Appearance-related cyberbullying and its association with the desire to alter physical appearance among adolescent females

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Abstract

Cyberbullying is associated with various mental health concerns in adolescents, including body dissatisfaction and disordered eating behaviours. However, there is a significant research gap concerning the unique effects of appearance-related cyberbullying (ARC) on adolescent mental health. This study examined the prevalence and psychological consequences of ARC among middle to late adolescent females (aged 14–19 years, $M_{age} = 15.98$, $N = 336$). Participants completed an online survey regarding their experiences of ARC, body image variables, and eating disorder symptomology. Findings indicate the widespread occurrence of ARC among adolescent females, with body shape and size emerging as predominant targets. Experiences of ARC-victimisation positively correlated with increased concerns about body shape, body shame, and eating disorder symptomology. Conversely, experiences of ARC-victimisation were negatively correlated with body esteem and body appreciation. Finally, appearance-related cybervictimisation was significantly associated with adolescent females' desire to pursue appearance alterations through methods such as dieting and exercising, altering self-presentation, and undergoing cosmetic procedures due to perceived experiences of ARC. These findings highlight the urgent need for preventative measures, such as age-appropriate social media policies and health promotion programs that encourage positive online behaviour, and strategies to address the impacts of ARC to protect the mental well-being of adolescent females.

Keywords Appearance-related cyberbullying, Victimisation, Adolescents, Body image, Eating disorders

Plain English Summary

Cyberbullying directed towards appearance is a serious problem for many adolescent females. Our study examined how often this type of cyberbullying happens online and its impact on females aged 14–19. We found that many adolescent females experience appearance-related cyberbullying, where they are teased or insulted about their body shape, weight, or physical features. These experiences make them more likely to feel bad about their bodies, leading to harmful behaviours like extreme dieting or considering cosmetic surgery. These findings highlight the urgent need for action from schools, parents, and social media platforms to prevent this form of cyberbullying and support those affected.

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Introduction

Adolescence represents a critical developmental stage characterised by profound changes in neurobiology, cognition, and social-emotional development [6, 7]. This period is marked by significant physical maturation and the intricate process of identity formation, rendering adolescents highly responsive to social and environmental influences [14, 17, 64]. Theoretical frameworks, such as those proposed by Thompson et al. [70] and Cash [12], highlight how social and environmental factors—including negative affect, low self-esteem, media pressures, social comparison processes, peer influences, internalisation of the societally-based thin-ideal, and parental pressures—intersect to shape adolescents' body image and contribute to body image concerns [62, 80].

Body image concerns are a significant issue for adolescents, with recent survey findings indicating that 90% of Australians aged 12–18 years are concerned with their body image, with more than 38% being very or extremely concerned [10]. Additionally, studies have found that 24–46% of adolescent girls and 12–26% of adolescent boys' report marked body dissatisfaction [8, 52, 67]. Notably, females, gender diverse youth, and those in the LGBTQIA + community report the highest levels of body dissatisfaction [30]. Body dissatisfaction, encompassing negative subjective evaluations of the weight and shape of one's own body, is closely linked with various mental health disorders among adolescent females, including depression, anxiety, and eating disorders [56, 66, 74].

The widespread use of social media has revolutionised communication, self-expression, and identity exploration among adolescents [47]. However, alongside these opportunities, social media platforms also pose significant threats to adolescent mental and social well-being, particularly for females, by shaping and perpetuating societal beauty ideals, fostering peer comparisons, and facilitating bullying [3, 53]. Recent sociocultural frameworks suggest that features of social media—such as idealised images of peers, celebrities, and influencers, along with the quantifiable feedback on these images—intersect with adolescent developmental factors and sociocultural gender socialisation processes to shape body image [15]. Cross-sectional studies have found that these interactions, particularly through online appearance-related activities, exacerbate body image concerns and negatively impact mental health among adolescence, particularly females [61, 65].

Of particular concern is appearance-related cyberbullying (ARC), which has emerged as the predominant form of bullying experienced by adolescent females [5, 13, 51]. ARC involves online harassment or criticism focused on physical appearance, including aspects such as weight, body shape, and facial features [5]. Notably, emerging research suggests that ARC is linked to increased emotional distress, perpetuation of negative societal beauty standards, and heightened vulnerability to body image concerns, including body dissatisfaction [5, 25, 57].

Despite the established association between cyberbullying and negative body image outcomes [34, 46, 54, 57], research specifically focusing on ARC remains sparse, particularly concerning vulnerable adolescent females. Understanding the distinct impacts of ARC is crucial for comprehending its implications on adolescent body image and mental health outcomes [5, 25]. Therefore, the aim of the current study is to conduct a quantitative investigation of ARC among adolescent females, focusing on its prevalence and psychological impacts.

Cyberbullying and body image outcomes among adolescent females

Cyberbullying and traditional bullying share commonalities in their intent to inflict harm through repeated aggressive behaviours and a power imbalance between the perpetrator and victim [29, 32, 50, 75]. However, while traditional bullying occurs in face-to-face contexts, cyberbullying occurs within the digital realm, utilising electronic communication to perpetrate harm [63, 71]. Further distinguishing features of cyberbullying include anonymity, rapid communication, lack of direct supervision, frequent repetition of incidents, and the potential to reach a broad audience [55]. Both forms of bullying involve three roles: perpetrators, victims, and bystanders. In cyberbullying dynamics, perpetrators initiate online aggression, causing distress to victims who suffer psychological and emotional harm [71]. Bystanders, on the other hand, observe these incidents and can inadvertently amplify them within the online environment [36].

Estimating cyberbullying prevalence is challenging due to underreporting, variability in definitions, rapid technological advances, cultural and social influences, and age-related development factors [82]. Research indicates that cyberbullying incident rates among adolescence range from 5.6–46.3% for perpetrators, 8.0–57.5% for victims and 62.3–75% for bystanders [2, 27, 82]. Gender disparities reveal higher rates of cybervictimisation among females and greater perpetration among males [33, 68].

