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RESEARCH ARTICLE



The development of gender biases in the attribution of distributive fairness

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ABSTRACT

We explored the early emergence and development of gender biases concerning expectations of fairness in the context of distributive actions. Children aged 2.5-, 6-, and 9 years, and adults watched events displaying fair and unfair distributive actions performed by a hidden distributor, and then, they were asked to guess the identity of the distributors by reaching for one of two drawings, or photos, depicting a male and a female face. Children attributed the fair distribution of resources more frequently to the male than to the female distributor, and they attributed the unfair distribution more frequently to the female distributor. Adults, by contrast, showed the opposite pattern of responses. Overall, these findings provide evidence of an early-emerging gender bias in reasoning about distributive fairness and support the prior literature on late-occurring developmental shifts in gender prejudices.

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KEYWORDS Gender bias; distributive actions; fairness; evaluations; socio-moral development

1. Introduction

‘Informed critical agency is important in combatting inequality of every kind, and gender inequality is no exception’ (Sen, 2001, p. 12). To date, the problem of gender inequality exists in most parts of the world, but it is not everywhere the same since it takes many different forms (Ridgeway, 2011). An important developmental question concerns the interplay between gender bias and distributive fairness since the distribution of resources establishes and maintains relationships (Corsaro, 2017). Developmental studies demonstrated that in the context of resource allocation where recipients belong to different groups (i.e., gender or race), children may justify unequal distributive actions to maintain status hierarchies, by favouring those who are similar to belonging to a group or adhering to

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stereotypes (Elenbaas et al., 2016; Olson et al., 2011; Renno & Shutts, 2015). Although it is well demonstrated that moral concerns relating to the issues of fairness, equity, and group identity develop early (Geraci, 2022; Sommerville, 2022; Surian et al., 2025), it is clear that they have implications for moral decisions throughout life in adulthood (Sims et al., 2023). Therefore, investigating the origins and development of children's thoughts about social categorization and gender prejudice provides valuable insight into how systems of inequity are perpetuated across generations, and how an initial gender bias may be mitigated in the first years of life (Heck et al., 2022).

A rich literature on the development of gender shows that children learn to categorize themselves and others as boys and girls from the second year of age (Fagot & Leinbach, 1993; Miller, 1983; Thompson, 1975). Along with gender differentiation comes a bias in partner choice, since children increasingly tend to choose playmates of the same sex (Glick & Hilt, 2000). Gender bias is defined as any one of the variety of stereotypical beliefs about individuals based on their gender, while gender stereotype is instead a fixed and simplified concept of the attitudes and behaviours considered appropriate for specific genders (VandenBos, 2015). Developmental research from the past decades has provided evidence of younger children's gender prejudice from 3 years of age (Bigler & Liben, 2007), and a peak of this prejudice from ages 5 to 7 years (Allport, 1954; Glick & Hilt, 2000; Trautner et al., 2005). Indeed, children in this age range have also developed a sense of gender constancy, which motivates a negative attitude towards another person or group based on their gender, which can be defined as a gender prejudice (VandenBos, 2015).

Prior empirical research has explored gender biases before the three years of life, demonstrating early knowledge and beliefs about adult gender-stereotyped activities (Eichstedt et al., 2002; Martin & Little, 1990; Poulin-Dubois et al., 2002; Serbin et al., 2002).

Concerning early expectations about others' distributive actions, previous research demonstrated an early-emerging sense of fairness (Geraci & Surian, 2011; Sloane et al., 2012; Surian et al., 2025; Ting et al., 2019), as well as a sensitivity to the identity of the recipients in infants' expectations of distributive actions (Bian et al., 2018; Burns & Sommerville, 2014) as well as in preschoolers' allocation of resources (Elenbaas et al., 2016; Olson & Spelke, 2008; Renno & Shutts, 2015; Rizzo et al., 2020). There are reasons to expect an early emergence of gender biases due to early experiences. Mothers typically manage food, provide care for their infants, and systematically consider children's needs (Britton et al., 2006; Linde et al., 2020; Slade et al., 1999). Moreover, previous animal studies found remarkable behavioural differences between males and females. For example, males of capuchin monkeys share resources indiscriminately with almost all partners, whereas capuchin females

share with their offspring and those with whom they have developed a mutual relationship (Britton et al., 2006).

Thus, both early experience and evolved processing mechanisms may lead to form expectations of favouritism when predicting the distributive actions of a female. Evolutionary research suggests that different attitudes to distributing resources may have evolved owing to different reproductive strategies and group pressures on males and females (Tomasello, 1999). In his seminal work on the development of moral judgement, Piaget (1932) proposed that male children had a more elaborate sense of norms than females, as manifested by their passion for complex systems and rules governing their spontaneous games. A rich tradition of research has also tried to assess the idea that male morality is dominated by abstract principles, including the principle of fairness, while female morality is best characterized as centred on caring concerns (Gilligan, 1982), giving rise to mixed results (Jaffee & Hyde, 2000).

Three different views have been proposed by developmental theorists trying to understand when and how gender categorization creates prejudice. The first one, the Social Learning Theory (Allport, 1954; Bandura, 1977; Bussey & Bandura, 1999) claimed that children learn prejudice and intergroup attitudes from parents, both directly and vicariously through observation. The second one, the Social Identity Development Theory (Nesdale, 1999; cf. Tajfel & Turner, 2004), posits that the concept of ingroup becomes an extension of the self, so one's self-esteem is increased when one's group is positively evaluated (Oakes & Turner, 1980). Thus, belonging to a group motivates individuals to evaluate their group more positively than other groups. The third one, the social-cognitive developmental theory, states that prejudice is affected by social and neurocognitive developments (Aboud, 1988, 2008), so when children become able to notice the differences between social groups, they start to evaluate individuals based on group membership (Aboud, 1988).

