



Associations among attitudes towards motherhood, pet-keeping, and postpartum depression symptoms

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Abstract

Certain companion animals' relationship to humans is analogous to child–parent attachment. Further, pet-keeping is associated with less physical and psychological health problems and animal-assisted interventions ameliorate depressive symptoms. Accordingly, cognitive representations of pet-keeping and parenthood may be related, and pet-keeping may protect against postpartum depression symptoms (PPDS). To test these hypotheses, we examined cognitive representations of pet-keeping and motherhood as well as various cognitive correlates of those in 715 women in an online questionnaire. Results indicate that among women who perceive maternity as a burdensome role, pet ownership is associated with an increased likelihood of having had PPDS. Among women with children, pet owners perceive maternity as more burdensome than non-owners and pet owners with a more positive attitude towards their pets are more likely to find maternity as a burdensome role. These findings suggest a relationship between women's thoughts regarding pets and motherhood and also that, to some degree, women perceive pets as playing a similar role as children. Importantly, childless women who own a pet perceived motherhood as less difficult; this effect of pet-keeping can be capitalized upon in the treatment of women whose psychological characteristics play a role in their infertility.

Keywords Pet-keeping · Motherhood · Depression · Postpartum · Cognitive representation

Introduction

Maternal feelings can be directed not only towards human children but also non-human animals. Indeed, pet owners' behaviour towards their pets resembles human parental behaviour, and some behavioural patterns between owners and their pets are similar to those between a mother and a child. In turn, household pets, such as family dogs who

exhibit behaviours eliciting continued care (Askew 1996), remain dependent on their owners into and throughout their adulthood.

The tendency to attribute human feelings and social motivations to non-human animals, i.e. anthropomorphism, enables people to benefit emotionally, socially, and physically from the unique set of interspecies relationships they share with companion animals. Breeding practices and selection of animals often favours physical and behavioural traits that facilitate this attribution of human emotional and other mental states to non-humans. As an example, in many instances, dogs were selectively bred for “infantile” features (physical) and to exhibit child-like motor patterns (Coppinger et al. 1987).

In addition to infantile and child-like features, dogs were also selectively bred for tendency to form attachments to humans. A dog's relationship to their owner is analogous to child–parent attachment. The owner provides a secure base for exploration and play with a stranger human, and separation from the owner promotes proximity- and contact-seeking behaviour (Prato-Previde et al. 2003; Topál et al. 1998). A human-analogue safe haven effect of the owner in

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a potentially dangerous situation was also demonstrated in dogs (Gacsi et al. 2013). Additionally, pets can also serve the two main regulatory functions of an attachment figure for humans; the first of these involves provision of a safe haven and a secure base and the second involves being a source of support (Zilcha-Mano et al. 2012). Indeed, owners can feel so emotionally connected to their companion animals that they feel a similar sense of security in their presence (Voith 1985). Empirical findings on human–animal interaction indicate that the presence of an animal reduces the negative effects of potentially stressful events (e.g. Allen et al. 1991). Others have suggested that pet-keeping is associated with lower stress and less health problems (e.g. Serpell 1991), especially in case of owners with higher scores on attachment scales (e.g. Friedmann and Thomas 1995).

In addition to being a source of security, some owners rely on their pets as alternative sources of social support (McConnell et al. 2011). Perhaps in part due to social support having a so-called healthcare effect (i.e. a positive effect on stress responsiveness and a protective effect on various diseases; e.g. Schwarzer and Leppin 1991), these characteristics of owner–pet relationships often go along with higher levels of psychological health and physiological well-being (Levine et al. 2013). One relevant domain of psychological health is depression; prior findings indicate both that lower social support and higher stress predict the onset, maintenance, and recurrence of depression (Kim and Shin 2004), whereas animal-assisted interventions reduce the number and severity of depressive symptoms (for a meta-analysis, see Souter and Miller 2007).

Depression with “postpartum” or “postnatal” onset is depression following, or linked to childbirth (APA 2000). Although giving birth to a child is typically an emotionally positive event in a woman’s life, it also confers increased risk for the development of mood disorders or symptoms (Kendell et al. 1987). Among the primary predictors of postpartum depression symptoms (PPDS) are history of a previous depressive episode, prenatal anxiety or depression, neuroticism, low self-esteem, low socio-economic status, low levels of social support, poor marital relationship, and stressful life events (e.g. O’Hara and Swain 1996). In terms of its manifestation and consequences, postpartum depression can be experienced by either parent (but typically the mother), affects the child, is associated with considerable personal and societal costs, and is considered a serious public health problem (O’Hara and Swain 1996; Shrivastava et al. 2015). Specifically, findings suggest that consequences for the mother include a decline in her marital and social relationships (Boath et al. 1998) and the results of longitudinal studies indicate that consequences for the child include negative effects on his or her physical health and emotional and social development (e.g. Verbeek et al. 2012). Given these data, it remains important to identify additional potential

predictors of symptoms to ultimately inform prevention and intervention efforts targeting postpartum depression. It is thus an important gap in the literature that although there may be beneficial effects of pet ownership (or pets, in general, including animal-assisted interventions) on the prevention or amelioration of depressive symptoms (e.g. via stress reduction, provision of a safe haven, and social support), little to no research has focused on the effects of pet-keeping on PPDS. Yet, the reviewed findings on breeding practices targeting infantile features and on pet animal–human relationships being analogous to child–parent attachment suggest that individual differences in cognitions related to pet ownership may be related to differences in risk for development of PPDS.