Emerging neurobiological research highlights the profound impact of cyberbullying on adolescent mental health, suggesting parallels between peer victimisation and physical pain processing in the adolescent brain [41, 73]. Such experiences may become biologically embedded, heightening adolescents' vulnerability to mental health problems associated with cyberbullying, including increased social anxiety and withdrawal [16], generalised anxiety and depression [48], body dissatisfaction and

disordered eating behaviours [18, 23, 57], self-harm and suicide attempts [37], and reduced psychological well-being [22].

Experimental research further highlights a reciprocal relationship between cyberbullying and body dissatisfaction. Cross-sectional studies show that adolescent females targeted by cyberbullying tend to internalise negative perceptions of their appearance more intensely than similarly victimised boys [24, 38, 42]. Longitudinal studies reveal that victims internalise online negativity, leading to lower self-esteem, body dissatisfaction, and increased depressive symptoms [57, 77]. Conversely, a systematic review by Holland and Tiggemann [35] shows that adolescents with elevated body dissatisfaction are more likely to seek social media validation, exposing themselves to negative comments and feedback, which exacerbates body dissatisfaction and compromises well-being [24, 57]. This cycle perpetuates the negative impacts of cyberbullying and body dissatisfaction, reinforcing one another.

As summarised above, current research has established an association between adolescents' experiences of cyberbullying and the development of body image issues and eating disorders [24, 34, 54, 57]. However, it is important to note that many studies addressing cyberbullying conflate evidence across online (i.e., cyberbullying) and offline (i.e., traditional bullying) experiences, thus complicating the ability to isolate and understand the unique impacts of cyberbullying in its original form, online [82]. Nevertheless, findings from cyberbullying studies parallel those observed in offline settings, whereby traditional bullying related to physical appearance has been shown to significantly heighten body dissatisfaction and the development of disordered eating behaviours among adolescent females [18]. More specifically, research shows that bullying targeting aspects of appearance, such as body shape, heighten adolescents' tendencies toward disordered eating behaviours [4, 44], while bullying that targets facial features increases adolescents' likelihood of considering cosmetic procedures later in life [18, 43]. Given the pervasive influence of digital spaces, research emphasises that ARC may be potentially more harmful to adolescent mental health than traditional forms of bullying, necessitating the importance of ongoing investigation [57].

Appearance-related cyberbullying and body image outcomes among adolescent females

Acknowledging the distinction between general cyberbullying and ARC is crucial for understanding the nuanced impacts and consequences on adolescent body image and mental health outcomes. This differentiation has guided significant research efforts, such as those by Berne et al. [5], Frisén and Berne [25] and Wang and Ding [76], who explored ARC's nuanced effects. In their focus group study involving 27 adolescence, Berne et al. [5] discovered a gender-specific pattern, showing that females were more frequently targeted regarding weight and shape, while boys were more likely to be cyberbullied about their muscularity. Additionally, the study revealed that adolescent females experienced more severe outcomes from ARC, including higher rates of depression, lower self-esteem, and greater body concerns. In a more recent study, Frisén and Berne [25] conducted a survey with 482 adolescents, examining the relationship between cybervictimisation and body image concerns, such as body-esteem, self-objectification, and internalisation of societal body ideals. Their findings indicated that victims of ARC experienced significantly worse body image outcomes compared to those subjected to general cyber victimisation. This included reduced satisfaction with their appearance, increased body shame, and deeper internalisation of thinness ideals, exacerbated by media representations of idealised body images.

Overview of the current study

Building upon foundational research, this study aims to address gaps in understanding the effects of ARC on body image and associated mental health outcomes among Australian adolescent females aged 14–18 years. Specifically, we investigate the prevalence, forms, and psychological impacts of ARC, and hypothesise that greater experiences of ARC victimisation will be associated with increased body dissatisfaction and heightened vulnerability to eating disorder symptoms.

Method
Participants

Participants were $N = 336$ individuals who identified as female, aged 14–19 years old ($M_{age} = 15.98$ $SD = 1.27$), and were recruited from the general community and the university of the research team. All participants outside of the age bracket, who did not identify as female, or those that did not provide explicit consent, were excluded from the study. The majority of participants were attending secondary school (85.4%) at the time of completing the survey.

Procedure

This study was approved by the Human Research Ethics committee at the home institution of the lead author (approval number S221703). Participants were recruited through social media paid advertisements, networks of the research team, and a first-year psychology student research participation scheme. The study was described as examining the relationship between ARC and body

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image outcomes. Participants were asked to carefully consider their participation and withdraw if topics of cyberbullying, body image, or disordered eating were triggering for them.

Data collection took place from March to June, 2023. Participants entered the online survey (hosted by Qualtrics), read the project information sheet, and before commencing were required to provide consent. To ensure informed consent, participants were required to complete a brief questionnaire aimed at assessing their comprehension and understanding of their participation in the research project before commencing the survey [45]. To maintain both anonymity and informed consent, a two-question strategy was implemented. One example question inquired, "Is my participation in this study voluntary?" Participants were required to select one of two options: (1) "My participation is not voluntary, and I am expected to complete the study," or (2) "My participation is voluntary, and it is perfectly okay to decline or withdraw at any point." Importantly, participants needed to answer both questions correctly (i.e., "My participation is voluntary, and it is perfectly okay to decline or withdraw at any point") to proceed to the main survey, ensuring a robust verification of their understanding and consent.

Once participants commenced the survey, they were required to first complete a set of demographic questions, followed by the above-mentioned self-report questionnaires in the following sequence: BCyQ, ARC measures (roles, types and impact), BSQ, BESSA, BISS, BAS-2 and chEDE-Q. After completing the self-report questionnaires, participants received a debriefing statement. Additionally, they were provided with links to relevant information from the Butterfly Foundation, a non-profit Australian organisation dedicated to supporting individuals with eating disorders and promoting body positivity [10], as well as links to other important mental health services. Participants were also offered a follow-up call with the research team member if required, and a list of resources were made available to participants to access further support if needed. Participants were provided with a separate link which allowed them to leave their details to enter a prize draw for six products worth AUD $50.