One way to know the origins of gender concerns is to investigate the attribution of responsibility for social action to one of the two male and female agents, such as a fair or unfair distribution of resources. In a recent study, some researchers investigated whether White 2.5-year-old and 7-year-old children's evaluations may be influenced by an initial racial bias, when both out-group and in-group protagonists (i.e., Black or White faces) were evaluated directly by attributing the responsibility of negative or positive outcomes, such as fair or unfair distributive actions (Geraci et al., 2024). Geraci et al. (2024), in line with prior findings, suggesting that photographs provoke more emotional reactions in children than drawings (Guerrero et al., 2010; MacDonald et al., 1996), presented children with a forced-choice task by using drawings or photographs of human faces. They found no race bias in toddlers, but an early intergroup coalition, which was a pro-Black/anti-White bias. Conversely, a race

prejudice was found in 7-year-olds (i.e., pro-White/anti-Black bias). Both age groups manifested these reactions when the Black or White faces were shown by photographs, but not when drawings of faces were used. Crucially, these findings suggest young children might not have a negative racial stereotype: No previous study explored the presence of negative gender bias in young children, a bias that may reveal an early emerging gender stereotype linked to fairness attributions.

There is a rich literature on the onset of infants' evaluations of distributive actions, which demonstrates an early-emerging sense of fairness (Geraci & Surian, 2011; Schmidt et al., 2011; Sloane et al., 2012; Ting et al., 2019; reviews see; Sommerville, 2022; Surian et al., 2025; Ting et al., 2020; Wood & Eagly, 2002). In particular, recent studies demonstrated 4-month-olds' expectations of equal over unequal allocation of resources (Buyukozer Dawkins et al., 2019), as well as a preference for fair over unfair distributors (Geraci & Surian, 2023a). These findings support recent developmental views suggesting an early-emerging moral core (Hamlin, 2013). Other studies have found that by 3 years of age, children recognize that monopolizing shared resources is unfair (Smetana & Ball, 2019), distribute resources equally among peers in third-party contexts (Olson & Spelke, 2008), and judge others' distributive actions Rizzo and Killen (2016). By 6 years of age, children allocate resources according to equity principles, distribute more resources to peers with less, and judge this action as fair in their verbal evaluations (Essler & Paulus, 2021; Schmidt et al., 2016). Some researchers also provided evidence for developmental changes in children's developing moral reasoning (Killen & Smetana, 2015; Rizzo & Killen, 2016). Another line of research demonstrated that infants can attribute moral traits to individuals, by linking the domains of fairness and prosocial actions (Surian et al., 2018), and use an individual's behaviour in one moral domain to make inferences about future actions in another moral domain (Ting et al., 2019), like children (Gill et al., 2023) and adults (Goodwin et al., 2014).

The current study investigated whether toddlers and school-aged children consider men and women equally likely to perform fair and unfair distributions of resources. If, by contrast, they hold a gender bias on this issue, they should guess that a fair or unfair division of resources is more likely to be the result of a distribution performed by a man, or by a woman. Following the method used by Geraci et al. (2024), in a within-subjects design, children were tested in two conditions (i.e., fair condition and unfair condition), in each of which participants, after viewing familiarization events, were presented with a forced-choice task.

The main aim of the present study was twofold. First, we wanted to investigate whether toddlers' attributions of distributive actions to an agent are affected by the gender of the distributor (Experiment 1). Second, we aimed to explore the existence of possible developmental shifts in this

attribution process by assessing two groups of older children as well as a group of adults (Experiments 2–4).

In addition to the decision to explore the origin of the gender bias in toddlerhood, the other two school age groups were selected based on prior findings revealing a peak of children's gender prejudice between 5 and 7 years (Allport, 1954; Glick & Hilt, 2000; Trautner et al., 2005), so we recruited participants with a mean age of 6 years and also 9-year-olds, and adults, to explore the developmental trajectory of gender bias. To investigate the possible role of social experiences on the development of gender prejudice, we considered some variables as possible predictors, such as families' SES and related cultural differences that affect adult and children's concerns on distributive actions (Henrich et al., 2005), and the presence of siblings that influences early cooperative behaviours (Dunn & Munn, 1986; Fehr et al., 2008; Ziv & Sommerville, 2017) and promotes imitative learning (Barr & Hayne, 2003). We collected information regarding whether our participants had siblings or not to test any links between gender bias and family experiences. This study was approved by the Internal Ethic Review Board of Psychology Research – IERB- Department of Educational Sciences, University of Catania.

2. Method

2.1. Experiment 1

2.1.1. Power analyses

No previous study on toddlers' gender bias was available to obtain the measured effect size for this study. A priori power analysis in G*Power (Faul et al., 2007) was performed for the binomial test employed in the forced-choice task (generic binomial test with proportions of $p_1 = 0.30$ and $p_2 = 0.70$, the statistical power of at least 0.90, and an alpha level of 0.05): the result indicated that a sample of 13 toddlers would be needed to detect the effect. An additional power analysis was performed for McNemar's test, by selecting a two-tailed, 3.0 effect size at an alpha of .05, 80% power, and 75% of the discordant proportion pairs: the results suggest that 40 participants would be needed to detect the effect. Thus, to achieve the pre-specified power we recruited 40 participants for each study.

2.1.2. Participants

Forty healthy toddlers participated (2.5-year-olds: $N = 40$; $M_{age} = 30$ months and 7 days; $range = 26$ months and 5 days to 36 months; 21 males). All participants were White. We asked the toddlers' parents to complete a questionnaire to provide information about the toddlers' date of birth, gender, development, and family information. According to the information given

by the parents, all toddlers had typical development of social, verbal, motor, and cognitive skills. The families' SESs, measured with Hollingshead's (1975) Four-Factor Index, reflected middle-high income ($SES_{tot} = 53$). Two additional toddlers were tested and excluded from the analysis because they did not follow familiarization events because they were fussy. All parents had given written consent and received printed information about this research.

2.1.3. Apparatus

The experiment was conducted in a quiet room of a nursery school. The stimuli were presented on a 14-inch monitor via a laptop. Toddlers were seated on a little chair, 60 cm from the monitor, while the experimenter was behind a white curtain and controlled the stimuli presentation using a mouse.

