA model 213,

Chino, California). Weight was measured to the nearest 0.045kg using the Tanita InnerScan Body Composition Monitor, Model BC-533 (Arlington Heights, Illinois). Height and weight were collected with the subjects wearing one layer of clothing and no footwear.

Behavioral assessments.—Reactive and proactive aggression were assessed using two self-reports (Raine et al., 2006; Dodge & Coie, 1987). For the Raine et al. (2006) questionnaire (RPQ), both verbally and physically aggressive behaviors were represented within the 23-item measure, with 11 items assessing reactive aggression (e.g., “How often have you gotten angry or mad or hit others when teased?”) and 12 items assess proactive aggression (e.g., “How often have you used force to obtain money or things from others?”). Subjects reported using a 3-point scale (1 = never to 3 = often). It should be noted that our 3-point scale is from 1 to 3 and not 0 to 2 as originally created by Raine et al. (2006). Reliability and validity of the scales have been demonstrated in several studies (Baker et al., 2008; Miller & Lynam, 2003). Internal consistencies were judged as adequate to good (proactive $\alpha = 0.76$; reactive $\alpha = 0.85$).

For the Dodge and Coie 1987 questionnaire (DC), proactive and reactive aggression was assessed using a six-item rating scale. Items were measured on a five point Likert scale from 1 (never) to 5 (almost always), with three item subscales assessing proactive (e.g., “I threaten or bully others in order to get my own way.”) and three assessing reactive (e.g., “When I have been teased or threatened, I get angry easily and strike back.”) aggression. Mean scores for both proactive and reaction aggression were computed and used for analysis. Previous research has shown this measure to have strong reliability and validity (Dodge et al., 1997; Waschbusch et al., 1998). Internal consistencies for the current study were modest to adequate (proactive $\alpha = 0.75$; reactive $\alpha = 0.60$), which is likely due to the scales consisting of only 3 items each which may limit validity with the small number of items used.

Statistical analysis.—Summary statistics with means and standard deviations were generated to describe baseline characteristics for body size and aggression score distributions in the study sample (see Table 1.1). We focused our analysis on males and females falling into the 75th percentile (upper quartile) range for both height and weight (Figure 1) and categorized as having a large body habitus. This group included 10.8% of all males and 10.7% of all females. Pearson correlation coefficient and generalized linear regression modeling was employed to evaluate the relationship between age, gender, body habitus and the RPQ and DC aggression scores in the study sample. The effects of body habitus on reactive aggression was modeled controlling for proactive aggression. Conversely, the effects of body habitus on proactive aggression were modeled controlling for reactive aggression. SAS statistical software version 9.2 (SAS Institute Inc. Cary, North Carolina, USA) was used for all data analyses and p-values less than 0.05 were considered significant.

Results

Descriptive Statistics

Table 1.1 shows the means, standard deviations, F and p-values of our study population for age, height, and weight in males and females with males significantly older, taller and heavier than females. The average height for males in the United States, aged 18–29 years is 176.1cm (CDC 2016 survey) and is similar to the average height of our 240 male subjects ($177.8\text{cm} \pm 7.2\text{cm}$, aged 18–25 years) (Figure 1; Table 1.1). The average height for our male subjects in the 75th percentile and above (upper quartile) was 188.7cm. The average height for females in the United States, aged 18–29 years is 162.5cm (CDC 2016 survey) and is similar to the average height of our 244 female subjects ($164.2\text{cm} \pm 7.0\text{cm}$, aged 18–25 years) (Figure 1; Table 1.1). The average height for the female subjects in the upper quartile was 173.6cm. The height data from our study and the national height data both follow a normal (Gaussian) distribution (Figure 1).

In the United States, the average weight for males aged 19–29 years is 81.7kg (CDC 2016 survey). Males from our study weighed less on average than what is nationally reported ($76.2\text{kg} \pm 13.6\text{kg}$, aged 18–25 years) (Figure 1; Table 1.1). The average weight for our male subjects in the upper or fourth quartile was 96.1kg while the average weight for females aged 18–29 years was 69.7kg (CDC 2016 survey). Females from our study weighed less on average than what is nationally reported ($62.6\text{kg} \pm 13.6\text{kg}$, aged 18–25 years) (Figure 1). The average weight for our female subjects in the upper quartile was 75.5kg. The subjects considered to have a large body habitus in our study were located above the 75th percentile for both height and weight. Males had to be at least 183.0cm or taller and weigh 82.1kg or more and females had to be at least 168.6cm in height and weigh at least 68.1kg, regardless of their BMI to be considered to have a large body habitus. Out of the 240 male subjects, 28 (11.7%) fell into the large body habitus category, while 26 (11.0%) of the 244 female subjects fell into the large body habitus category.