Measures

Cyberbullying and cybervictimisation

The Berlin Cyberbullying-Cybervictimisation Questionnaire (BCyQ) [60] was used to assess experiences of cyberbullying (20 items) and cybervictimisation (19 items). The BCyQ has been validated and has good psychometric properties in young people aged 9–17 years. Participants were asked if they had experienced a list of behaviours over the previous six months, as well as if

they had acted in that way. The scale ranged from 1 (*has not happened to me at all*) to 5 (*several times a week*). Combined scores were then created to allow a total score for both cyberbullying (score range = 18–90) and cyber-victimisation (score range = 17–85), with higher scores indicating greater frequency of either bullying or victimisation. These scales were shown to have good internal consistency in this study (cyberbullying $\alpha = 0.883$; cyber-victimisation $\alpha = 0.94$).

Appearance-related cyberbullying (ARC)

Due to the limited research on ARC, there is a scarcity of tailored questionnaires that adequately measure its dimensions. Thus, this study adopted an approach to examine the various dimensions of ARC through three distinct measures, based on the frameworks established in previous research [5, 25, 76].

ARC roles   The first measure of ARC utilised six items from the BCyQ to evaluate the different roles in ARC dynamics. From the BCyQ's original set of 17 victimisation and 18 bullying items, we carefully selected and adapted three items from each measure based on their applicability to ARC. This selection process facilitated the categorisation of participants as either ARC-bullies, ARC-victims, ARC-bully-victims, or those with no experience of ARC. A key modification in this adaptation was the integration of the phrase "my appearance or body" into the text of the six chosen statements, thereby tailoring the measure to focus specifically on appearance-related aspects of cyberbullying. For example, the BCyQ statement 'Others spread embarrassing, insulting, or humiliating video clips/photos of me without my permission on the Internet or by mobile phone' was revised to 'Others spread embarrassing, insulting, or humiliating video clips/photos of my appearance or body without my permission on the Internet or by mobile phone.' The instructions and response scales are the same as the BCyQ. Participants were asked if they had experienced a list of behaviours over the previous six-months, as well as if they had acted in that way. The 5-point Likert scales ranged from 1 *(has not happened to me at all)* to 5 *(several times a week).* Combined scores were then created to allow a total score (analogous to the scoring methodology of the BCyQ) for ARC-bullies (score range = 4–15) and ARC-victims (score range = 4–15) or ARC-bully-victims (score range = 4–15 on both victim and bully scale), with higher scores indicating greater frequency of ARC. Cronbach's alpha for this category was calculated at 0.76, indicating acceptable internal consistency.

Types of ARC experienced   The second measure comprised ten items formulated by the research team to

delineate specific types of ARC. Drawing from established body image, eating disorder, and appearance-related questionnaires [19, 40, 79] these items explored several aspects of appearance, including body shape, body size, specific body attributes (e.g., breasts), disability, changes to appearance (e.g., scars), facial features, clothing or style, skin colour, age, and body tone or muscularity. Participants were asked if they had ever experienced these types of ARC. An example question is, "Have you ever been made fun of or teased online because of your body shape?" The 5-point Likert scales ranged from 1 *(has not happened to me at all)* to 5 (*several times a week)*. The internal consistency for this measurement was robust, with a Cronbach's alpha of 0.92.

Impact of ARC on the desire to change physical appearance   The third measure aimed to investigate the emotional and psychological impact of ARC. Informed by research that suggests an association between experiences of appearance-related bullying and the desire to change physical appearance [18], three items were utilised to evaluate the extent to which individuals desired to alter their physical appearance due to their experience with ARC. Participants were asked whether and how often they had felt a certain way about their appearance because of their experience with ARC. An example question is, "Have you ever felt the need to change your appearance through cosmetic procedures (e.g., nose job, boob job) because of appearance-related cyberbullying?" The 5-point Likert scale ranged from 1 *(never)* to 5 (*frequently)*. The internal consistency of this category was evidenced by a Cronbach's alpha of 0.86.

Body satisfaction
The Body Shape Questionnaire subscale (BSQ-8) was used to assess body dissatisfaction and body shape/weight concerns. The BSQ-8 contains 8 items that assess factors such as preoccupation with weight, dissatisfaction with specific body parts, and the desire to change one's body shape over the past month (4 weeks). Examples of items in the BSQ-8 include "Have you felt so bad about your shape that you have cried?" and "Have you avoided running because your flesh might wobble?" Participants indicated their agreement with each statement on a 6-point Likert scale from 1 (*never*) to 6 (*always)*. Total scores for the BSQ ranged from 8 to 48, with higher scores indicating higher levels of body dissatisfaction and body shape/weight concerns. This scale was shown to have good internal consistency in this study ($\alpha = 0.91$) and in past research [79].

Body esteem
The Body Esteem Scale for Adolescents and Adults (BESAA) [49] is a 23-item tool designed to assess an individual's cognitive, emotional, and behavioural responses to their body image, providing insights into their self-perception and body esteem. The BESAA has three subscales: BE-Appearance (general feelings about one's appearance; e.g., "I like what I see when I look in the mirror") (ten items), BE-Weight (satisfaction with one's weight; e.g., "I really like what I weigh") (eight items) and BE-Attribution (evaluations attributed to others about one's body and appearance (e.g., "People my own age like my looks") (five items). Using a five-point a five-point Likert-scale ranging from 0 (*never*) to 4 (*always*), participants were asked to indicate the degree to which they agreed with each statement on. Total scores for the BESAA ranged from 23 to 115, with higher scores indicating higher body esteem. The BESAA is a widely used measure in research and clinical settings and was shown to have good internal consistency in this study ($\alpha = 0.94$) and in past research [40].

Body shame
The Body Image Shame Scale (BISS) [19] was used to measure experiences of body image shame. The BISS is a 14-item scale comprising a two-factor structure that assesses both externalised and internalised dimensions of body shame. The externalised dimension consists of seven items that assess judgments of being negatively evaluated or criticised by others based on one's physical appearance, such as feeling uncomfortable in social situations due to fear of criticism (e.g., " The relationship I have with my physical appearance makes it difficult for me to feel comfortable in social situations"). The internalised dimension includes seven items that focus on negative self-evaluations based on one's physical appearance, such as feeling like a defective person when seeing one's body in the mirror (e.g., "I choose clothes that hide parts of my body that I consider ugly or disproportional"). Additionally, a combined score for overall body shame was calculated. Participants rated each item based on the frequency of experiencing body image shame, ranging from 0 (*never*) to 4 (*almost always*). Total scores for the BISS ranged from 14 to 70, with higher scores indicating higher levels of body shame. This scale was shown to have good internal consistency in this study ($\alpha = 0.95$) and in past research with a female adolescent sample [78].