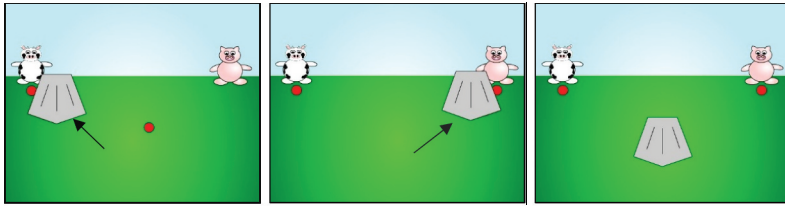
2.1.4. Stimuli and procedure

Familiarization events were aimed at providing toddlers with information about distributive actions and outcomes. They were the same as those used by Geraci et al. (2024). In each familiarization event, toddlers were shown three agents in a scenario characterized by a green lawn (like in Geraci & Surian, 2011, 2023b). At the start of each event, following an attractive sound, toddlers saw the distributor that was covered by a grey box and placed in the centre of the lawn with two apples. Then, the other two agents, which were represented by two animal figures and played the roles of receivers (i.e., cow and pig), entered the scene from the sides of the screen, one from the left and one from the right side of the screen. In the 'fair distribution', the distributor gave an apple to each of the two receivers. In the 'unfair distribution' the distributor gave the second apple to the same receiver, giving two apples only to one of the two receivers (see Figure 1a). The duration of each familiarization event was 16 s, as in Geraci et al. (2024). The order of presentation of conditions (i.e., fair distribution vs unfair distribution) was counter-balanced across subjects. Following each familiarization event, the experimenter fixed and blocked the final scene of the distribution on the monitor, and then, toddlers were presented with a forced-choice task.

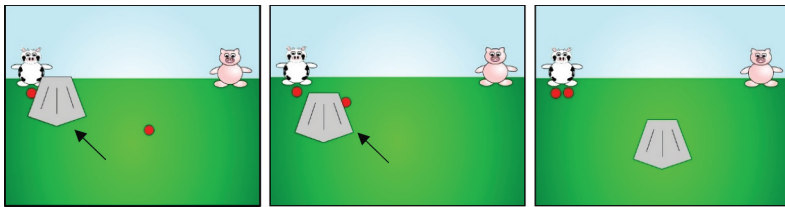
A second experimenter who was blind to the familiarization events held the pictures in front of the toddlers, approximately 30 cm apart and initially out of reach. These pictures (10 cm × 13 cm) were placed in front of the toddler by using a 50 cm × 30 cm dark-grey foam tray, and they showed two drawings depicting male and female faces (i.e., cartoon faces; adapted pictures from <https://www.freepik.com>). All drawings depicting faces were presented against a black background, and in frontal orientation with a happy expression. All female and male faces presented somatic features of the toddlers' local population (i.e., the colour of skin, eyes, and hair) (see stimuli Figure 1b). Two different pairs of faces were used, so toddlers were presented

a) Familiarization events

Fair distribution



Unfair distribution Condition



b) Forced-choice task

Experiments 1 and 3-4

Experiment 2



(Pair 1)



(Pair 2)

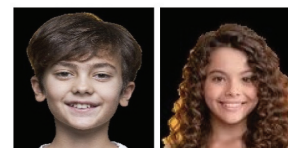


Figure 1. Schematic illustrations of familiarization events (a) and pictures used in the forced-choice task in Experiments 1–3(b).

with a different pair of faces in each condition. In each pair, male and female faces were similar in somatic features.

Toddlers were required to look at both pictures, while these were out of reach and later to choose one of the two; once they did so, the shapes were moved within reach. The experimenter asked: 'Which one of the two characters did this (while indicating the final scene of the familiarization event on the monitor)? Pick it up!'. She looked at the toddler during the verbal request and then moved her gaze to the centre of the black foam tray. The choice was determined online by the first experimenter as the first picture that toddlers contacted with a visually guided manual reach. The position of the two pictures was counterbalanced across subjects.

2.1.5. Results

By comparing gender choices across fair and unfair conditions, the patterns of choices towards male and female faces in the two conditions were significantly different, $\chi^2(1, 40) = 6.084, p = .014, \phi = .275$.

Fair distribution of resources. Twenty-seven (67.5%) toddlers chose the male face and 13 (32.5%) chose the female face ($p = .038$, binomial test, two-tailed; medium *Cohen's g* = .170, see Cohen, 1988) (see Figure 2a). Multiple linear regression was used to test the effect of toddlers' gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .019, F(4, 35) = .167, p = .953$). It was found that the gender of participants ($\beta = .032, p = .851$), presence of siblings ($\beta = .035, p = .836$), SES ($\beta = .002, p = .506$), and order of conditions ($\beta = .015, p = .928$) did not significantly predict toddlers' choices.

Unfair distribution of resources. Sixteen (40%) toddlers chose the male face and 24 (60%) chose the female face ($p = .268$, binomial test, two-tailed; small *Cohen's g* = .10, see Cohen, 1988) (see Figure 2a). Multiple linear regression was used to test the effect of toddlers' gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .019, F(4, 35) = .036, p = .997$). It was found that gender ($\beta = .062, p = .728$), the presence of siblings ($\beta = .005, p = .976$), SES ($\beta = .001, p = .972$), and the order of conditions ($\beta = .014, p = .938$) did not significantly predict toddlers' choices.

A statistically reliable gender bias was also found when we compared the responses given by each participant on both kinds of distributions. We found that 11 toddlers attributed both kinds of distributions to male characters eight toddlers attributed both distributions to female characters, 16 toddlers attributed the fair distribution to the male character and the unfair distribution to the female character, but only five toddlers showed the opposite pattern (McNemar $\chi^2 = 4.762, p = .027$).