Table 1.2 shows the means, standard deviations, F and p-values of our study population for the aggression subtypes as a combined group and by gender specific groups. In general, males had higher mean scores than females for both reactive and proactive aggression from both the DC and RPQ instruments. On average, males with a large body habitus were significantly more reactively and proactively aggressive than the smaller males according to the mean scores from both instruments. Females did not display a statistically significant difference in aggression subtype mean scores with either the DC or RPQ instruments.

Correlational Analysis of Body Habitus and Aggression Type

Table 2 shows the relationship between large body habitus and aggression subtypes used in the study. Proactive and reactive aggression scores measured from both instruments were significantly and positively associated with large body habitus in the male subjects but not in the female subjects. Body habitus was not related to age ($R = -0.02$, $p = 0.73$).

Regression Modeling of Aggression Subtypes

Prior studies examining physical size and antisocial behavioral outcomes have used both body mass index (an index of obesity) and “body bulk” (used as an index of physical stature) as continuous variables (Ishikawa et al., 2001). Our regression analyses were conducted by comparing physically large males (183.0cm or taller and 82.1kg or heavier) with their relatively smaller counterparts in terms of being proactively and reactively aggressive. As described, reactive and proactive measurements were highly correlated in our analyses (Table 2). Regression modeling found that body habitus in males significantly predicted proactive aggression using both the Dodge and Coie (DC) and RPQ metrics even after age and reactive aggression were controlled. Covariance matrices in Figure 2 further illustrates the differential relationship between large and smaller body habitus when modeling proactive vs reactive aggression in males. This relationship was not observed when reactive aggression in males were modeled or any aggression measures in females (Table 3; Figure 3). The results suggest that body habitus may be more strongly associated with bullying than retaliatory aggression.

Discussion

The current study examined the relationship between sex, large body habitus, and aggression subtype and generated two principle findings that contributed to the advancement of the aggression literature. First, large body habitus in males was positively correlated with aggression from both the DC and the RPQ defined questionnaires, but more robustly predicted the proactive aggression subtype (Table 2; Figure 2). Further, no association was found between body habitus for either proactive or reactive aggression in females (Table 2; Figure 3). These data are consistent with reported reduced likelihood of physical acts of aggression in females relative to males where size may be more influential (Felson, 1996; Salas-Wright & Vaughn, 2016; Archer & Thanzami, 2007; Ishikawa et al., 2001). Current findings are consistent with previous work indicating a link between body size and aggression in humans (Ishikawa et al., 2001) and animals (Archer, 1988), and this work extends the prior literature by suggesting that body habitus is particularly relevant for goal-oriented aggressive acts, such as bullying behavior, rather than impulsive, retaliatory acts of aggression. Reactive aggression may be considered a “fight” response generated from a more primitive part of the brain while proactive aggression more likely originates in the frontal cortex (Scarpa, Haden & Tanaka, 2010). Frontal lobe responses are more easily conditioned over time and theoretically early success with proactive aggression by individuals may increase its usage as a tool in the future.

Larger males in our study also scored higher on reactive aggression as well as proactive measures and may be considered a strength of our study; however, an instrument used had a narrow range of responses: 1–3 (never to often), and did not include a measure of aggression intensity (threat, punch, beating, etc.), nor a range of time (from childhood, adolescence, young adulthood, etc.). Therefore, some data may have been lost. Also, the sociological home environment for each individual tested would have been a key data piece to obtain, for example, was there violence in the home? The use of self-reports in our study could also be perceived as a limitation. Subjects may have forgotten certain occurrences of aggression in

the past or unwilling to admit to their own displays or feelings of aggression. Other limitations could be that our study cohort was a sample of college students and findings may not be generalized to other populations of emerging adults. College students may also be more advantaged and may have more conflict resolution skills than those unable to attend college. One may anticipate increased aggression from the more disadvantaged. Our study cohort also contained a smaller number of individuals with large body habitus compared to national rates. However, it seems unlikely that these limitations can explain the major findings identified in our study. This study demonstrates a link between large body habitus, reactive and proactive aggression independent of age in healthy, young adult males but not in females. There is a paucity of data on the role or frequency of aggression subtypes. These observations should be replicated, and factors taken into consideration when studying the effects of body size and relationship to risk for both proactive and reactive aggression subtypes in different age groups in humans.

