

Comparison of selected subscales of the Canine Behavioral Assessment and Research Questionnaire with behaviour observed during a brief separation test in companion dogs in the Czech Republic

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Abstract

Separation-related problems represent one of the most prevalent behavioural conditions in companion dogs, with major implications for animal welfare and the dog-owner relationship. Owner-completed questionnaires such as the Canine Behavioral Assessment and Research Questionnaire (C-BARQ) are widely used to assess canine behaviour, but their correspondence with directly observed separation responses remains unclear, particularly when applied in new language settings. The aim of this study was to examine whether scores from selected subscales of a Czech language version of C-BARQ are associated with behavioural responses observed during a standardised brief separation test in companion dogs. A total of 40 companion dogs of various breeds aged 1–10 years (median 4.0 years, IQR 5.5) were recruited from private households. Prior to testing, owners completed the C-BARQ translated into Czech, and analyses focused on the separation-related behaviour and attachment, and attention-seeking subscales. Each dog subsequently underwent a 10-min standardised separation test, during which behaviour was continuously recorded. At the subscale level, separation-related scores were positively associated with door proximity ($\rho = 0.36$, $P = 0.021$) and negatively associated with panting ($\rho = -0.40$, $P = 0.011$), whereas the attachment and attention-seeking subscale showed a positive association with yawning ($\rho = 0.34$, $P = 0.031$). At the item level, the strongest correlation was found between yawning and the attachment item concerning agitation towards affection shown to others ($\rho = 0.45$, $P = 0.004$). Overall, the results indicate partial correspondence between owner-reported questionnaire scores and behaviour observed during a brief separation test in companion dogs in the Czech Republic.

Animal welfare, acute stress, owner report, behavioural coding

Separation-related problems belong among the most important behavioural conditions affecting companion dogs, compromising both canine welfare and the dog-owner relationship (Palestrini et al. 2010; De Assis et al. 2020). Dogs affected by these problems may display vocalisation, restlessness, exit-oriented behaviour, or destructive activity when left alone, and in more severe cases these problems may contribute to relinquishment or euthanasia (Overall et al. 2001; Eagan et al. 2022). Contemporary dog populations are affected by a wide range of hereditary health and behavioural conditions, and separation-related problems represent one of the most frequently reported behavioural concerns both in shelter and companion dog populations (Vitulová et al. 2018; Bláhová et al. 2026). Current understanding also indicates that separation-related problems represent a heterogeneous group of behavioural manifestations that may arise from partially different underlying emotional states, including fear, frustration, or panic-like responses related to separation from an attachment figure (De Assis et al. 2020; Lenkei et al. 2021). Separation-related problems affect 6–55% of pet dogs, although prevalence estimates vary depending on terminology, diagnostic criteria, and study design (Salonen et al. 2020).

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One of the widely used instruments for owner-reported assessment of canine behaviour is the Canine Behavioral Assessment and Research Questionnaire (C-BARQ), originally developed by Hsu and Serpell (2003) and later expanded to its current 100-item, 14-subscale structure by Duffy and Serpell (2012). The questionnaire has been used across a wide range of pet, shelter, and working dog populations (Bray et al. 2019; Hunt et al. 2020). C-BARQ has also been adapted for use in different linguistic and cultural settings, which supports its value as a standardised framework for behavioural assessment (Nagasawa et al. 2011; Broseghini et al. 2023). However, studies that translate and psychometrically validate the full questionnaire differ in aim from studies that apply selected translated items or subscales in a more targeted research context.

According to European pet population statistics, the Czech Republic has approximately 2 million dogs, and 42% of households own at least one dog (FEDIAF 2025). Dogs in Czech urban households are frequently kept in small apartments and left alone for extended periods, which are conditions associated with an elevated risk of separation-related problems (Baranyiová et al. 2005). To our knowledge, no published study has examined the use of Czech language version C-BARQ subscales in relation to directly observed separation behaviour. This is relevant because even when a questionnaire is well established internationally, its interpretation in a new language setting requires caution, particularly in behavioural domains where wording, owner perception, and local usage may influence responses (Tonoike et al. 2015). The study was therefore not designed as a full linguistic or psychometric validation of the Czech C-BARQ. Instead, it focused on the subscales that are directly relevant to separation-related behaviour (Wray et al. 2026).