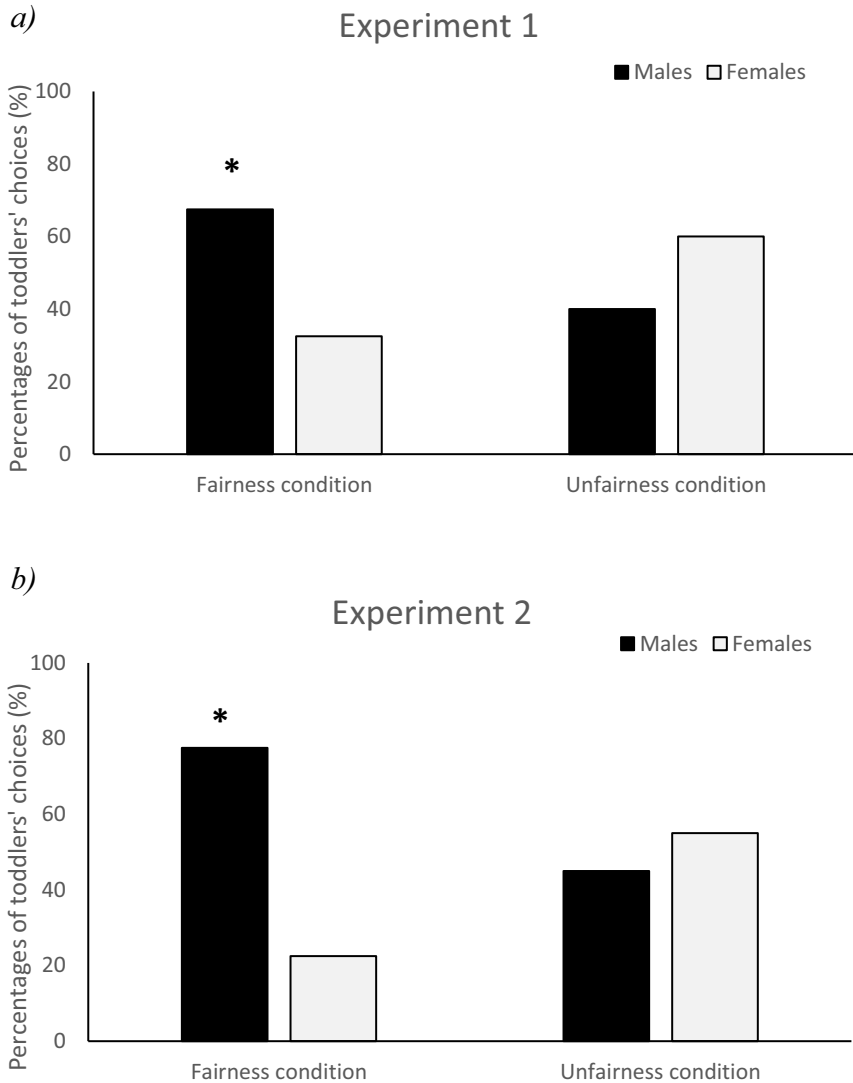


Figure 2. Percentages of toddlers' choices of Experiments 1 (a) and 2 (b).

2.1.6. Discussion

When toddlers were presented with a fair distribution of resource condition, they showed a gender bias in their attributions since they were more likely to attribute the fair distribution to the male than to the female characters. By contrast, when they were presented with an unfair distribution of resource condition, they did not show any gender bias. These results suggest the early emergence of a gender bias in toddlerhood, extending prior findings on the onset of gender bias from 3 years of age

(e.g., Bigler & Liben, 2007; Hester & Gray, 2020). Since no significant effect of our predictors was found, we found no support for the claim that this initial gender bias could be affected by social and family experiences (Grossmann et al., 2008; Lamb, 2004; Meuwissen & Carlson, 2015; Russell & Saebel, 1997). Furthermore, the lack of significant results of our predictors seems to suggest an early-emerging gender bias, in line with evolutionary theoretical accounts supporting the influence of group pressures on males and females. Indeed, the females' propensity to distribute resources with greater caution (i.e., 'there is not always food for everyone!') can be explained as an adaptation to ensure the survival of offspring, in particular of the neediest sons (Henrich & Muthukrishna, 2021; Trivers, 1971).

2.2. Experiment 2

Since it is well known that the realism of a photograph provokes more emotional reactions in toddlers than a simple line drawing (Geraci et al., 2024; Guerrero et al., 2010; MacDonald et al., 1996), we carried out an additional study to replicate the results of Experiment 1 by replacing drawings with photographs.

2.2.1. Participants

Forty healthy toddlers participated (2.5-year-olds: $N = 40$; $M_{\text{age}} = 32$ months and 5 days; $\text{range} = 27$ months to 36 months; 25 males). All participants were White. We asked the toddlers' parents to complete a questionnaire to provide information about the toddlers' date of birth, gender, development, and family information. According to the information given by their parents, all toddlers had typical development of social, verbal, motor, and cognitive skills. The families' SESs, measured with Hollingshead's (1975) Four-Factor Index, reflected middle-high income ($SES_{\text{tot}} = 53.2$). Three additional toddlers were tested and excluded from the analysis because they were fussy. All parents had given written consent and received printed information about this research.

2.2.2. Apparatus

Like Experiment 1, this experiment was conducted in a quiet room of a nursery school. The stimuli were presented on a 14-inch monitor via a laptop. Toddlers were seated on a little chair, 60 cm from the monitor, while the experimenter was behind a white curtain and controlled the stimuli presentation using a mouse.

2.2.3. Stimuli and procedure

Stimuli and procedure were the same as used in Experiment 1, with the exception that in the test phase, the drawings depicting male and female cartoon faces were replaced by photographs showing male and female real faces (see Figure 1b).

2.2.4. Results

By comparing gender choices across fair and unfair conditions, the patterns of choices towards male or female faces in the two conditions were significantly different, $\chi^2(1, 40) = 8.901, p = .003, \phi = .333$.

Fair distribution of resources. Thirty-one (77.5%) toddlers chose the male face and nine (22.5%) toddlers chose the female face ($p = .001$, binomial test, two-tailed; large *Cohen's g* = .275, see Cohen, 1988) (see Figure 2b). Multiple linear regression was used to test the effect of toddlers' gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .060, F(4, 35) = .560, p = .693$). It was found that the gender of participants ($\beta = .215, p = .164$), the presence of siblings ($\beta = .102, p = .536$), order of conditions ($\beta = -.054, p = .717$), and SES ($\beta = .001, p = .960$) did not significantly predict toddlers' choices.

Unfair distribution of resources. Eighteen (45%) toddlers chose the male face and 22 toddlers chose the female face (55%) ($p = .636$, binomial test, two-tailed; negligible *Cohen's g* = .05, see Cohen, 1988) (see Figure 2b). Multiple linear regression was used to test the effect of toddlers' gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .137, F(4, 35) = 1.388, p = .258$). It was found that the gender of participants ($\beta = .018, p = .918$), the presence of siblings ($\beta = .001, p = .994$), the order of conditions ($\beta = .145, p = .395$), and SES ($\beta = .009, p = .056$) did not significantly predict toddlers' choices.