Accordingly, our aim in the current self-report questionnaire study was to examine whether there is a relationship between cognitive (mental) representations and correlates of pet ownership (to take care of a pet) and cognitive representation and correlates of motherhood (to take care of a child), accounting for the role of some of the established predictors of PPDS, personality, and social support.

Previous studies mainly focused on the effects of human–dog interaction and attachment. Other companion species may have similar favourable effects; thus, broadening the scope of the involved species was an important goal of our study.

Specifically, we examined whether (1) pet ownership is associated with differences in the likelihood of women having suffered from PPDS, (2) among those with PPDS, pet ownership is associated with differences in the number of such symptoms, (3) among pet owners, differences in attitude towards pets are associated with differences in the likelihood of women having suffered from PPDS, (4) among pet owners with PPDS, differences in attitude towards pets are associated with differences in the number of such symptoms, (5) there is a difference between pet owners and non-owners in attitude towards motherhood, and (6) among pet owners, differences in attitudes towards pets are associated with differences in attitude towards motherhood.

Our corresponding hypotheses were that (1) pet owners exhibit a lower likelihood of having suffered from PPDS, (2) among those with symptoms, pet owners have less severe symptoms than non-owners, (3) among pet owners, relative to those with a more negative attitude, those with a more positive attitude towards pets exhibit a lower likelihood of having suffered from PPDS (4) among pet owners with symptoms, relative to those with a more negative attitude, those with a more positive attitude towards pets have less severe symptoms, (5) pet owners report a more positive attitude towards motherhood than non-owners, and (6) among pet owners, relative to those with a more negative attitude, those with a more positive attitude towards pets also have more positive attitudes towards motherhood.

Materials and method

Participants

Participants were 715 Hungarian women between the ages of 18–35 years ($M \pm SD = 336.09 \pm 54.77$ months). For demographic and descriptive data, see Table 1.

Procedures

Participants were recruited from the Eötvös Loránd University, Department of Ethology Family Dog Project as well as via different popular social networking services. To be included, participants had to be in their early adulthood, the lower bound of which is typically demarked at the age of 18 and the upper bound of which is demarked at the age of 35 years (Armstrong 2007; Gow et al. 2017). (This age group is referred to as “generation Y” in the literature and as an identifiable group with its own behaviours, features, beliefs, and values; e.g. Lancaster and Stillman 2002.) Participants were asked to complete an online questionnaire package that was comprised of demographic questions as well as scales and questions about perceived social support,

past and present pet ownership, attitude towards pets, current pet-keeping practices, attitude towards motherhood, personality, and past PPDS (see below).

Measures

Postpartum depression symptoms

Mothers with a child 3 years old or younger were asked to retroactively report on their PPDS by responding to questions based on the Edinburgh Postnatal Depression Scale (EPDS; Cox et al. 1987). The original ten EPDS items (using the Hungarian translation obtained from the Ministry of Health, “Védőnők Szakmai Kollégiuma”), e.g. “I have been anxious or worried for no good reason”), combined with three additional items (“I felt everyone was interested only in the baby but not me”; “I felt like doing the simplest thing is effortful”; and “I had difficulties with making decisions”) describing PPDS, were used. Participants were asked if there was a period, lasting for at least 1 week from childbirth until the day they completed the questionnaire, during which at least five of the listed feelings were concurrently true for them (regardless of the duration of any given feeling). Those who indicated that there was such a period were asked to

Table 1 Demographic data on study participants

	Total sample (<i>N</i> = 715)	Has PPDS (<i>n</i> = 111)	Does not have PPDS (<i>n</i> = 90)	Has pet (<i>n</i> = 505)	Does not have pet (<i>n</i> = 210)	Has children (<i>n</i> = 243)	Does not have children (<i>n</i> = 472)
Age in years (<i>M</i> ± <i>SD</i>)	28 ± 4.6	29.7 ± 4.0	30.5 ± 3.6	28 ± 4.7	28 ± 4.2	30.4 ± 3.8	26.8 ± 4.4
Education							
High school or lower	289 (40.4%)	47 (42.3%)	29 (32.2%)	213 (42.2%)	76 (36.2%)	91 (37.4%)	198 (41.9%)
Postsecondary	426 (59.6%)	64 (57.7%)	61 (67.8%)	292 (57.8%)	134 (63.8%)	152 (62.6%)	274 (58.1%)
Place of resi- dence							
Rural	54 (7.6%)	10 (9.0%)	10 (11.1%)	47 (9.3%)	7 (3.4%)	24 (9.9%)	30 (6.3%)
(Incorporated) town	254 (35.5%)	57 (51.4%)	32 (35.6%)	196 (38.8%)	58 (27.6%)	104 (42.8%)	150 (31.8%)
Chief town of a county	128 (17.9%)	20 (18.0%)	23 (25.6%)	88 (17.4%)	40 (19.0%)	54 (22.2%)	74 (15.7%)
Capital	279 (39.0%)	24 (21.6%)	25 (27.8%)	174 (34.5%)	105 (50.0%)	61 (25.1%)	218 (46.2%)
Marital status							
Single woman	166 (23.2%)	2 (1.8%)	1 (1.1%)	118 (23.4%)	48 (22.9%)	3 (1.2%)	163 (34.5%)
Lives with partner	329 (46.0%)	39 (35.1%)	35 (38.9%)	228 (45.1%)	101 (48.1%)	88 (36.2%)	241 (51.1%)
Married	209 (29.2%)	69 (62.2%)	53 (58.9%)	151 (29.9%)	58 (27.6%)	142 (58.4%)	67 (14.2%)
Divorced or widow	11 (1.5%)	1 (.9%)	1 (1.1%)	8 (1.6%)	3 (1.4%)	10 (4.1%)	1 (.2%)