Body appreciation
Feelings of body appreciation and acceptance were measured by the Body Appreciation Scale-2 (BAS-2) [72]. The BAS-2 is a 10-item scale consisting of a series

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of statements that capture positive attitudes and behaviours related to body image, such as valuing one's body for its functionality, expressing gratitude towards one's body, and treating one's body with kindness and respect. Using a 5-point Likert scale with responses ranging from 1 (*never*) to 5 (*always*), participants were asked to rate their level of agreement or disagreement with each statement (i.e., "I respect my body") on. Total scores for the BAS-2 ranged from 10 to 50, with higher scores indicating greater body appreciation. The BAS-2 has shown good internal consistency in this study ($\alpha = 0.95$) and in previous studies [72].

Eating disorder (ED) symptomology

The 8-item Child Eating Disorder Examination Questionnaire (chEDE-Q8) [39] was used to assess ED symptomology. The chEDE-Q8 is based on the EDE-Q (a gold standard diagnostic interview for EDs) but is modified for use in younger populations. The chEDE-Q includes 8-items that assess key attributes of eating disorders over the past 14-days, such as dietary restraint, eating concern, shape concern, and weight concern. Participants were asked questions such as "How many times in the past 14-days have you been trying to cut down on food to control your weight or shape?" in which they responded to on a 7-point Likert scale ranging from 1 (*no days*) to 7 (*every day*). Total scores for the chEDE-Q8 ranged from 8 to 56, with higher scores indicating greater eating disorder symptomatology. The chEDE-Q8 has been shown to have good internal consistency in this study ($\alpha = 0.92$) and good convergent reliability, validity and internal consistency in young people aged 13–18 years [39].

Statistical analysis

Data analysis was conducted using SPSS® (version 27, IBM Corporation, Chicago, IL, USA). Prior to analysis, a series of assessments were performed to ensure data integrity, including checking for normality, homogeneity of variance, and identification of any potential outliers.

Descriptive statistics assessed the means and standard deviations (SD) for various body image and ED measures across different ARC groups (bullies, victims, bully-victims, and those with no experience of ARC). Notably, ARC-bullies were excluded from further analysis due to the small sample size. Pearson's correlations were used to assess relationships between these measures, and ANOVA identified differences in body image and ED variable measures between ARC groups (i.e., ARC-victims, ARC-bully-victims, and no experience of ARC). The assumption of normality was met for ANOVA testing. Levene's statistic was non-significant, indicating that the assumption of homogeneity of variances was met for all measures ($p > 0.05$).

Three separate multiple regression analyses (MRA) were conducted for each of the following criterion variables: the desire to change physical appearance through diet or exercise, the desire to change self-presentation (e.g., changing hair, makeup, or clothing), and the desire to change appearance through cosmetic procedures. Each model incorporated 11 predictor variables, including one demographic factor (i.e., age) and 10 distinct types of ARC, including ARC directed towards: body shape, body size, specific body attributes, facial appearance, changes to appearance, clothing or style, skin colour, age, disability and body tone or muscularity. the predictor variables included age and experiences of ARC-victimisation directed towards: body shape, body size, specific body attributes, changes to appearance, facial appearance, clothing or style, body tone or muscularity, skin colour, age, and disability.

Assumption testing included normality of the predictor variables, which was verified through normal probability plots; homoscedasticity, assessed via scatterplots of residuals; absence of multivariate outliers, confirmed using Mahalanobis distance (threshold ≤ 13.82 for df = 2, $\alpha = 0.001$); and multicollinearity, assessed through tolerance values (all > 0.2) [1].

Results

Preliminary analysis

A total of $N = 612$ survey responses were collected. Missing data were handled using a combination of deletion and imputation methods. Responses flagged by Qualtrics as bot responses or empty surveys ($n = 199$) were excluded from the dataset. Additionally, responses with substantial missing self-report data were excluded ($n = 77$); this included participants who did not complete any items within one or more of the three ARC measures ($n = 35$) and those with more than 25% missing data across all four body image questionnaires and the eating disorder questionnaire ($n = 42$). Mean replacement was applied to participants with smaller amounts of missing data (17 data points across 5 participants). A Missing Completely at Random (MCAR) test was conducted to ensure the appropriateness of our data handling methods, and the results indicated that the missing data were random. After exclusions and imputations, a final total of $N = 336$ survey responses were included in the analysis.

To ensure that the final sample was representative, we conducted an analysis comparing demographic data collected (i.e., age and education status) between the included ($N = 336$) and excluded ($N = 77$) participants. An independent samples t-test revealed no significant difference in age between included (*Mage* = 15.98, SD = 1.27) and excluded participants (*Mage* = 15.83, SD = 1.13); t(411) = − 0.957, $p = 0.339$, with a mean

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difference of − 0.151 (95% CI − 0.461 to 0.159). Effect size measures indicated a small effect size (Cohen's d = − 0.121, 95% CI − 0.369 to 0.127). A chi-square test also showed no significant difference in the distribution of education status (secondary school, university, or neither) between included and excluded participants; $\chi^2(2, N = 412) = 1.366, p = 0.505$.

An a priori power analysis was conducted using G*Power [21]. The analysis indicated that 152 participants was recommended to achieve adequate statistical power considering an effect size of 0.15, error probability of 0.05, and desired power level of 0.90. With our final sample size of 336 participants, we can confidently affirm that our study possesses ample statistical power. Descriptive statistics are summarised in Table 1.

Participants were categorised based on their experiences relating to ARC, aligning with the reporting of the BCyQ. Those with a total score exceeding 17 on the ARC-victimisation scale (N = 167) were categorised as 'ARC-victims.' Individuals scoring above 18 on the ARC-bully scale (N = 9) were categorised as 'ARC-bullies ' [60]. Participants who scored above these thresholds on both scales (N = 33) were classified as 'ARC-bully-victims.' Those scoring below 17 on the ARC-victimisation scale and below 18 on the ARC-bully scale were categorised as 'no experience' (N = 127).