Previous work suggests that some degree of association may exist between owner-report and observed behaviour during separation. Konok et al. (2011) reported links between questionnaire-based assessment and dogs' behaviour during separation and reunion, and video-based studies have shown that dogs with separation-related problems commonly exhibit vocalisation, locomotor activity, environmental orientation, and reduced behavioural settling when left alone (Palestrini et al. 2010). Questionnaire scores reflect repeated owner experience across everyday situations, whereas standardised tests capture behaviour in one short and highly controlled context. For this reason, even limited correspondence between translated questionnaire subscales and observed behaviour may be informative.

The aim of the study was to examine whether scores from selected subscales of a Czech version of C-BARQ are associated with behavioural responses observed during a standardised brief separation test in companion dogs in the Czech Republic. We expected that dogs with higher owner-reported separation-related scores would show more pronounced behavioural signs of distress during separation, particularly greater exit-oriented behaviour, reduced behavioural settling, and increased stress-related activity.

Materials and Methods

Ethical framework

The study was conducted in accordance with the relevant national legislation of the Czech Republic governing the use of animals in research. According to Act No. 246/1992 Coll. on the protection of animals against cruelty and Directive 2010/63/EU, the procedures used in this study did not meet the definition of an animal experiment, as no invasive interventions or manipulations beyond behavioural observation were performed. Owners provided informed consent prior to testing, were informed about all procedures in advance, and were free to withdraw their dogs from the study at any time.

Animals

Dogs were recruited through social media platforms of the research team in the Czech Republic in summer 2025. Owners expressing interest in participation completed an initial screening questionnaire regarding their dogs' age, health status, and behavioural characteristics.

Inclusion criteria were: age between 1 and 10 years, good general health, no ongoing medication that could affect behaviour, and routine experience with visits to unfamiliar environments in the owner's presence. The age restriction was established to include only adult individuals, to reduce the influence of ontogenetic phases associated with fear and juvenile separation anxiety, which may modify the intensity of behavioural manifestations during short-term separation (Flannigan and Dodman 2001). The upper age limit was set to minimise potential effects of age-related cognitive decline or reduced locomotor activity (Landsberg et al. 2012). Dogs with owner-reported or questionnaire-indicated high levels of aggression towards humans were not enrolled in the study, in order to ensure the safety of researchers during behavioural testing.

The final sample consisted of 40 companion dogs living in private households in the Czech Republic, representing 17 named breeds and a mixed-breed category. The sample included 15 males and 25 females; median age was 4.0 years (IQR 5.5, range 1–10). Breed representation, age and sex distribution were evaluated descriptively. These demographic variables were not included in inferential analyses because of the exploratory design of the study and the limited sample size. Neuter status was not included in the analysis.

Canine Behavioral Assessment and Research Questionnaire

Prior to behavioural testing conducted during summer 2025 at the Department of Animal Protection and Welfare and Veterinary Public Health, University of Veterinary Sciences Brno, Czech Republic, all owners completed the full Czech translation of the C-BARQ (Hsu and Serpell 2003; Duffy and Serpell 2012). Although the complete questionnaire was administered, this study focused only on two subscales relevant to the study aim: "Separation-related behaviour" and "Attachment and attention-seeking".

The Czech translation of the full questionnaire had been prepared for broader research use by the authors' team. For the purposes of our study, this translated version was used as a research tool; the study was not designed as a full linguistic or psychometric validation of the Czech C-BARQ. The wording of the translated items was reviewed by two independent native Czech speakers for clarity and terminological consistency prior to use. Formal back-translation and pilot psychometric testing were not conducted, which is consistent with the exploratory aim of the present study and is acknowledged when interpreting the findings.

Owners were asked to complete the questionnaire independently, based on their dog's behaviour over the preceding month, before arriving at the testing facility. Response options followed the original C-BARQ format (0 = never, 1 = seldom, 2 = sometimes, 3 = usually, 4 = always, x = not applicable). Owner responses from the Czech language version were entered manually into the official C-BARQ scoring system, which generated the raw scores and subscale scores according to the standard C-BARQ scoring procedure. "Not applicable" responses were handled automatically by the official scoring system (University of Pennsylvania, Philadelphia, USA). Only scores from the separation-related behaviour and attachment and attention-seeking subscales were included in the analyses reported in this manuscript. The selected items and their codes are presented in Table 1.