PPDS = postpartum depression symptoms; has PPDS = mothers with a child 3 years old or younger who retroactively report PPDS; does not have PPDS = mothers with a child 3 years old or younger who do not retroactively report PPDS; has children = women who have children; does not have children = women who do not have children

indicate the feelings that were true for them. We considered only these women as having suffered from PPDS, as e.g. having experienced one or two symptoms may have occurred for reasons other than PPDS. The original EDPS demonstrated acceptable psychometric properties (Cox et al. 1996) and so have different versions of the Hungarian translation, including internal consistency and test–retest reliability (Töreki et al. 2013) as well as sensitivity and specificity (Töreki et al. 2013; Nagy et al. 2011). The revised EPDS used in the current study demonstrated excellent internal consistency ($\alpha = .897$).

We chose the 3-year cut-off (mothers with a child 3 years old or younger) given that there is no consensus as to the time period following childbirth during which a depressive episode can be conceptualized (for research purposes) as a postpartum depressive episode (O’Hara and McCabe 2013). As there were no diagnostic goals in the current study, we relied on our national legislation, which allows mothers to stay at home with their children for up to 3 years, to determine our cut-off. Potential issues with retroactive report of a period of this length are less relevant as prior findings indicate that negative information is better remembered than neutral information (Kensinger and Corkin 2003). In addition, memories of emotional responses are reconstructed, in part, based on current appraisals of events (Levine et al. 2001) and mothers with a child 3 years old or younger are likely in a life circumstance comparable to when they experienced the symptoms—a factor that potentially contributes to increased accuracy of the recalled memories.

Attitude towards motherhood

The Maternity Representations Questionnaire (Papay et al. 2014), developed with a Hungarian sample, was used to assess participants’ attitude towards motherhood. The Maternity Representations Questionnaire is comprised of four subscales, *Maternity as a natural part of a woman’s identity*, hereafter: *Identity maternity* (e.g. “Female beauty evolves during motherhood”), *Maternity as an obligatory female role*, hereafter: *Obligatory maternity* (e.g. “Motherhood is an obligation in every woman’s life”), *Maternity as something that is to be consciously prepared for*, hereafter: *Conscious maternity* (e.g. “Women have to find a lifelong partner before bearing of a child”), and *Maternity as a burdensome female role*, hereafter: *Burdensome maternity* (e.g. “Motherhood attends with abandonments and sacrifices”), comprised of 25 items rated on a 5-point Likert-type response format scale ranging from 1 (strongly disagree) to 5 (strongly agree). Initial reports on the psychometric properties of the subscales indicated that those fell in the acceptable range (Cronbach α s ranging from .60 to .70). In the current sample, the total scale demonstrated acceptable internal consistency ($\alpha = .734$). The *Identity maternity* and

Obligatory maternity subscales demonstrated acceptable internal consistencies (α s = .791 and .712, respectively) and the *Conscious maternity* and *Burdensome maternity* subscales had acceptable internal consistencies, though in the questionable range (α s = .593 and .623, respectively). Higher scores on the *Identity maternity* and *Conscious maternity* subscales and lower scores on the *Obligatory maternity* and *Burdensome maternity* subscales indicate a more positive attitude towards motherhood.

Past and present pet ownership and current pet-keeping practices

To assess past pet ownership, nine of the more major commonly described developmental stages were listed (based on József 2011) and participants were asked to indicate the stages during which they had a pet/pets. Participants were also asked about the type of pet they had during each stage [categories: (1) dog; (2) cat; (3) ferret; (4) rabbit; (5) rodent; (6) bird; (7) reptile; (8) amphibian; (9) fish; (10) other (e.g. arthropods)].

To assess current pet ownership, participants were asked if they have a pet/have pets, about the type of pet(s) they have, and if they have more which is their favourite pet. Participants were also asked about the origin of this favourite pet

(categories: (1) I found it/a family member or friend found; (2) from shelter/animal rescue; (3) from a breeder; (4) from a pet shop; (5) it was born in my home; (6) it was born in the home of a family member or friend; (7) I do not know),

about the identity of the person responsible for the animal

(categories: (1) I alone; (2) I and (one) other person(s) with whom I live in the same household; (3) I and (one) other person(s) with whom I do not live in the same household; (4) someone else/others)

and about the amount of time they as the owner spend with the favourite pet/day

(categories: (1) up to 1 h; (2) ≥ 1 h but < 3 h; (3) ≥ 3 h but < 6 h; (4) > 6 h and, according to owners’ own judgment (1) much more time; (2) a little more time; (3) about the same amount of time; (4) a little less time; (5) much less time as other owners who have the same or a similar type of pet).