Implications of these types of research measures and outcomes related to body size and aggression may impact on means of prevention or intervention, particularly with proactive expression behavior in young adult males as large males scored higher on both proactive and reactive aggression seen in our study. It is possible that the presence of a large body physique may reinforce aggressive behavioral traits acquired through life experiences and activities evoking physical dominance. When working with young males of larger stature, emphasizing verbal skills and non-physical problem solving may be particularly important for the prevention of future bullying and other proactively aggressive behavior. Such an influence may also be amenable to behavioral modification through education, outreach and intervention efforts. Specifically, males of larger stature may benefit from the modelling of effective problem solving and contingency management training that includes being reinforced for appropriate social skills and conflict resolution to reduce the use of aggression to obtain one's goals. The efforts should occur early in childhood and be reinforced in the home and at school. Alternatively, the relationship may reflect neurological processes related to size influenced by genetic factors and hormones leading to antisocial behaviors (Pine et al., 1997). Future directions or research may include the role of inheritance and family history (e.g., genes for aggression). Human genome-wide association studies (GWAS), transcriptome-wide studies in rodents and candidate gene analysis have advanced a genetic architecture of aggressive behaviors (Zhang-James et al., 2018). Genes involved in dopaminergic and serotonergic neurotransmission, hormone receptors and regulation, exon guidance, signaling pathways such as G-protein coupled receptor (GPCR), reelin signaling in neurons and ERK/MAPK signaling and synaptic pathways may also be keys in aggression and body size in humans (e.g., Fernandez-Carrillo & Cormand, 2016). Other factors to be considered would include epigenetics or impact on the environment in gene function or activity, social-economic status (although our students were young adults attending a public university in the Midwest region of the US and hence from a rather homogenous population, primarily Caucasians), chronic and acute health issues (e.g., medication use) impacting on behavior and interaction with others, drug and alcohol consumption and length of exposure.

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Figure 1.
Histograms Showing the Distributions of Male and Female Height and Weight Measures

Figure 2.
Scatterplot and Analysis of Aggression Subtype Scores in Males

Figure 3.

** Scatterplot and Analysis of Aggression Subtype Scores in Females

Table 1.1.

Descriptive Statistics of Age, Height and Weight

	Total mean ± S.D.	Male mean ± S.D.	Female mean ± S.D.	F	p-value
Age (years)	19.0 ± 1.2 (n = 468)	19.2 ± 1.3 (n = 230)	18.8 ± 1.1 (n = 238)	14	0.0002
Height (cm)	171.0 ± 9.8 (n = 478)	177.8 ± 7.2 (n = 240)	164.2 ± 7.0 (n = 238)	441	<0.0001
Weight (kg)	69.3 ± 14.4 (n = 478)	76.2 ± 13.6 (n = 240)	62.6 ± 11.7 (n = 238)	131	<0.0001

Note: Not all study participants agreed to have all physical measures obtained.

Table 1.2.

Descriptive Statistics of Aggression Subtype Scores in Individuals with Large Body Habitus Compared to their Smaller Counterparts

	Total mean $\pm$ S.D.	Above the 75 th percentile mean $\pm$ S.D.	Below the 75 th percentile mean $\pm$ S.D.	F	p-value
Male DC reactive aggression	2.20 $\pm$ 0.71 (n = 240)	2.50 $\pm$ 0.90 (n = 26)	2.17 $\pm$ 0.69 (n = 214)	.00	0.03
Female DC reactive aggression	2.00 $\pm$ 0.69 (n = 238)	1.90 $\pm$ 0.60 (n = 26)	2.05 $\pm$ 0.71 (n = 212)	.90	0.30
Male DC proactive aggression	1.40 $\pm$ 0.65 (n = 240)	1.88 $\pm$ 1.11 (n = 26)	1.34 $\pm$ 0.55 (n = 214)	7.3	<0.0001
Female DC proactive aggression	1.24 $\pm$ 0.46 (n = 238)	1.18 $\pm$ 0.40 (n = 26)	1.24 $\pm$ 0.46 (n = 212)	.40	0.53
Male RPQ reactive aggression	1.7 $\pm$ 0.35 (n = 240)	1.89 $\pm$ 0.38 (n = 26)	1.68 $\pm$ 0.34 (n = 214)	.43	0.004
Female RPQ reactive aggression	1.61 $\pm$ 0.31 (n = 238)	1.53 $\pm$ 0.25 (n = 26)	1.61 $\pm$ 0.32 (n = 212)	.70	0.20
Male RPQ proactive aggression	1.2 $\pm$ 0.22 (n = 240)	1.31 $\pm$ 0.34 (n = 26)	1.17 $\pm$ 0.21 (n = 214)	0.4	0.001
Female RPQ proactive aggression	1.10 $\pm$ 0.13 (n = 238)	1.07 $\pm$ 0.09 (n = 26)	1.10 $\pm$ 0.13 (n = 212)	.53	0.50