Prevalence and characteristics of cyberbullying experiences

Most of the sample reported at least one experience of cyberbullying (n = 320; 98.2%), and 62.2% (n = 209) reported ARC. Of those that reported general cyberbullying, 20.6% (n = 67) reported cybervictimisation, 1.5% (n = 5) reported cyberbullying perpetration, 76.1% (n = 248) reported cyberbullying and cybervictimisation, and 1.8% (n = 6) reported no experience of cyberbullying. Of those that reported ARC, 49.7% (n = 167) reported ARC-victimisation, 2.7% (n = 9) reported ARC-perpetration, 9.8% (n = 33) reported ARC-perpetration and ARC-victimisation and 37.8% (n = 127) reported no prior experience of ARC.

Among the participants with reported experiences of ARC-victimisation, the majority indicated that it was directed at aspects of their physical appearance, with body shape and size (fatness, thinness) being the most commonly targeted attributes. Specific body attributes, such as breasts and bottom, facial appearance, clothing or style, changes to appearance (e.g., scars, burns, skin conditions) and body tone and muscularity were also

Table 1 Descriptive statistics for variables related to appearance-related cyberbullying and body image

Variables	N	Mean	SD	IQR
Age		15.98	1.27	2.00
ARC directed towards…				
Body shape	209	0.82	0.38	2.00
Body size (e.g., Fatness, thinness)	209	0.82	0.38	2.00
Specific body attributes (e.g., Breasts, bottom)	209	0.77	0.42	2.00
Disability	209	0.26	0.44	0.00
Changes to appearance (e.g., Scars, burns, skin conditions etc.)	209	0.66	0.47	1.00
Facial appearance (e.g., Teeth, acne)	209	0.77	0.42	2.00
Clothing or style	209	0.69	0.46	2.00
Skin colour	209	0.33	0.47	1.00
Age	209	0.35	0.47	1.00
Body tone or muscularity	209	0.52	0.50	1.00
Desire to change…				
Body shape, size, or elements of physical appearance (e.g., through diet or exercise) because of ARC	209	4.12	1.15	1.50
Self-presentation (e.g., changing hair, make up, or clothing) because of ARC	209	3.96	1.19	1.50
Appearance through cosmetic procedures (e.g., nose job, boob job) because of ARC	209	3.11	1.46	2.00
Body shape concern	335	3.96	1.32	1.75
Body esteem	334	2.44	0.73	1.00
Body shame	335	3.26	1.03	1.50
Body appreciation	335	2.85	0.93	1.25
Eating disorder symptomology	333	3.68	1.60	2.00

ARC appearance-related cyberbullying; *IQR* interquartile range; *N* number; *SD* standard deviation

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frequently reported. Less commonly, ARC-victimisation focused on age, skin colour and disabilities.

Furthermore, 96.2% of participants who reported an experience of ARC reported feeling like they would like to change their body shape, size, or physical appearance (i.e., through diet or exercise) due to ARC, with 74.2% reporting experiencing this feeling often or always. Additionally, 95.2% of participants felt like they would like to change how they present themselves (i.e., changing hair, makeup, or clothing) because of ARC, with 69.4% reporting feeling this way often or always. Finally, 81.3% of participants felt like they needed to change their appearance through cosmetic procedures (i.e., nose job, boob job etc.) due to ARC experiences, with 40.7% indicating experiencing such feelings often or always.

Analysis of ARC effects on body image outcomes and desire to change appearance

The subsequent analyses examined the impact of ARC experiences (i.e., ARC-victim, ARC-bully-victim, ARC-bully, and no experience of ARC) on psychological constructs such as body shape concern, body esteem, body shame, body appreciation, and eating disorder symptomology. As shown in Table 2, participants categorised as ARC-victims and both ARC-bully-victims had higher mean scores for body shape concerns, body shame, and eating disorder symptomology, and lower mean scores of body esteem and appreciation, compared to ARC-bullies and those without ARC experiences. Pearson's correlation analysis (Table 3) revealed significant associations, indicating that higher rates of ARC-victimisation correlated with increased body shape concerns, body shame, and eating disorder symptomology, while negatively correlating with body esteem and body appreciation.

Due to the small sample size of reported ARC-bullies ($n = 9$; 2.7%), this group was excluded from further analysis.

The ANOVAs revealed statistically significant differences between the three groups (ARC-victims, ARC-bully-victims, and no experience of ARC) on scores related to body shape concern body esteem body shame body appreciation and eating disorder symptomology. Subsequent post-hoc analyses utilising Bonferroni correction indicated significant pairwise differences between

Table 2 ANOVA results for various body image and eating disorder variable measures across different groups based on ARC experience, with mean scores and standard deviation (SD), including Bonferroni post hoc test results

	M (SD)				ANOVA				Significant differences
	No experience	Victim	Bully-victim	Bully#	F	df	p	η²	
Body shape concern	3.43 (1.26)	4.30 (1.20)	4.43 (1.31)	3.57 (1.51)	20.38	2, 323	<0.001	0.11	No Exp<Victim**, No Exp<Bully-Victim**
Body esteem	2.69 (0.73)	2.27 (0.65)	2.28 (0.80)	2.68 (0.67)	14.48	2, 322	<0.001	0.08	No Exp>Victim**, No Exp>Bully-Victim**
Body shame	2.86 (0.98)	3.52 (0.95)	3.54 (1.07)	3.12 (1.05)	17.90	2,323	<0.001	0.10	No Exp<Victim**, No Exp<Bully-Victim**
Body appreciation	3.16 (0.92)	2.64 (0.81)	2.67 (1.06)	3.24 (1.03)	13.58	2,323	<0.001	0.08	No Exp>Victim**, No Exp>Bully-Victim**
Eating disorder symptoms	3.08 (1.53)	4.01 (1.50)	4.42 (1.66)	3.25 (1.55)	17.91	2,324	<0.001	0.10	No Exp<Victim**, No Exp<Bully-Victim**

ANOVA Analysis of Variance; *ARC* appearance-related cyberbullying; *df* degrees of freedom; *F* F-statistic; *M* mean; *p* p-value; *SD* standard deviation; *η²* eta squared (effect size)