As the categories were highly unequally distributed, we merged some in the following way: type of the favourite pet [merged categories: (1) dog; (2) cat; (3)–(10) “other”];

origin of the favourite pet [merged categories (1) and (2) “saved”; (3) and (4) “bought”; (5), (6) and (7) “other”]; the amount of time the owner spends with the favourite pet/day [merged categories: according to own judgment (1) and (2) “more”; (3) “same”; (4) and (5) “less” time as other owners who have the same or a similar type of pet].

Attitude towards pets

Participants completed a pet attitude scale based on their feelings towards their favourite pet (based on Lexington Attachment to Pets Scale [LAPS]; Johnson et al. 1992). As the original LAPS is comprised of 23 items (e.g. “I love my pet because it never judges me”) suitable only for dog and cat owners, there was simultaneous need to shorten (to minimize burden of participation) and broaden the scope of the original scale. To this end, we retained 13 items from the LAPS (c, f, h, i, m, n, o, p, q, r, t, u, v) and added two additional ones (i.e. “I enjoy watching and observing my pet” and “I like to talk to my pet”) relevant to pet owners beyond dogs and cats and based on other pet attitude scales (e.g. Pet Attitude Scale—Modified [PAS-M], Templer et al. 1981; Munsell et al. 2004; Pet Attitude Inventory [PAI], Wilson et al. 1987). Each of the fifteen items was rated on a 4-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). The original LAPS has demonstrated acceptable psychometric properties, including evidence of reliability and (e.g. construct) validity (Johnson et al. 1992). The revised version of the LAPS used in the current study demonstrated excellent internal consistency ($\alpha = .895$). Higher scores indicate a more positive attitude towards pet-keeping.

Perceived social support

To assess participants’ perception about the degree of social support they receive, they were asked to indicate on a Likert-type response format scale ranging from 1 (strongly disagree) to 7 (strongly agree), the extent to which they agree with the following statement: “*I feel that my social environment (family, friends, and colleagues) is emotionally supportive of me (emotional support: being cared for by someone, feeling of belonging to someone, receiving advice from someone or help, when needed)*”. Higher scores indicate perceptions of greater social support. As the distribution of responses was highly unequal across participants, those were merged to create the following categories: (1)–(5) “low”, (6) “medium” (7) “high” social support.

Personality

Participants also completed the Brief version of the Big-Five Personality Inventory, the Ten-Item Personality Inventory (TIPI) (Gosling et al. 2003; Hungarian version: Mirnics

2006). In this measure, each item consists of two descriptors, beginning with the common stem: “I see myself as...”. Each item was rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The TIPI has demonstrated acceptable psychometric properties as indexed by evidence of test–retest reliability, inter-rater reliability between self and observer ratings, convergence with widely used self-, observer and peer report on Big Five measures, and associations with relevant external correlates (Gosling et al. 2003; John and Srivastava 1999).

Data analysis

Primary dependent variables of interest were the presence of at least five PPDS, the number of symptoms and attitude towards motherhood, and primary predictor variables were whether or not a woman had/did not have children and whether or not she had/did not have a pet. Secondary predictor variables considered were: educational level, perceived social support, the identity of the person responsible for the animal, the amount of time the owner spends with his/her pet, the origin and type of the pet, and participants’ past experiences with pets. Relevant covariates were participant age, personality, attitude towards motherhood, and attitude towards pets.

In testing hypotheses (1)–(4), data of mothers with a child 3 years old or younger were used (as PPDS-related analyses were relevant only for these women). For analyses (5) and (6), data of all participants, i.e. women with and without children, were used (as motherhood attitude-related analyses were relevant to all women, regardless of whether or not they have a child/children).

All analyses were conducted in SPSS V22.0. To address questions related to the likelihood of women having suffered from PPDS, it was treated as a binary variable based on participant had at least five symptoms or had less than five symptoms and analysed in generalized linear models (GLMs). To address questions about differences in the number of PPDS, it was treated as a continuous dependent variable and analysed in (univariate) general linear models. To examine the association between pet ownership and attitude towards motherhood, as well as between attitude towards pets and motherhood, (multivariate) general linear models were used. For analyses pertaining to PPDS, the data of participants with a child 3 years old or younger were selected. For analyses pertaining to pet ownership, participants were grouped as pet-owners (if they had a pet at the time of completing the questionnaire and in the previous life stage) versus non-owners (if they neither had a pet at the time of questionnaire completion nor in the previous life stage). Individuals who had a pet at the time of completing the questionnaire and in the previous developmental stage also

likely had a pet around gestation and parturition; as such, pet-keeping may have affected their PPDS (see Table 2).

Results

Is pet ownership associated with differences in the likelihood of women having suffered from PPDS?