Behavioural recording and coding

Behavioural testing was conducted in a standardised indoor room at the Department of Animal Protection and Welfare and Veterinary Public Health, University of Veterinary Sciences Brno. The testing room (36 m²) was illuminated by natural daylight and maintained under stable environmental conditions throughout the testing period. The room was inspected before each test to ensure animal safety and welfare and was disinfected after each test session. The room contained a bowl with fresh water, a resting area equipped with a bed provided by the owner, and a chair for an unfamiliar person who remained present throughout the separation phase for welfare and safety reasons.

Prior to separation, each dog underwent a 3-min adaptation phase in the presence of the owner, researcher, and unfamiliar person. This was followed by a 10-min separation phase during which the owner and researcher left the room, while the unfamiliar person remained seated and avoided verbal, physical, and direct eye contact with the dog. The unfamiliar person remained passive throughout the test and was authorised to terminate the procedure if signs of excessive stress were observed. Dogs were able to move freely without a leash throughout the test. The duration was chosen to provide a standardised observation period for separation-related behaviours, in line with previous brief separation paradigms used in dogs (Riemer et al. 2016; Mariti et al. 2018).

Behaviour was recorded continuously throughout the separation phase using two video cameras (Niceboy VEGA X PRO, Niceboy s.r.o., Prague, Czech Republic) with integrated microphones, positioned to cover the entire room without blind spots. Audiovisual recordings were analysed using Observer XT 16 software (Noldus Information Technology, Wageningen, the Netherlands) employing continuous coding. The frequency and duration of selected behavioural indicators associated with separation-related stress and social orientation were evaluated according to the ethogram shown in Table 2. Behaviours were classified as states or events based on their temporal characteristics. State behaviours were quantified as duration in seconds during the separation phase. Event behaviours were quantified as frequencies and expressed as the number of occurrences per minute of observation.

To assess inter-observer reliability, 30% of recordings were independently coded by a second observer. Both observers involved in behavioural coding were blind to questionnaire scores. Cohen's kappa values indicated strong agreement across coded behaviours ($\kappa > 0.96$, $P < 0.05$).

Table 1. Selected C-BARQ subscales and their component items included in this study.

Factor code	Factor	Question
SRB_54	Separation-related	Dog displays shaking, shivering, or trembling when left or about to be left on its own.
SRB_55	Separation-related	Dog displays excessive salivation when left or about to be left on its own.
SRB_56	Separation-related	Dog displays restlessness, agitation, or pacing when left or about to be left on its own.
SRB_57	Separation-related	Dog displays whining when left or about to be left on its own.
SRB_58	Separation-related	Dog displays barking when left or about to be left on its own.
SRB_59	Separation-related	Dog displays howling when left or about to be left on its own.
SRB_60	Separation-related	Dog displays chewing or scratching at doors, floors, windows, curtains, etc. when left or about to be left on its own.
SRB_61	Separation-related	Dog displays loss of appetite when left or about to be left on its own.
AA_68	Attachment-attention	Dog displays a strong attachment to a particular member of the household.
AA_69	Attachment-attention	Dog tends to follow a member of the household from room to room about the house.
AA_70	Attachment-attention	Dog tends to sit close to or in contact with a member of the household when that individual is sitting down.
AA_71	Attachment-attention	Dog tends to nudge, nuzzle, or paw a member of the household for attention when that individual is sitting down.
AA_72	Attachment-attention	Dog becomes agitated when a member of the household shows affection for another person.
AA_73	Attachment-attention	Dog becomes agitated when a member of the household shows affection for another dog or animal.

SRB = separation-related behaviour; AA = attachment and attention-seeking. Item wording reproduced for study purposes from the C-BARQ framework (Hsu and Serpell 2003).

Table 2. Ethogram and spatial measures used for behavioural analysis during the separation phase.