Excluded from ANOVA due to small sample size

*$p < 0.05$; **$p < 0.001$

Table 3 Pearson's correlation of body image and eating disorder variables within the ARC-victimisation category

	1	2	3	4	5
1. ARC-victimisation					
2. Body shape concern	0.422**				
3. Body esteem	− 0.386**	− 0.764**			
4. Body shame	0.437**	0.812**	− 0.815**		
5. Body appreciation	− 0.387**	− 0.647**	0.870**	− 0.727**	
6. Eating disorder symptomology	0.425**	0.792**	− 0.707**	0.722**	− 0.643**

ARC appearance-related cyberbullying; *$p < 0.05$; **$p < 0.001$

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Table 4 Pearson's correlation between types of ARC experiences and the desire to change aspects of one's body

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Desire to change elements of physical appearance													
2. Desire to change self-presentation	0.740*												
3. Desire to change appearance through cosmetic procedures	.0542**	0.592**											
4. Age	−0.130	−0.088	0.066										
ARC directed at…													
5. Body shape	0.535**	0.395**	0.343**	−0.115									
6. Body size (e.g, fatness, thinness)	0.524**	0.405**	0.360**	−0.095	0.803**								
7. Specific body attributes	0.451**	0.306**	0.360**	−0.019	0.492**	0.551**							
8. Disability	0.107	0.186**	0.128	0.001	0.135	0.135	0.094						
9. Changes to appearance (e.g., Scars, burns, skin conditions etc.)	0.350**	0.221**	0.253**	−0.166*	0.329**	0.329**	0.377**	0.222**					
10. Facial appearance (e.g., teeth, acne)	0.313**	0.268**	0.321**	−0.046	0.343**	0.402**	0.405**	0.120**	0.377**				
11. Clothing or style	0.233	0.273**	0.183**	−0.107	0.263**	0.345**	0.254**	0.138*	0.225**	0.230**			
12. Skin colour	0.207**	0.205**	0.215**	0.062	0.219**	0.246**	0.287**	0.135	0.289**	0.287**	0.224**		
13. Age	0.182**	0.179**	0.202**	−0.074	0.287**	0.261**	0.185**	0.223**	0.335**	0.185**	0.204**	0.361**	
14. Bone tone or muscularity	0.324**	0.279**	0.280**	−0.015	0.329**	0.404**	0.291**	0.143**	0.277**	0.337**	0.251**	0.374**	0.387**

*ARC appearance-related cyberbullying; *$p < 0.05$, **$p < 0.001$*

groups ($p < 0.05$). Specifically, ARC-victims and ARC-bully-victims demonstrated significantly higher body shape concern, body shame and eating disorder symptomology, compared to those with no experience. Additionally, ARC-victims and ARC-bully-victims also reported lower body esteem and body appreciation than those with no experience. The results suggest that individuals who have encountered ARC, whether as cybervictims or cyberbully-victims, exhibit more negative body image and higher ED symptomology compared to those with no such experiences.

ARC-victimisation on the desire to change appearance
To investigate the association between specific types of ARC-victimisation and the desire to change aspects of appearance in adolescent females because of perceived ARC, Pearson's correlations (Table 4) and three standard MRAs were performed (Table 5).

The model incorporated 11 predictor variables, including one demographic factor (i.e., age) and 10 distinct types of ARC, including ARC directed towards: body shape, body size, specific body attributes, facial appearance, changes to appearance, clothing or style, skin colour, age, disability and body tone or muscularity. The analysis was based on data from 209 participants with a reported experience of ARC.

Association between ARC-victimisation and the desire to change physical appearance through diet or exercise
Significant positive correlations were found between the desire to change one's body shape, size, or elements of their physical appearance (e.g., through diet or exercise) because of perceived ARC, and experiences of ARC-victimisation directed towards body shape, body size, specific body attributes, changes to appearance, facial appearance, clothing or style, and body tone or muscularity ($p < 0.001$). Additionally, age and ARC directed towards skin colour and age, also showed significant, albeit weaker ($p < 0.05$) positive correlations. No significant correlations were found between experiences of ARC directed towards a disability ($p = 0.06$) and the desire to change the abovementioned elements of physical appearance.

The overall model was statistically significant, accounting for 37.4% of the variance in the desire to change one's body shape, size, or aspects of physical appearance (for instance, via dieting or exercising) because of perceived ARC and experiences of ARC-victimisation (F $(11,197) = 10.688$, $p < 0.001$). The regression coefficients for the predictors in the model indicated that ARC directed towards one's body shape ($\beta = 0.280$, $t = 2.904$, $p = 0.004$) and specific body attributes ($\beta = 0.166$, $t = 2.302$, $p = 0.022$) were the

only individual significant predictors of an individual's desire to change their body shape, size, or elements of physical appearance (e.g., through diet or exercise).

Association between ARC-victimisation and the desire to change self-presentation
Significant positive correlations were found between the desire to change self-presentation (e.g., changing hair, make up, or clothing) because of perceived ARC and experiences of ARC directed towards body shape, body size, specific body attributes, changes to appearance, facial appearance, clothing or style, and body tone or muscularity ($p < 0.001$). Additionally, ARC directed towards a disability, skin colour, and age, also showed significant, albeit weaker ($p < 0.05$) positive correlations.

The second regression model, incorporating the abovementioned predictors, was also significant, and explained 23.3% of the variance in the desire to change self-presentation due to ARC-victimisation ($R^2 = 0.233$, F (11, 197) = 5.426, $p < 0.001$) in adolescent females. However, the regression coefficients for the predictors in the model indicated that no individual variables contributed significantly to the prediction of the desire to change self-presentation due to ARC-victimisation.

Association between ARC-victimisation and the desire to change appearance through cosmetic procedures
Significant positive correlations were found between the desire to change one's appearance through cosmetic procedures because of perceived ARC, and experiences of ARC directed towards body shape, body size, specific body attributes, changes to appearance, facial appearance, skin colour, and body tone or muscularity ($p < 0.001$). Additionally, ARC directed towards a disability, clothing or style, and age, also showed significant, albeit weaker ($p < 0.05$) positive correlations. No significant correlations were seen between age of participants ($p = 0.172$) and the desire to change one's appearance through cosmetic procedures.