In analyses predicting PPDS as a binary dependent variable, the total sample size was 141 ($n_{\text{with symptoms}} = 78$; $n_{\text{pet owner}} = 116$). The final model was better than the intercept only model, $\chi^2(7) = 45.632, p = .000$. Low relative to high ($\exp(\beta) = 10.408 [2.929; 36.984], p < .001$) and medium relative to high social support $\exp(\beta) = 3.155 [1.300; 7.659], p = .011$) as well as higher scores on the *Conscious maternity* subscale ($\exp(\beta) = 3.542 [.451; 2.078], p = .002$) were associated with an increased likelihood of having had at least five PPDS. Higher conscientiousness ($\exp(\beta) = .618 [-.849; -.114], p = .010$) as well as the pet by *Burdensome maternity* interaction ($\exp(\beta) = .24 [-7.076; -.397], p = .028$) were associated with a decreased likelihood of having had PPDS.

Regardless of whether they were owners or non-owners, if they scored low on the *Burdensome maternity* subscale, women had a comparably low likelihood of having had at least five PPDS. Both pet owners and non-owners, if they scored high on this scale, had a greater likelihood of having had at least five feelings, but this effect was stronger for owners (see Fig. 1).

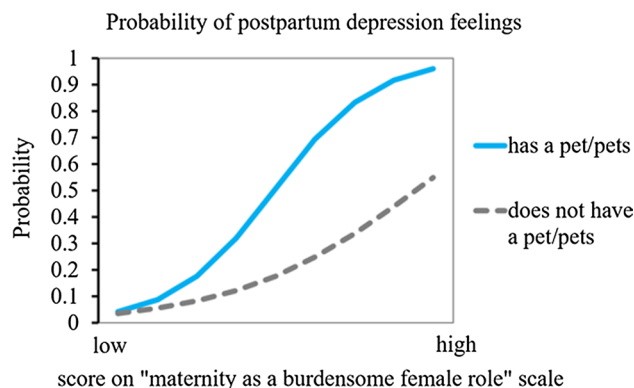


Fig. 1 Probability of postpartum depression feelings given pet ownership and scores on the *Burdensome maternity* subscale

Table 2 Analytic models and corresponding variables of interest involved in primary study hypotheses (final models)

Model	Statistical model	Data selection	DV	Primary predictors	Secondary (potential) predictors	Relevant covariates
(1)	Generalized linear models (GLMs)	Have baby	PPDS as a binary DV based on having at least five symptoms or having less than five symptoms	Have pet	Education level; social support	Attitude towards motherhood; personality; age
(2)	(Univariate) general linear models	Have baby; have PPDS	PPDS as a continuous DV, considering the number of symptoms	Have pet	Education level; social support	Attitude towards motherhood; personality; age
(3)	Generalized linear models (GLMs)	Have baby; have pet	PPDS as a binary DV based on having at least five symptoms or having less than five symptoms		Education level; social support; type of pet; amount of time the owner spends with the pet	Pet attitude; attitude towards motherhood; personality; age
(4)	(Univariate) general linear models	Have baby; have PPDS; have pet	PPDS as a continuous DV, considering the number of symptoms		Education level; social support; type of pet; amount of time the owner spends with the pet	Pet attitude; attitude towards motherhood; personality; age
(5)	(Multivariate) general linear models	No data selection	Attitude towards motherhood	Have pet; have child		Personality; age
(6)	(Multivariate) general linear models	Have pet	Attitude towards motherhood	Have child	Type of pet; origin of pet	Pet attitude; personality; age

In case of secondary predictors, categories were merged as described in the methods
 PPDS postpartum depression symptoms, DV dependent variable

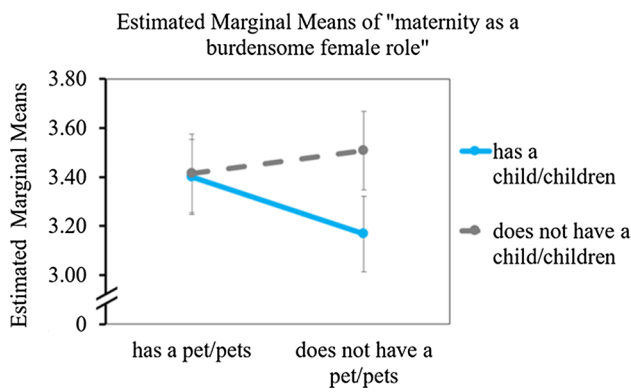


Fig. 2 Women’s perception of maternity as a burdensome female role depending on whether or not they have a child/children and/or a pet/pets

Among women with at least five PPDS, is pet ownership associated with differences in number of symptoms?

In analyses predicting the number of PPDS, the total sample size was 78 ($n_{\text{pet owner}} = 61$). We found that lower educational level ($\beta = .863, p = .064; \eta_p^2 = .046$), scores on *Conscious maternity* subscale ($\beta = -1.259, p = .002, \eta_p^2 = .122$), and emotional stability ($\beta = -.448, p = .003, \eta_p^2 = .112$) were associated with greater number of symptoms.

Among pet owners, are differences in attitude towards pets associated with differences in the likelihood of women having suffered from PPDS?