A gender bias was also found when we compared the responses given by each participant on both kinds of distribution. We found that 14 toddlers attributed both kinds of distributions to male characters, 5 toddlers attributed both distributions to female characters, 17 toddlers attributed the fair distribution to the male character and the unfair distribution to the female character, but only four toddlers did the opposite pattern (McNemar $\chi^2 = 6.857, p = .008$).

2.2. 6 Discussion

The current results replicate the results of Experiment 1, confirming an early gender bias in the second year of life. No significant effect of predictors was found, supporting that this initial gender bias is not affected by family experiences. Differently from toddlers' reactions that were found about race bias when they were presented only with photographs of faces (Geraci et al., 2024), here the use of photographs or drawings did not determine different results, extending prior literature on methods to investigate toddlers' prejudices (Guerrero et al., 2010; MacDonald et al., 1996).

2.3. Experiment 3

To study the developmental trajectory of this gender bias, an additional experiment was carried out on 6- and 9-year-old children, presenting children, with drawings depicting human faces that are the same used in Experiment 1. Moreover, the stimuli are similar to those used in recent studies on school-aged children's concerns for fairness and social categorization (Elenbaas et al., 2016). Prior findings have reported a peak of gender stereotypes between 5 and 7 years of age (Allport, 1954; Glick & Hilt, 2000; Trautner et al., 2005); therefore, we expect a strong gender bias in these two age groups.

2.3.1. Participants

The sample of 80 healthy children: forty 6-year-olds ($M_{\text{age}} = 75$ months and 6 days; $\text{range} = 71$ months and 15 days to 80 months; 20 males), and forty 9-year-olds ($M_{\text{age}} = 110$ months and 3 days; $\text{range} = 102$ months and 10 days to 112 months; 18 males). All participants were White. We asked the children's parents to complete a questionnaire to provide information about the children's date of birth, gender, development, and family information. According to the information given by their parents, all children had typical development of social, verbal, motor, and cognitive skills. The families' SESs, measured with Hollingshead's (1975) Four-Factor Index, reflected middle-high income for both age groups ($SES_{6\text{-year-olds}} = 52$; $SES_{9\text{-year-olds}} = 49$). All parents had given written consent and received printed information about this research.

2.3.2. Apparatus

Like Experiment 1, this experiment was conducted in a quiet room of a primary school. The stimuli were presented on a 14-inch monitor via a laptop. Children were seated on a little chair, 60 cm from the monitor, while the experimenter was behind a white curtain and controlled the stimulus presentation using a mouse.

2.3.3. Stimuli and Procedure

Stimuli and procedure were the same used in Experiment 1.

2.3.4. Results

Fair distribution of resources

Six-year-olds. By comparing gender choices across fair and unfair conditions, the patterns of choices towards male and female faces in the two conditions were significantly different, $\chi^2(1, 40) = 9.825$, $p = .002$, $\phi = .350$. Twenty-eight (70%) children chose the male face and 12 (30%) children chose the female face ($p = .017$, binomial test,

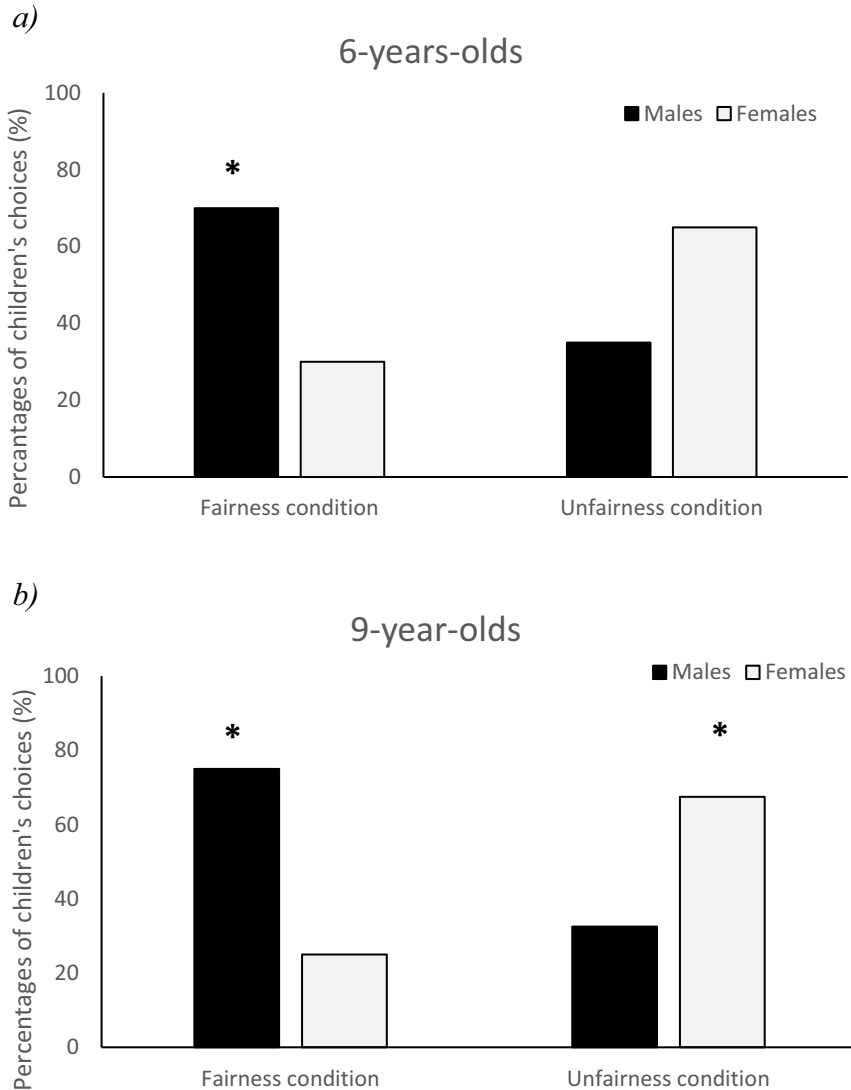


Figure 3. Percentages of 6-year-old (a) and 9-year-old (b) children's choices in Experiment,

two-tailed; medium *Cohen's g* = .20, see Cohen, 1988) (see Figure 3a). Multiple linear regression was used to test the effect of children's gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .141$, $F(4, 35) = 2.069$, $p = .106$). It was found that the gender of participants ($\beta = .227$, $p = .119$), presence of siblings ($\beta = -.089$, $p = .574$), order of conditions ($\beta = -.280$,

$p = .060$), and SES ($\beta = .003$, $p = .362$) did not significantly predict children's choices.