Behaviour	Type	Definition
Standing	State	Standing on all four limbs without forward movement for at least 2 seconds.
Sitting	State	Sitting with body weight supported on the hindquarters and forelimbs in contact with the floor, without forward movement.
Lying	State	Lying with the chest in contact with the floor, without clear orientation toward the environment.
Locomotion	State	Walking or pacing around the room without environmental exploration.
Exploration	State	Motor activity toward the environment involving sniffing or oral investigation (e.g. licking).
Lip-licking	Event	Extension of the tongue along the upper lip, not associated with food or water intake.
Yawning	Event	Slow, wide opening of the mouth accompanied by deep inhalation.
Panting	State	Rapid breathing with the muzzle open and tongue extended, occurring in the absence of physical exertion.
Vocalisation	State	Performance of acoustic signals including barking, whining, howling, or whimpering.
Door proximity	State	Presence within a distance of ≤ 1 m from the exit door.
Free area	State	Presence anywhere outside all predefined spatial zones (door zone and unfamiliar person zone) within the testing room.
Unfamiliar person proximity	State	Presence within a distance of ≤ 70 cm from the unfamiliar person within the predefined area.

Data analysis

Statistical analyses were performed using Python 3.11.5 (NumPy 1.24.3, SciPy 1.13.1, Pandas 2.3.3, Matplotlib 3.10.6). Normality of distribution was assessed using the Shapiro-Wilk test. Because questionnaire scores and behavioural variables were not normally distributed, descriptive statistics are presented as median and interquartile range (IQR).

Associations between the two selected C-BARQ subscale scores and behavioural measures obtained during the separation phase were assessed using Spearman's rank correlation coefficient. Additional exploratory analyses were performed at the level of individual C-BARQ items and selected observed behaviours. All statistical tests were two-tailed, with significance set at $P < 0.05$.

The strength of correlations was interpreted descriptively using conventional thresholds, with $|\rho| < 0.30$ considered weak, $|\rho| = 0.30$ – 0.49 moderate, and $|\rho| \geq 0.50$ strong. Only exploratory item-level correlations with $|\rho| \geq 0.30$ are presented in the results tables.

Results

Descriptive statistics for C-BARQ subscale scores and behavioural variables recorded during the separation phase are presented in Table 3. C-BARQ separation-related scores showed considerable variability across the sample (median 0.57, IQR 1.50), whereas attachment and attention-seeking scores were more centrally distributed (median 2.00, IQR 1.04).

Table 3. Descriptive statistics for C-BARQ subscale scores and behavioural variables recorded during the separation phase.

C-BARQ subscales	Median	Q1	Q3	IQR	Min	Max
Separation-related behaviour	0.57	0.13	1.63	1.50	0.00	3.25
Attachment and attention-seeking	2.00	1.46	2.50	1.04	0.17	3.83
Behavioural variables	Median	Q1	Q3	IQR	Min	Max
Door proximity (s)	75.8	17.3	204.7	187.3	0.0	552.7
Standing (s)	120.4	63.7	246.7	183.1	2.2	603.6
Lying (s)	215.8	0.0	380.0	380.0	0.0	656.4
Panting (s)	88.3	2.7	235.8	233.0	0.0	607.2
Vocalisation (s)	0.0	0.0	41.5	41.5	0.0	405.9
Lip-licking (count/min)	2.75	0.0	9.0	9.0	0.0	27.0
Yawning (count/min)	1.00	0.0	2.0	2.0	0.0	8.0

Q1 = first quartile; Q3 = third quartile; IQR = interquartile range; s = seconds; count/min = number of occurrences per minute of observation

Selected correlations between C-BARQ subscales and observed behaviours during the separation phase are presented in Table 4. The separation-related behaviour subscale was positively correlated with door proximity ($\rho = 0.36$, $P = 0.021$) and negatively correlated with panting ($\rho = -0.40$, $P = 0.011$). The attachment and attention-seeking subscale was positively correlated with yawning frequency ($\rho = 0.34$, $P = 0.031$).

Selected correlations between individual C-BARQ items from the separation-related behaviour (SRB) and attachment and attention-seeking (AA) subscales and observed

Table 4. Selected correlations between C-BARQ subscales and behaviours observed during the separation phase.