In these analyses predicting binary PPDS, the total sample size was 116 ($n_{\text{with symptoms}} = 61$). The final model was better than the intercept only model, $\chi^2(4) = 30.168, p = .000$. Low compared to high ($\exp(\beta) = 12.949 [3.361; 49.887], p < .001$) and medium compared to high social support ($\exp(\beta) = 3.206 [1.264; 8.133], p = .014$) as well as higher scores on the *Conscious maternity* subscale ($\exp(\beta) = 3.574 [.425; 2.123], p = .003$) were associated with an increased likelihood, whereas higher conscientiousness ($\exp(\beta) = .571 [-.958; -.163], p = .006$) was associated with a decreased likelihood of having had at least five PPDS.

Among pet owners with at least five PPDS, are differences in attitude towards pets associated with differences in number of symptoms?

Among participants who reported having had at least five PPDS ($n = 61$), lower scores on the *Conscious maternity* subscale ($\beta = -1.142, p = .030; \eta_p^2 = .085$) and lower emotional stability ($\beta = -.539, p = .005; \eta_p^2 = .138$) were associated with greater number of symptoms.

Table 3 Written overview of the main statistical results obtained

Model	Results
(1)	Increased likelihood of having had at least five PPDS Lower level of social support Higher scores on the <i>Conscious maternity</i> subscale Higher scores on the <i>Burdensome maternity</i> subscale—this effect was stronger for owners Decreased likelihood of having had at least five PPDS: Higher conscientiousness
(2)	Higher number of symptoms: Lower educational level Lower scores on <i>Conscious maternity</i> subscale Lower emotional stability
(3)	Increased likelihood of having had at least five PPDS: Lower level of social support Higher scores on the <i>Conscious maternity</i> subscale Decreased likelihood of having had at least five PPDS: Higher conscientiousness
(4)	Higher number of symptoms: Lower scores on <i>Conscious maternity</i> subscale Lower emotional stability
(5)	Scores on the <i>Burdensome maternity</i> subscale: Women without children or a pet > women without children and with a pet > mothers with a pet > mothers without a pet
(6)	More positive attitude towards pets: Lower scores on the <i>Conscious maternity</i> subscale Higher scores on the <i>Burdensome maternity</i> subscale

For the details, see also Table 2
PPDS postpartum depression symptoms

Is there a difference between pet owners and non-owners in attitude towards motherhood?

Although data selection based on participants' status on any variable was not employed (all were able to complete the motherhood attitude scale regardless of whether or not they have a child or children), to roughly equalize the number of pet owners and non-owners as well as the number of women who have and who do not have a child, a random sample of 288 women ($n_{\text{pet owner}} = 139$; $n_{\text{women with a child}} = 144$) was drawn from the total sample. The children by pet interaction had a significant effect on the *Burdensome maternity* subscale, $F(4, 275) = 4.135, p = .043, \eta_p^2 = .015$. Women without children or a pet exhibited highest scores on the *Burdensome maternity* subscale ($M = 3.508$; $SE = .081$), followed by comparable scores between women without children and with a pet ($M = 3.414$; $SE = .083$) and mothers with a pet ($M = 3.401$; $SE = .086$), and mothers without a pet having lowest scores ($M = 3.168$; $SE = .078$) (see Fig. 2).

Among pet owners, are differences in attitudes towards pets associated with differences in attitude towards motherhood?

Data from pet owners were used for these analyses (as only owners had data on the pet attitude scale), and to roughly equalize the number of women who have and who do not have a child, a random sample of 330 women ($n_{\text{women with a child}} = 165$) was drawn from the total sample. Differences in attitude towards pets were associated with the *Conscious maternity*, $F(4, 314) = 6.644, p = .010, \eta_p^2 = .021$, and the *Burdensome maternity*, $F(4, 314) = 4.133, p = .043, \eta_p^2 = .013$, subscales. A more positive attitude towards pets was associated with lower scores on the *Conscious maternity* subscale, $\beta = -.046, 95\% \text{ CI} = [-.081, -.011], p = .010$ and with higher scores on the *Burdensome maternity* subscale, $\beta = .174, 95\% \text{ CI} = [.006, .343], p = .043$. Neither pet type nor origin of pet had effects on PPDS or on attitude towards motherhood. (See Table 3 for a summary of results.)

Discussion

Our primary aim in the current study was to examine the relations between pet ownership and PPDS and between attitude towards pets and motherhood. Based on prior findings suggesting that animal-assisted interventions reduce the number and severity of depressive symptoms, we generally predicted that pet ownership would protect against PPDS. With regard to the likelihood of women having had at least five PPDS or to number of symptoms, results generally do not support the hypothesis that pet ownership has a protective effect on the development or severity of PPDS. One

explanation for this discrepancy between relevant, prior findings, and the current results may be related to differences in sample compositions across studies. For example, in earlier research, the beneficial effects of pet ownership, attachment towards pets or of human–animal interaction on depression symptoms was examined in elderly or patients in hospitals or sanatoriums (e.g. Souter and Miller 2007). Conversely, the current sample was drawn from a community sample of younger women who likely have much higher levels of functioning (e.g. they participated in a series of University-based research studies conducted in the context of the Family Dog Project and/or accessed popular social networking services). In line with this explanatory hypothesis, others also did not find differences in depression between pet owners and non-owners in working women (Watson and Weinstein 1993). The authors interpreted their results as indicating that working women may not have sufficient time to spend with pets, resulting in little effect of differences in pet ownership on depression.