Nine-year-olds. By comparing gender choices across fair and unfair conditions, the patterns of choices towards male and female faces in the two conditions were significantly different, $\chi^2 (1, 40) = 14.532$, $p = .001$, $\phi = .426$. Thirty children (75%) chose the male face and 10 (25%) children chose the female face ($p = .002$, binomial test, two-tailed; large, *Cohen's g* = .250, see Cohen, 1988) (see Figure 3b). Multiple linear regression was used to test the effect of toddlers' gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .063$, $F (4, 35) = .584$, $p = .676$). It was found that the gender of participants ($\beta = .164$, $p = .282$), the presence of siblings ($\beta = .174$, $p = .344$), order of conditions ($\beta = .101$, $p = .496$), and SES ($\beta = .003$, $p = .398$) did not significantly predict children's choices.

2.3.3.1. Unfair distribution of resources. *Six-year-olds.* Fourteen (35%) children chose the male face and 26 (65%) children chose the female face ($p = .081$, N.S., binomial test, two-tailed; small *Cohen's g* = .15, see Cohen, 1988) (see Figure 3a). Multiple linear regression was used to test the effect of children's gender, presence of siblings, order of conditions, and SES. The overall regression was statistically significant ($R^2 = .357$, $F (4, 35) = 4.864$, $p = .003$). It was found that the gender of participants ($\beta = -.313$, $p = .023$) and the presence of siblings ($\beta = .449$, $p = .004$) significantly predicted children's choices, but not the order of conditions ($\beta = -.028$, $p = .835$) and SES ($\beta = .001$, $p = .622$). In particular, concerning the gender of participants, 16 (84.2%) of 19 male children chose the female face ($p = .004$, binomial test, two-tailed; high *Cohen's g* = .34, see Cohen, 1988), while 11 (52%) of 21 female children chose the female face ($p = 1$, binomial test, two-tailed; negligible *Cohen's g* = 0.02, see Cohen, 1988). The patterns of choices of female and male participants were significantly different, $\chi^2 (1, 40) = 4.607$, $p = .032$, $\phi = .339$. Concerning the presence of siblings, 22 (81.5%) of 27 children with siblings chose the female face ($p = .002$, binomial test, two-tailed; high *Cohen's g* = .31, see Cohen, 1988), while 9 (69%) of 13 children without siblings chose the male face ($p = .267$, binomial test, two-tailed; medium *Cohen's g* = .19, see Cohen, 1988). The patterns of choices of participants with siblings and those without siblings were significantly different, $\chi^2 (1, 40) = 9.920$, $p = .002$, $\phi = .497$.

Nine-year-olds. Thirteen (32.5%) children chose the male face and 27 (67.5%) children chose the female face ($p = .038$, binomial test, two-tailed; medium *Cohen's g* = .17, see Cohen, 1988) (see Figure 3b). Multiple linear regression was used to test the effect of children's gender, presence of siblings, order of conditions, and SES. The overall regression was statistically significant ($R^2 = .275$, $F (4, 35) = 3.320$, $p = .021$). It was found that the

presence of siblings ($\beta = .412$, $p = .022$) significantly predicted children's choices but not the gender of participants ($\beta = -.101$, $p = .486$), order of conditions ($\beta = -.196$, $p = .169$) and SES ($\beta = -.002$, $p = .534$). Concerning the presence of siblings, 24 (80%) of 30 children with siblings chose the female face ($p = .001$, binomial test, two-tailed; high Cohen's $g = .30$, see Cohen, 1988), while 7 (70%) of 10 children without siblings chose the male face ($p = .344$, binomial test, two-tailed; medium Cohen's $g = .20$, see Cohen, 1988). The patterns of choices of participants with siblings and those without siblings were significantly different, $\chi^2(1, 40) = 8.547$, $p = .003$, $\phi = .462$.

A gender bias was also found in both age groups when we compared the responses given by each participant on both kinds of distributions. In 6-year-olds, we found that six children attributed both kinds of distributions to male characters four children attributed both distributions to female characters, 22 children attributed the fair distribution to the male character and the unfair distribution to the female character, but only eight children showed the opposite pattern (McNemar $\chi^2 = 5.633$, $p = .017$).

In 9-year-olds, we found that nine children attributed both kinds of distributions to male characters and six attributed both distributions to female characters, 21 children attributed the fair distribution to the male character and the unfair distribution to the female character, but only four children did the opposite pattern (McNemar $\chi^2 = 10.240$, $p = .001$).

2.3.4. Discussion

Both 6 and 9-year-olds showed a significant tendency to attribute a fair distribution of resources to male distributors. Also, 9-year-olds demonstrated a significant tendency to attribute an unfair distribution to female distributors, whereas 6-year-olds showed no significant choice towards one of the two faces, in the unfair condition. These findings suggest a developmental trend that is consistent with the socio-cognitive developmental views (Allport, 1954; Bandura, 1977). Confirming this, we also found that the presence of siblings predicted children's choices in both age groups, supporting a growing role of social experience in fairness expectations about distributors' genders. School-aged children with siblings manifested a stronger tendency to attribute unfair distributions to female faces, suggesting the role of family experience in the development of gender bias. These findings are in line with prior findings supporting the role of the presence of siblings in social evaluation, as well as in the onset of prosocial actions, such as sharing behaviours (Fehr et al., 2008; Ziv & Sommerville, 2017). Moreover, we found an effect of gender in 6-year-old children's choices, since male children showed a significant tendency to attribute an unfair distribution to female faces. These results support prior findings on gender stereotype rigidity from ages 5 to 7 years (Allport, 1954; Glick & Hilt, 2000; Trautner et al., 2005).

2.4. Experiment 4

To know the developmental trajectory of the bias found in Experiments 1–3 and to explore how this forced-choice task is interpreted also by adults, an additional experiment was carried out by assessing university students with the same method used in Experiments 1 and 3.