Note: Values for aggression questionnaire measures are from the mean scores of all of the items. DC: Dodge and Coie 1987 questionnaire (3 items; 1–5 per item). RPQ: Raine et al. 2006 questionnaire (11 items; 1–3 per item). More significant differences in aggressive subtypes were seen in males compared with females.

Table 2.

Correlation Between Aggression Subtype Scores and Body Habitus

Item	Sex	N	r	<i>p-value</i>
DC Reactive	Male	240	0.16	0.02
DC Proactive	Male	240	0.31	<0.0001
DC Reactive + Proactive	Male	240	0.27	<0.0001
DC Reactive	Female	244	-0.07	0.31
DC Proactive	Female	244	-0.05	0.47
DC Reactive + Proactive	Female	244	-0.07	0.31
RPQ Reactive	Male	240	0.20	0.002
RPQ Proactive	Male	240	0.21	0.0014
RPQ Reactive + Proactive	Male	240	0.22	0.0005
RPQ Reactive	Female	244	-0.09	0.16
RPQ Proactive	Female	244	-0.05	0.43
RPQ Reactive + Proactive	Female	244	-0.09	0.17

Note: Aggression subtypes and correlations with body habitus by sex [Dodge and Coie, 1987 (DC); Raine et al. 2006 (RPQ)].

Table 3.

Regression Models to Assess Influences of Body Habitus on Aggression Subtypes by Gender

Mean DC Proactive Aggression Score for Males			Mean DC Reactive Aggression Score for Males		
	F	p-value		F	p-value
Large body habitus	12.6	0.05	Large body habitus	0.01	0.93
DC Reactive aggression	60.5	<0.01	DC Proactive aggression	60.5	<0.01
Age	0.48	0.49	Age	2.40	0.12
<i>Overall Model: F=27.2; df=3; p<0.0001</i>			<i>Overall Model: F=22.6; df=3; p<0.0001</i>		
Mean RPQ Proactive Aggression for Males			Mean RPQ Reactive Aggression for Males		
	F	p-value		F	p-value
Large body habitus	4.53	0.03	Large body habitus	0.64	0.42
RPQ Reactive aggression	130	<0.01	RPQ Proactive aggression	130	<0.01
Age	0.06	0.8	Age	0.51	0.68
<i>Overall Model: F=49.6; df=3; p<0.0001</i>			<i>Overall Model: F=47.6; df=3; p<0.0001</i>		
Mean DC Proactive Aggression Score for Females			Mean DC Reactive Aggression Score for Females		
	F	p-value		F	p-value
Large body habitus	0.06	0.81	Large body habitus	0.48	0.49
DC Reactive aggression	65.9	<0.01	DC Proactive aggression	65.9	<0.01
Age	0.12	0.73	Age	0.54	0.46
<i>Overall Model: F=22.1; df=3; p<0.0001</i>			<i>Overall Model: F=22.5; df=3; p<0.0001</i>		
Mean RPQ Proactive Aggression Score for Females			Mean RPQ Reactive Aggression Score for Females		
	F	p-value		F	p-value
Large body habitus	0.00	0.99	Large body habitus	1.3	0.25
RPQ Reactive aggression	80.8	<0.01	RPQ Proactive aggression	80.8	<0.01
Age	1.05	0.31	Age	0.48	0.49
<i>Overall Model: F=27.5; df=3; p<0.0001</i>			<i>Overall Model: F=27.7; df=3; p<0.0001</i>		

Males, N = 230. Females, N = 238. [Dodge and Coie, 1987 (DC). Raine et al. 2006 (RPQ)].