One exception to the general lack of an effect of pet ownership on the development or severity of PPDS was an interaction effect between pet ownership and perception of maternity as a burdensome female role. Women less likely to perceive maternity in this manner were also less likely to develop at least five PPDS, regardless of whether they were owners or not, and women more likely to perceive maternity in this manner were also more likely to develop at least five PPDS, with this effect being stronger for owners than non-owners. Mothers who found motherhood burdensome may suffer from greater emotional distress and thus have a higher risk to suffer from PPDS. 97% of respondents designated themselves as primarily responsible for the pet, alone or with the help of someone (mainly from the same household). Of the 505 pet owners, only 12 declared that someone else was primarily responsible for the animal. For a mother who finds motherhood difficult, responsible pet-keeping may be yet another difficulty that has the potential to enhance emotional distress. However, it is also possible that mothers who suffered from PPDS consequently found therefore maternity as burdensome.

Of note, in the analyses predicting PPDS as a binary dependent variable from predictors including the *Burdensome maternity* subscale, we could not equalize the number of owners and non-owners, as the size of the latter sample would have been too small. As such, the corresponding results could have been due to the considerably higher number of pet owners in the examined sample. Replication with a more balanced sample is warranted in future research.

Related, the relationship between perception of maternity as a burdensome role and pet ownership was moderated by attitude towards pets. Pet owners with a more positive attitude towards pets are more likely to find maternity as a burdensome role than owners with a less positive

attitude. Women with a more positive attitude towards pets may worry more about their pet and spend more time to take care for it (Blouin 2013). This attitude can result in pet ownership sometimes being difficult and this feeling may be generalized to any dependent, regardless of whether or not participants have experienced motherhood.

Also with regard to the likelihood of women having had at least five PPDS or to number of symptoms, our results are in line with previous findings on lack of social support and lower education as main risk factors of postpartum depression (O'Hara and McCabe 2013). Specifically, in the current study, lower social support was associated with increased likelihood of women having PPDS and, among women with such feelings, lower education was associated with greater number of symptoms.

Our findings revealed that two Big Five personality traits, conscientiousness and emotional stability, were associated with the likelihood/number of PPDS. Specifically, higher conscientiousness was associated with reduced likelihood of having had at least five PPDS and lower emotional stability was associated with greater number of symptoms. These results are generally consistent with prior findings on a combination of high neuroticism combined with low agreeableness, conscientiousness, and extraversion corresponding to a “Depressive Personality” (Chien et al. 2007); meta-analyses suggesting that high neuroticism, low conscientiousness, and extraversion are associated with depression (i.e. broad diagnosis of unipolar depression and specific diagnosis of major depressive disorder) (Kotov et al. 2010), and other data indicating a link between emotional instability and depression (e.g. Bunevicius et al. 2008) and between neuroticism and depression (Song et al. 2008) (emotional instability and neuroticism are parts of the same personality dimension; Digman 1990). More specifically, several meta-analyses revealed associations between neuroticism and postpartum depression (O'Hara and Swain 1996) and our current results replicate these findings.

Our findings also indicate relations between women's thoughts regarding motherhood and PPDS. Among women in general, higher scores on the *Conscious maternity* subscale were associated with an increased likelihood of having had at least five PPDS. Among women who have had at least five PPDS, however, lower scores on this scale were associated with greater number of symptoms. Differently stated, when women as a group are considered, those who score higher on the *Conscious maternity* subscale are more likely to have had at least five PPDS but when only women who present with at least five symptoms are considered, those who score lower on the *Conscious maternity* subscale have less symptoms. Of note, these results are to be interpreted with caution, as albeit in the acceptable range, the *Conscious*

maternity subscale had questionable internal consistency in the current sample.

Although in the absence of prior theory or data on the specific relationship between this cognitive representation of motherhood and postpartum depression we are reluctant to extensively reflect on or speculate about these results, examining the item content of this subscale may help generate relevant explanatory hypotheses. Women scoring higher on this scale tend to consider appropriate livelihood, relationship stability, healthy lifestyle, and conscious preparation for motherhood prior to parenting as important. Women with these beliefs, if and when their expectations are not met (which, to some extent, unavoidably happens at one point or another), such as they experience poverty, relationship instability, or poor health, may be more prone to developing symptoms of depression. On the other hand, mothers who already exhibit symptoms of depression may have pre-existing depressogenic schemas, including apathy about the future, such as about preparation for motherhood. This depressogenic schema may also contribute to these women experiencing more and more severe symptoms. Independently of the depressogenic schema, those women who for some reason prepare for motherhood less consciously later may face difficulties that can cause the occurrence of more symptoms. These are testable hypotheses that, along with other mechanisms or third variables that may explain these seemingly discrepant findings, are worthwhile targets of investigation in future studies.