2.4.1. Participants

The sample of 40 healthy young adults, which were undergraduate ($M_{\text{age}} = 20$ years; $\text{range} = 18$ to 21 years; 20 males). The participants were recruited from the University of XX, and they were White. We asked them to complete a questionnaire to provide information about their date of birth, gender, development, and family information. All participants had typical development of social, verbal, motor, and cognitive skills. The families' SESs, measured with Hollingshead's (1975) Four-Factor Index reflected middle-high income ($\text{SES} = 52,4$).

2.4.2. Apparatus

This experiment was conducted in a quiet room at the University. The stimuli were presented on a 14-inch monitor via a laptop. Participants were seated on a chair, 60 cm from the monitor, while the experimenter was behind a white curtain and controlled the stimuli presentation using a mouse.

2.4.3. Stimuli and Procedure

Stimuli and procedure were the same used in Experiment 1.

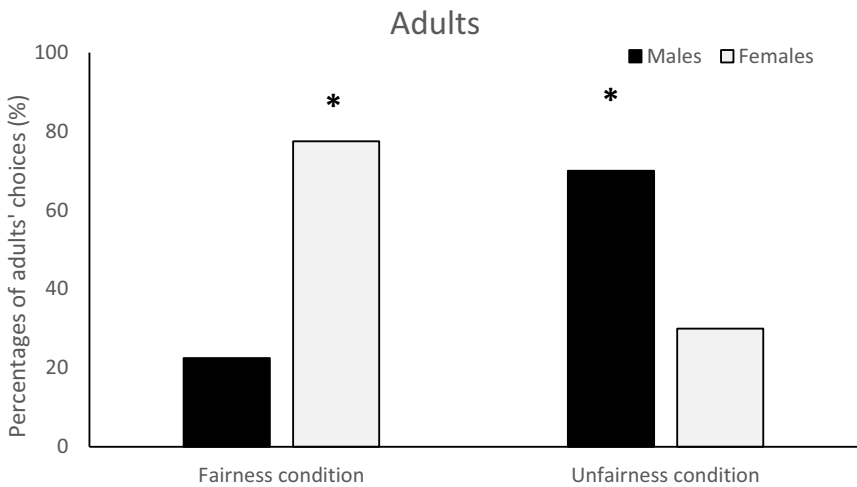


Figure 4. Percentages of adults' choices in Experiment 4.

2.4.4. Results

By comparing gender choices across fair and unfair conditions, the patterns of choices of male and female faces in the two conditions were significantly different, $\chi^2(1, 40) = 18.152, p = .001, \phi = .358$.

Fair distribution of resources. Thirty-one (77.5%) adults chose the female face, and nine (22.5%) adults chose the male face ($p = .001$, binomial test, two-tailed; high Cohen's $g = .27$, see Cohen, 1988) (see Figure 4). Multiple linear regression was used to test the effect of participants' gender, presence of siblings, order of conditions, and SES. The overall regression tended to be significant ($R^2 = .230, F(4, 35) = 2.614, p = .052$). It was found that the gender of the participants was significant ($\beta = .403, p = .004$), while the presence of siblings ($\beta = .286, p = .126$), order of conditions ($\beta = -.028, p = .823$), and SES ($\beta = -.002, p = .585$) did not significantly predict adults' choices. In particular, concerning the gender of participants, 19 (95%) of 20 females chose the female face ($p = .001$, binomial test, two-tailed; high Cohen's $g = .45$, see Cohen, 1988), while 12 (60%) of 20 males chose the female faces ($p = .503$, binomial test, two-tailed; small Cohen's $g = .10$, see Cohen, 1988). The patterns of choices of female and male participants were significantly different, $\chi^2(1, 40) = 7.025, p = .008, \phi = .419$.

Unfair distribution of resources. Twenty-eight (70%) adult participants chose the male face and 12 (30%) participants chose the female face ($p = .017$, binomial test, two-tailed; medium Cohen's $g = .20$, see Cohen, 1988) (see Figure 4). Multiple linear regression was used to test the effect of toddlers' gender, presence of siblings, order of conditions, and SES. The overall regression was not statistically significant ($R^2 = .171, F(4, 35) = 1.801, p = .151$). It was found that the gender of the participants was significant ($\beta = .382, p = .016$), while the presence of siblings ($\beta = .318, p = .135$), order of conditions ($\beta = -.022, p = .876$) and SES ($\beta = -6.225, p = .986$) did not significantly predict adults' choices. In particular, concerning the gender of participants, 17 (85%) of 20 females chose the male face ($p = .002$, binomial test, two-tailed; high Cohen's $g = .35$, see Cohen, 1988), while 11 (55%) of 20 males chose the male faces ($p = .823$, binomial test, two-tailed; small Cohen's $g = .05$, see Cohen, 1988). The patterns of choices of female and male participants were significantly different, $\chi^2(1, 40) = 4.286, p = .038, \phi = .327$.

We found that four adults attributed both kinds of distributions to female characters and 0 attributed both distributions to male characters, 27 adults attributed the fair distribution to the female character and the unfair distribution to the male character, but only nine participants did the opposite pattern (McNemar $\chi^2 = 8.028, p = .004$).

2.4.5. Discussion

Contrary to what we found in children, adults showed a significant tendency to attribute a fair distribution of resources to female distributors and an unfair

distribution to male distributors. In particular, female adults manifested a strong gender bias (i.e., pro-women/anti-men) in evaluations of distributive actions, and so in morally relevant expectations, supporting the prior literature on gender differences in both explicit and implicit prejudice (Ekehammar et al., 2003), as well as on the role of intergroup contact (Endendijk, 2024). Crucially, these results demonstrated that during the emerging adulthood (18–21 years) an increased complexity in gender bias emerges, reflecting an important change in how a gender bias is manifested (Glick & Hilt, 2000). These findings extend the literature on the development of gender bias, revealing a developmental change from childhood to adulthood, since a gender prejudice, in terms of a negative attitude about a person based on their membership in a social group (Aboud, 1988), resulted to be emerged in young adults. Current evidence suggests that an initial gender bias with evolutionary origins, for which females can distribute resources unfairly in specific circumstances, changes and differs between males and females in late adolescence. Thus, females manifest a gender prejudice first, supporting the role of social and cognitive development (Aboud, 1988, 2008), as well as the interplay between the experiences and motivational/self-regulatory mechanisms (Bussey & Bandura, 1999). A possible explanation of this developmental reversal is that in workplaces, men are perceived to be oriented towards ‘agentic’ goals, such as self-affirmation, self-expansion, and dominance, while women are oriented towards ‘communal’ goals, such as selflessness and concern with others (Eagly & Steffen, 1984; Koenig & Eagly, 2014). So, in adulthood, women can be perceived as more prosocial than men and also more oriented to distribute resources equally.