The third regression model, incorporating the abovementioned predictors, was statistically significant and explained 22.3% of the variance in the desire to change appearance through cosmetic procedure ($R^2 = 0.223$, F (11, 197) = 5.132, $p < 0.001$) in adolescent females. The regression coefficients for the predictors in the model indicated that, individually, ARC directed towards specific body attributes ($\beta = 0.161$, $t = 2.01$, $p = 0.046$) was the only variable to significantly contribute to the prediction of the desire to change one's appearance through cosmetic procedures.

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Table 5 Multiple regression analysis of the type of ARC experienced, and the desire to change (1) body shape, size or physical appearance (e.g., through diet or exercise) (2) self- presentation (e.g., changing hair, make up, or clothing) and/or (3) appearance through cosmetic procedures (e.g., nose job, boob job) as a result of ARC

Independent variable	Desire to change body appearance				Desire to change self-presentation				Desire for cosmetic procedures			
	B	SE B	β	R	B	SE B	β	R	B	SE B	β	R
Constant	3.344	0.868	–	< 0.001**	3.23	0.991	–	0.001*	− 0.525	1.224	–	0.668**
Age	− 0.057	0.052	− 0.064	− 0.130	− 0.042	0.059	− 0.046	− 0.088	0.122	0.073	0.108	0.066
Type of ARC												
Body shape	0.862	0.291	0.286	0.535*	0.562	0.331	0.181	0.395	0.432	0.410	0.113	0.343
Body size	0.349	0.313	0.116	0.524	0.337	0.357	0.108	0.405	0.251	0.441	0.066	0.360
Body feature	0.439	0.197	0.160	0.451*	0.168	0.224	0.059	0.306	0.558	0.278	0.161	0.360*
Disability	− 0.001	0.154	− 0.001	0.107	0.282	0.175	0.105	0.186	0.121	0.217	0.037	0.128
Changes to appearance	0.320	0.162	0.132	0.350	0.005	0.185	0.002	0.221	0.158	0.232	0.051	0.253
Facial appearance	0.059	0.183	0.021	0.313	0.173	0.208	0.061	0.268	0.448	0.257	0.129	0.321
Clothing or style	0.068	0.154	0.027	0.233	0.304	0.175	0.118	0.273	0.080	0.218	0.025	0.183
Skin colour	− 0.002	0.159	− 0.001	0.207	0.097	0.181	0.038	0.205	0.048	0.226	0.015	0.215
Age	− 0.133	0.160	− 0.055	0.182	− 0.047	0.182	− 0.019	0.179	0.122	0.225	0.040	0.287
Body tone/ muscularity	0.249	0.156	0.108	0.324	0.205	0.178	0.086	0.279	0.242	0.220	0.083	0.202

ARC appearance-related cyberbullying; *B* unstandardised beta coefficient; *β* standardised beta coefficient; *p* p-value; *R* correlation coefficient; *SE* standard error.
*p < 0.05, **p < 0.001

Discussion

The impact of ARC on adolescent mental health is an emerging and critical area of research. Our study contributes valuable insights to the growing body of cyberbullying and body image literature by examining the intricate relationship between ARC and various psychological variables in adolescent females. Collectively, our findings reveal that experiences of ARC-victimisation are associated with significantly elevated levels of body shape concern, body shame, and ED symptomology, coupled with diminished levels of body esteem and body appreciation in adolescent females. Additionally, such experiences were associated with a heightened desire among adolescent females to alter their physical appearance through practices such as dieting, exercise, changing self-presentation, and/or cosmetic procedures. These findings support our hypothesis, and highlight the detrimental effects of ARC on body image and eating disorder-related variables in adolescent females.

The proliferation of social media use among adolescents has coincided with a surge in cyberbullying, particularly concerning body image and EDs among adolescent females. While valuable, prior research into ARC is limited [5] and often faces methodological challenges such as the absence of validated tools for assessing ARC's prevalence, frequency, types, and consequences.

Our investigation into ARC utilises three targeted measures to explore its different dimensions among adolescent females. These measures allow us to identify the prevalence and specific roles individuals assume in ARC situations, the types of ARC experienced, and the extent to which ARC is perceived to impact an individual's desire to alter their physical appearance. This approach facilitates a deeper understanding of ARC and its influence on adolescent body image and ED variables, emphasising the critical need for methodological progress in the study of cyberbullying. The lack of suitable measures necessitated the curation of items which captured the varied outcomes of ARC. We acknowledge that while these measures were based on frameworks established in previous research [5, 25, 76], these measures have not undergone rigorous testing to ensure their psychometric properties are suitable. Accordingly, we encourage researchers to develop measures in this space which are generalisable across diverse populations and cultural contexts.

In line with earlier results from Berne et al. [5], body shape and size emerged as the primary focus of ARC encounters reported by our sample of adolescent females. Building on this foundation, our findings indicate that ARC targeting body shape and size is significantly associated with the desire among adolescent females to change their body shape, size, or other physical attributes through means such as dieting or exercising because of perceived ARC. Considering the established link between dieting behaviours and the increased risk of developing long-term disordered eating behaviours and EDs during adolescence, it is critical to identify the risk factors that lead to dieting. Our study uniquely contributes to this understanding by highlighting the potential role of ARC

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as an important factor associated with dieting behaviours among adolescent females.

Furthermore, encounters with ARC were linked to a heightened desire among adolescent females to change their self-presentation, involving adjustments to their hair, makeup, and/or clothing. Drawing from existing literature, the inclination to alter one's appearance has been recognised as a potential catalyst for the development of negative body image perceptions, reduced self-esteem, and other adverse psychological outcomes [12, 58]. Moreover, societal pressures to conform to prevailing beauty standards have been associated with the adoption of unhealthy weight control behaviours and disordered eating patterns [20]. Hence, it is essential for both research efforts and intervention strategies to thoroughly acknowledge the influential role of ARC in shaping these dynamics.