Another finding was that among those who have children, pet owners perceive maternity as more burdensome than non-owners. Of the 243 mothers who completed the questionnaire, the majority had one or two children and only 13 had three or more. As such, the number of children was not taken into account in the analyses. Among mothers, 201 women had at least one child 3 years old or younger. Although the number of children has not been established as a risk factor of postpartum depression, Gove and Geerken (1977) revealed that rate of demands reported by wives increases as the number of children increases and decreases as the age of the youngest child increases. In their study, non-working wives reported more life demands than working wives. Mainly among non-working wives, the desire to be alone increased with the number of children and decreased as age of the youngest child increased. Also in this group, the presence of children increased the rate of psychiatric symptoms, perhaps due to lack of adult interaction, time for themselves, opportunity to use skills such as are those associated with having a job, or lack of other sources of gratification (Gove and Geerken 1977). These data and interpretations are consistent with the implications of our finding that mothers with a child 3 years old or younger stay at home with their little and very dependent child and have less opportunity to meet and interact with other adults.

If women perceive children and pets as playing somewhat similar roles in the family, the presence of an animal can actually resemble an increase in the number of (dependent) children.

Childless women who own a pet perceived motherhood as less difficult on the *Burdensome maternity* scale. This effect of pet-keeping can be very important from a therapeutic point of view for women whose psychological characteristics play a dominant role in their infertility (Negro-Vilar 1993). It stands to reason that many young couples get a pet prior to planning having children, as for them, taking care of a pet may be a good chance to practice caring for a dependent.

Taken together, these findings support the hypothesis that there is a relationship between women's cognitive representations of motherhood and pet ownership and suggest that, to some degree, women perceive children and pets as playing somewhat similar roles in the family. These outcomes are in line with those obtained in previous studies suggesting that owners can develop strong emotional ties with their pets and that a bond similar to that between a human mother and her infant can be formed between a human owner and her/his dog (Serpell 2002). Supposedly, mothers who have a child and a pet try to take care for the child and the animal in a similar manner and thus may find motherhood burdensome. This assumption is supported by the vast majority of owners having designated themselves as the person primarily responsible for the animal in this study.

Limitations

A few limitations are worthy of note. First, to assess participants' attitude towards motherhood, we employed the Maternity Representations Questionnaire (Papay et al. 2014). Initial reports indicated that the psychometric properties of the subscales fell in the acceptable range, with some at the lower end of such range (Cronbach α s ranging from .60 to .70). No other questionnaire that measures motherhood-related thoughts and feelings, suitable for use with mothers and childless women, exists in the literature (let alone one validated on a Hungarian sample).

Second, in two cases, we modified existing, psychometrically validated questionnaires to use in our study, albeit no major changes were made. It was important that we balance maximizing our ability to address our research questions with minimizing participant burden, that is, for example in the case of the LAPS (Johnson et al. 1992), we needed to modify the scale to be appropriate for use with pets beyond dogs and cats. However, the online questionnaire package was comprised of demographic questions and scales and questions about perceived social support, past and present pet ownership, attitude towards pets, current pet-keeping practices, attitude towards motherhood, personality, and past PPDS, with a total of 90 items, with a minimum completion

time of ~ 15 min. Nevertheless, the modified questionnaires had excellent internal consistency estimates in this sample, suggesting confidence in the present results.

Third, we asked mothers with a child 3 years old or younger to retroactively report on their PPDS. As there is no consensus in the literature as to what constitutes the postpartum period for research purposes, we chose the 3-year cut-off based on our national legislation and also given reason to believe that mothers with a child 3 years old or younger are in a life circumstance similar to when they experienced the symptoms (e.g. as they are typically still at home with their child). Nevertheless, the effects of a potential recall bias on the accuracy of recalled memories have to be considered. Related, it is important to mention that these results do not generalize to women who reach diagnostic levels of postpartum depression. Yet, including women only if they reached such clinical levels would have greatly reduced the number of participants we were able to enrol.

However, some of the predictors and covariates (social support, pet attitude, attitude towards motherhood) represent the subjects' current state that can cause bias when examining the associations between the variables. As such, our investigation and results should be considered as preliminary indication about relations among the phenomena that were of interest in this research and future studies may benefit from assessment of these associations during the actual postpartum period in women who reach diagnostic levels. In the current design, women who currently suffer from PPDS could also participate and, compared to those who had only suffered from PPDS in the past, their symptoms may affect their responses. Investigated associations during the actual postpartum period would also be an approach to rule out any such effects.

Conclusions for future biology

This study is probably one of those that aim to establish a possible effect of family pets (dogs) on human maternal behaviour. There could be multiple perspectives on this issue. Enjoying a positive relationship with a pet may protect women against postpartum depression symptoms (PPDS). But it can also enhance the chance of becoming a mother in women whose psychological characteristics play a dominant role in their infertility. These first findings are certainly worth for broader follow-up. In future research, it should be an important task to modify and further evaluate the current questionnaire and/or to develop and empirically validate a psychometrically sound measure of attitudes towards motherhood. The improved questionnaires could be utilized in hospitals and gynaecology offices. Eventually, the possession of a family dog may indeed increase the chance to become pregnant.

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Data accessibility The data sets supporting this article have been uploaded as part of the Supplementary Material.

Compliance with ethical standards

Conflict of interest None of the authors have any financial interests or potential conflicts of interest.

Ethical statement All procedures performed involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Questionnaire completion was anonymous so the study does not violate respondents' privacy. Informed consent was included in the introductory letter of the questionnaire. Ethical permission for this study was obtained from our local institutional review board, the "A Pszichológiai Kutatások Egyesült Etikai Bíráló Bizottsága (EPKEB)" (Permission #2017/37).

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