3. General discussion

These findings provide evidence for an early-emerging gender bias (Trautner et al., 2005), by demonstrating fairness-related attributions based on gender from the second year of age and extending prior literature on the development of prejudices (Allport, 1954; Bigler & Liben, 2007; Glick & Hilt, 2000). The present results are coherent with recent evidence on early-emerging racial bias, and late-emerging negative prejudice towards out-group members from 6 years of age (Geraci et al., 2024). In particular, the current findings suggest the existence of an interesting developmental change in the negative gender bias: in the attribution of unfair distribution of resources, 6-year-old boys chose the female face, 9-year-olds did not show any bias, and adult women chose the male face.

Crucially, we consistently found that, by the age of 2.5 years, if children are presented with fair distributions and are asked to ascribe it to a male or a female, they reliably ascribe it to a male than to a female distributor. The early onset of this gender bias seems at odds with the most prominent

theoretical accounts on the origins and development of gender biases. According to one account, toddlers' gender biases are an extension of the self, so one's self-esteem is increased when one's group is positively evaluated (Nesdale, 1999; Oakes & Turner, 1980). In the current study, the gender of participants was not a significant factor either in toddlers' or in children's responses. Thus, belonging to a gender group did not motivate toddlers and children to evaluate their gender group more positively than the other group. According to another prominent account, toddlers learn prejudice from parents' input and family environment (Allport, 1954; Bandura, 1977). Although toddlers' responses are not influenced by social and family experiences, the present data shed light on how the presence of siblings, and so social and family contexts affect school-aged children's responses to unfair distributions (Fehr et al., 2008; Ziv & Sommerville, 2017; see also Geraci et al., 2023).

Crucially, both toddlers and school-aged children's responses reflect a significant tendency to attribute the fair distribution of resources to the male distributor. Two plausible accounts would explain these findings. First, the current results indicate a biological root of gender bias, which could be the result of different reproductive and survival strategies, as well as group pressures on males and females (Tomasello, 1999). Prior findings on animal studies revealed relevant differences between males and females: capuchin males share resources indiscriminately with all partners, whereas capuchin females share with their offspring and with their cooperators. However, these considerations provide no explanation for the reversal of the gender bias we found in adults. Further studies are needed to document more precisely when such a reversal occurs and to cast light on why it occurs. Second, some results on preschool-aged children suggest that social learning may also play a crucial role, suggesting an age-related influence of early social experiences and gendered caregiving roles. For instance, growing children may observe that mothers or female caregivers often prioritize need-based fairness (e.g., responding to siblings' needs), while male caregivers are less involved in daily resource allocation. This kind of exposure could subtly shape gender-linked expectations about fairness and impartiality.

Also, there is evidence that males and females differ in their ability to recognize and interpret moral issues (i.e., moral sensitivity), such as justice and care (Gilligan, 1982), as demonstrated by neuroscience studies (Harenski et al., 2008; cf.; Robertson et al., 2007). In particular, a functional neuroimaging study found that patterns of brain activities during moral processing differ between men and women, after that, they were scanned by using fMRI while viewing unpleasant pictures, half of which depicted moral violations (Harenski et al., 2008). Crucially, the women showed an increased activity in regions associated with care-based moral evaluations (posterior and anterior cingulate, anterior insula), while men showed an increased activity in regions linked to justice-based moral evaluations

(superior temporal sulcus). Thus, the tendency to solve moral conflicts by following justice issues that rest on an ideal of reciprocity and justice may be stronger in men than in women, whereas the tendency to follow care issues that are based on an ideal of attention and response to individuals' needs (empathy) may be stronger in women than in men. Future studies will also need to assess the extent to which the biases we reported in the present study are due to gender preferences as opposed to fairness expectations. Note that a simple gender preference would lead to a similar bias in the two types of trials involving fair and unfair distributions. Therefore, we think it is unlikely that the present results can be accounted for by gender preferences, but it would certainly be useful to carry out experiments explicitly designed to test this possibility.

A different line of explanation may stem from prior research that provided evidence that men tend to be more prosocial than women (De Caroli & Sagone, 2013; Dorrough & Glöckner, 2019; Hine, 2017) and to help more in public or heroic contexts, while women exhibit more empathic, relational helping behaviours (Carlo et al., 2014; Eagly & Crowley, 1986; Fabes & Eisenberg, 1998). More recent developmental studies have also found a gender brilliance stereotype, that is the stereotype associating high-level intellectual ability brilliance with men more than women, in school-aged children (Bian et al., 2017; Shu et al., 2022). Taken together, these findings suggest that gendered beliefs of brilliance are acquired early, and so they can affect children's interests and behaviours until adulthood.

Dorrough and Glöckner (2019) support an a biosocial perspective, according to which innate factors can be accentuated by social influences, in line with the Social Role Theory (Wood & Eagly, 2002). Thus, gender differences vary across cultures and are influenced by the separation of men's and women's roles in the respective nations. Future studies could investigate this gender bias in other WEIRD, and also in non-WEIRD societies. All our participants were living in a specific urban region, and this sample may not be representative of children from other backgrounds. As previously mentioned, there are marked cultural differences in adults' and children's concerns about distributive actions (Henrich et al., 2005; Spadaro et al., 2023), so future studies should test school-aged children or adults from diverse backgrounds to investigate whether and how gender biases are shaped by culture-specific practices. Finally, future research could explore whether and how other factors of daily social life (e.g., media, parenting, role modelling, etc.) may play a role and could be acknowledged as possible contributors to the emergence of gender bias.

Overall, the present results provide evidence of an early-emerging gender bias in reasoning about distributive fairness in the second year of life, and also of a late-emerging gender prejudice from childhood. Certainly, future research is needed to promote discussions and to explore when and how early educational and psychological interventions may help to rectify social inequalities,

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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