C-BARQ subscale	Type	Observed behaviour	Type	ρ	P value
Separation-related	Subscale	Panting	State	-0.40	0.011
Separation-related	Subscale	Door proximity	State	0.36	0.021
Attachment-attention	Subscale	Yawning	Event	0.34	0.031

Only correlations with $|\rho| \geq 0.3$ and $P < 0.05$ are shown.

behaviours are presented in Table 5. Among the separation-related items, positive correlations with door proximity were found for SRB_55 ($\rho = 0.39$, $P = 0.012$), SRB_56 ($\rho = 0.37$, $P = 0.020$), SRB_58 ($\rho = 0.36$, $P = 0.023$), and SRB_59 ($\rho = 0.32$, $P = 0.046$). Positive correlations with standing were observed for SRB_56 ($\rho = 0.33$, $P = 0.035$) and SRB_58 ($\rho = 0.37$, $P = 0.018$). Negative correlations with panting were found for SRB_59 ($\rho = -0.38$, $P = 0.019$), SRB_61 ($\rho = -0.38$, $P = 0.016$), SRB_56 ($\rho = -0.35$, $P = 0.028$), and also SRB_57 ($\rho = -0.33$, $P = 0.040$). In addition, SRB_58 was negatively correlated with lying ($\rho = -0.37$, $P = 0.018$).

Among the attachment and attention-seeking items, AA_73 was positively correlated with yawning frequency ($\rho = 0.45$, $P = 0.004$), and AA_71 showed an additional positive correlation with yawning frequency ($\rho = 0.36$, $P = 0.022$). AA_72 was positively correlated with vocalisation ($\rho = 0.40$, $P = 0.010$), whereas AA_70 was negatively correlated with lip-licking ($\rho = -0.32$, $P = 0.043$).

Table 5. Selected correlations between individual C-BARQ items and behaviours observed during the separation phase.

C-BARQ item	Subscale	Observed behaviour	Type	ρ	P value
SRB_55	Separation-related	Door proximity	State	0.39	0.012
SRB_56	Separation-related	Panting	State	-0.35	0.028
SRB_56	Separation-related	Standing	State	0.33	0.035
SRB_56	Separation-related	Door proximity	State	0.37	0.020
SRB_57	Separation-related	Panting	State	-0.33	0.040
SRB_58	Separation-related	Lying	State	-0.37	0.018
SRB_58	Separation-related	Door proximity	State	0.36	0.023
SRB_58	Separation-related	Standing	State	0.37	0.018
SRB_59	Separation-related	Panting	State	-0.38	0.019
SRB_59	Separation-related	Door proximity	State	0.32	0.046
SRB_61	Separation-related	Panting	State	-0.38	0.016
AA_70	Attachment-attention	Lip-licking	Event	-0.32	0.043
AA_71	Attachment-attention	Yawning	Event	0.36	0.022
AA_72	Attachment-attention	Vocalisation	State	0.40	0.010
AA_73	Attachment-attention	Yawning	Event	0.45	0.004

SRB = separation-related behaviour item; AA = attachment and attention-seeking item. Only correlations with $|\rho| \geq 0.30$ and $P < 0.05$ are shown.

Discussion

The study examined whether owner-reported C-BARQ scores correspond with behavioural responses observed during a standardised short-term separation test in companion dogs in the Czech Republic. The results showed partial correspondence between questionnaire-based assessment and direct behavioural observation. At the subscale level, the observed associations were weak to moderate, with the separation-related behaviour subscale correlated with door proximity and panting, whereas the attachment and attention-seeking subscale showed only limited association with the observed behaviours. At the item level, several separation-related questions were associated with behaviours reflecting an active response to owner absence.

Questionnaire-based methods and standardised behavioural tests do not assess exactly the same phenomenon, even when they target a similar behavioural domain. This is particularly relevant in the case of separation-related problems, which have been described as a clinically common but behaviourally diverse condition in dogs (Ogata 2016). The C-BARQ summarises owner impressions across repeated situations in the home environment.

In contrast, the test conducted in our study captured one acute response in a brief unfamiliar setting. Wray et al. (2026) reported a similar divergence, finding that neither the C-BARQ attachment and attention-seeking nor the separation-related behaviour factor significantly predicted observed behaviour during a modified Separation and Greeting Test. In the case of separation-related behaviour, owners are usually absent during the acute episode and may therefore rely on indirect evidence or retrospective interpretation (Konok et al. 2011).