Finally, our study aligns with existing research that has indicated a connection between bullying and an increased desire for cosmetic procedures among adolescent females [43]. Importantly, we extend current research by revealing that ARC-victimisation is significantly associated with the desire to alter aspects of physical appearance through cosmetic procedures because of perceived ARC. Specifically, cyberbullying targeting specific body attributes emerged as the sole individual variable significantly associated with this desire, demonstrating the intricate consequences of ARC among adolescent females. Collectively, these findings highlight the urgent need for targeted interventions, such as age-appropriate social media policies, health promotion programs encouraging positive online behaviour, and strategies to address the impacts of ARC to protect the mental well-being of adolescent females.

Limitations and implications

While our study provides valuable insights into the impacts of ARC on adolescent females, it is not without limitations. Firstly, the sample consisted exclusively of female (sex assigned at birth) participants within a narrow age range. Although this specificity is a strength, allowing for a detailed exploration within a highly affected group, it also limits the applicability of our results to broader, more diverse populations. Thus, diverse, and intersectional analyses, incorporating various genders, ethnicities, and socioeconomic backgrounds, are essential to contributing to a more comprehensive understanding of how ARC affects different demographic groups. This is especially important considering the prevalence of body image disturbances and eating disorders among gender and sexually diverse communities [11] and racial minority groups [8, 9]. Additionally, the reliance on self-report data may introduce bias, and the cross-sectional nature of the study limits our ability to establish causal relationships. The cross-sectional design hinders causal inferences, emphasising the need for longitudinal investigations to uncover the temporal dynamics of ARC and its psychological consequences.

Moreover, our study did not include a measure for ARC bystander experiences, a vital component considering the prevalence of bystander involvement in cyberbullying incidents, especially within social media contexts [28]. Addressing this gap is crucial, as bystanders' exposure to ARC could amplify societal beauty standards, contributing to the internalisation of the thin ideal and body dissatisfaction among adolescents. Specifically, observing cyberbullying that targets body image and appearance may exacerbate young females' concerns over being subjected to similar negative feedback, potentially driving them towards unhealthy behaviours to conform to societal body image expectations. Future research should incorporate assessments of cyberbystander experiences to gain a comprehensive understanding of the broader impact of cyberbullying on adolescent well-being. Including the perspective of bystanders will enhance our insight into the ways in which witnessing ARC influences adolescents' perceptions of body image, self-esteem, and overall mental health. Expanding the scope to include ARC-bystanders is essential for a more complete evaluation of the role of social and cultural norms in perpetuating body image issues and for crafting solutions that foster healthier online interactions.

Another potential limitation of our study is the design of one of the ARC measures, which was intended to capture participants' perceptions of the impact of ARC on their desire to change their appearance through diet, exercise, or cosmetic procedures. Accordingly, our findings likely reflect perceived impacts rather than a causal relationship. Future research should employ longitudinal designs or alternative methodologies to better disentangle the relationships between cyberbullying experiences, body dissatisfaction, and body modification desires. For instance, future studies could include measures of general body dissatisfaction and desire for appearance changes without directly attributing these to ARC experiences, providing a clearer understanding of these comparative dynamics.

Additionally, the absence of a standard definition of ARC in our measure presents another limitation. This omission may lead to varied interpretations of what constitutes cyberbullying, potentially impacting the consistency and reliability of our findings. Including a clear definition of ARC before presenting the questions could help ensure a more uniform understanding among participants and improve the reliability of self-reported data.

Future studies should incorporate such definitions to enhance the clarity and accuracy of the data collected.

Future research will provide the opportunity to enhance our comprehension of ARC among adolescents and its complex effects on mental health. One direction involves integrating neurobiological approaches to investigate the neural mechanisms involved in ARC, body dissatisfaction, and eating disorders on the developing adolescent brain. This approach is pivotal in identifying how ARC impacts key developing brain areas involved in emotional regulation, self-esteem, and body image processing, such as the limbic system, prefrontal cortex, and the visual and somatosensory cortices. These areas are critical for managing emotions, self-perception, and integrating visual and somatic information related to one's body image.

Employing advanced neuroimaging techniques like functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI), researchers have been able to map the specific brain changes and neural circuits altered by the negative experiences associated with ARC and body image concerns. For example, studies utilising fMRI have revealed significant alterations in the prefrontal cortex (PFC) and limbic system—areas crucial for emotional regulation and stress response—in adolescents exposed to victimisation [23, 69]. These changes highlight the profound impact of cyberbullying on the emotional and psychological well-being of adolescents. Similarly, research has identified aberrant activation in these regions among adolescents with body image concerns and EDs, highlighting the neural basis of such issues [59, 81]. Further, investigations employing DTI have documented changes in white matter integrity in brain areas pivotal for body image and self-perception in adolescents with EDs [26, 31]. This comprehensive mapping not only corroborates the subjective psychological distress reported by victims of ARC, but also begins to reveal the underlying neural mechanisms, laying a foundational basis for the development of targeted interventions. Thus, neuroimaging research offers critical insights into the intricate relationship between ARC and adolescent brain development, charting a path toward more effective prevention and treatment strategies. By incorporating these neuroimaging findings into therapeutic practices, we can more adeptly address the multifaceted impacts of ARC on adolescent mental health, contributing to the advancement of nuanced and effective interventions.

Conclusion

To summarise, this is the first study to provide a robust examination of appearance-related cyberbullying and its implications for the mental health and well-being of adolescent females. The research identified a strong positive correlation between experiences of appearance-related cybervictimisation and heightened concerns about body shape, body shame, and symptoms of eating disorders. Inversely, these experiences were linked to lower body esteem and body appreciation. Additionally, ARC-victimisation was associated with the inclination among adolescent females towards changing their appearance through dieting, exercising, altering self-presentation, and considering cosmetic procedures. The nuanced insights into specific targets of ARC and desires for change, coupled with a detailed analysis of psychological outcomes and regression models, enhance our understanding of the complex interplay between ARC and its effects on self-perception, body image, and eating disorders in adolescent females. These findings highlight the need for future research to explore potential prevention interventions to support the mental well-being of adolescent females affected by ARC.

Supplementary Information

Additional file 1.

Declarations

Ethics approval and consent to participate
This study was approved by the Human Research Ethics committee at home institution of the lead author (approval number S221703). All participants provided informed electronic consent before commencing the survey.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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