An interesting finding at the subscale level was the positive association between the separation-related behaviour subscale and door proximity. Orientation towards the exit and attention to the point of owner departure are among the most commonly described signs of acute separation distress in dogs. Video-based studies of dogs with separation-related problems have shown that owner absence is often associated with vocalisation, locomotor activity, environmental orientation, and reduced engagement in calm or exploratory behaviour (Palestrini et al. 2010; Scaglia et al. 2013). In this context, the association between higher owner-reported separation-related scores and greater door proximity found in our study suggests that owners may detect a broader pattern of distress that becomes visible in the test as exit-oriented behaviour.

A similar interpretation applies to the item-level associations between several separation-related questions and door proximity or standing. These findings should not be interpreted as validation of individual items. Wray et al. (2026) suggest that questionnaire items may capture broader or partially overlapping behavioural tendencies that become visible in the test as a more general response style. Owner-reported signs such as restlessness, whining, barking, or howling may correspond to a broader observed response style characterised by increased arousal, reduced behavioural settling, and persistent orientation towards owner departure.

The results also showed a negative association between separation-related scores and panting. Panting is commonly considered a stress-related sign in dogs, but it is not specific to separation distress and may reflect a different aspect or timing of the stress response. Palestrini et al. (2010) observed that barking and environmental orientation tended to decrease over time, whereas panting tended to increase, suggesting that panting may reflect a later or less directed component of arousal. In our study, dogs with higher owner-reported separation-related scores may have expressed distress more through directed behaviours, such as door proximity and standing, than through panting. Therefore, this negative association should be interpreted cautiously and should not be taken to indicate that panting is unrelated to stress in this context.

At the subscale level, the attachment and attention-seeking score was associated only with yawning frequency, and at the item level the strongest result referred to agitation when a household member shows affection to another dog or animal (AA_73). As suggested by Wray et al. (2026), such items may not reflect attachment in a narrow sense, but may also capture jealousy-like behaviour, competition for social attention, or broader emotional reactivity. In our study, the association with yawning may indicate increased tension or uncertainty. However, this result should not be overinterpreted. Yawning is context-dependent and may also have been influenced by the unusual testing situation, including the presence of an unfamiliar person. The positive association between agitation towards affection shown to another person (AA_72) and vocalisation should also be interpreted with caution. Vocalisation was highly skewed in our sample, with most dogs remaining silent throughout the test. Therefore, the correlation may reflect a small number of vocal individuals rather than a consistent pattern. Vocal behaviour in dogs may also serve an attention-evoking function for human listeners, which further complicates interpretation of its emotional specificity (Jégh-Czinege et al. 2020). The negative correlation between proximity-seeking behaviour (AA_70) and lip-licking was the weakest item-level finding and its direction is difficult to interpret, given the context-dependent nature of lip-licking as a stress-related signal.

Several methodological factors probably contributed to the limited overall correspondence. First, the test conducted in our study lasted only 10 min and was performed in a novel environment, whereas separation-related behaviour in daily life usually occurs in the home and may develop over longer periods. Second, the ethogram necessarily included only selected observable behaviours and did not cover all signs represented in the questionnaire. Owner reports are also influenced by interpretation and by the ability to recognise subtle stress-related behaviour. These differences in context and information source likely explain why questionnaire scores and direct observation overlapped only partially in our study.

The Czech translation of the C-BARQ was used here as a targeted research tool for examining correspondence with observed behaviour, not as a full psychometric validation of the instrument. The results suggest that the selected subscales, particularly the separation-related behaviour subscale, may provide useful supplementary information when combined with direct behavioural observation or video analysis. Future studies conducted in the Czech Republic should include larger samples and broader behavioural composites in order to clarify the relationship between owner-reported and directly observed separation responses.

In conclusion, the selected C-BARQ subscales translated into Czech showed partial correspondence with behaviours observed during a standardised separation test, capturing aspects of exit-oriented distress but not fully reflecting the behavioural complexity of the separation response. These results support combining owner-reported questionnaires with direct behavioural observation for a more comprehensive assessment of separation-related problems in companion dogs.

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