An Exploration of the Benefits of Animal-Assisted Activities in Undergraduate Students in Singapore

Abstract

The rise in psychological problems, attrition and suicide rates of university students has been linked to the stressful challenges faced during university life. To buffer this, Animal-Assisted Activities (AAA) may assist in improving psychological and physiological well-being in students, however, to date, there is little empirical evidence for their effectiveness. Consequently, this study explored the psychological and physiological benefits of AAA in a sample of undergraduate students. Sixty-two students from two local universities participated in an hour-long AAA session delivered by Therapy Dogs Singapore (TDS). Measures of perceived stress, anxiety, state self-esteem, and blood pressure (BP) were taken before and after the sessions. The results indicated that students experienced significant decreases in state anxiety, systolic and diastolic BP post AAA, and when compared to a quiet reading comparison session. State self-esteem increased post AAA and, further, was found to moderate the change in anxiety in addition to perceived stress, whereby, perceived anxiety reduced more in those with low state self-esteem and high perceived stress. These results suggest that AAA can be an effective intervention for stress among undergraduate students, which utilizes a novel, easy to implement and enjoyable approach for Singaporean students.

Keywords: *animal assisted activities, therapy dogs, perceived stress, university students, self-esteem*

Introduction

In recent years, Singapore has grown as a regional hub for academic excellence, attracting students from worldwide to engage in further or higher education (Mok, 2011; OECD, 2011). However concurrently, the challenges and potential stressors faced by these students has also increased (Ko, Kua, & Fones, 1999). The pressure to succeed can increase vulnerability to the development of negative health behaviours, placing students at risk of increased emotional stress and mental health problems (Economos, Hildebrandt, & Hyatt, 2008; O'Brien et al., 2008; Oliver, Reed, & Smith, 1998; Pritchard, Wilson, & Yamnitz, 2007). Consequently, many leading higher education institutions worldwide have seen a rise in mental health problems due to academic stress (Hudd et al., 2000; Yorgason, Linville, & Zitzman, 2008).

The Association of American Medical Colleges (AAMC) recently indicated the need to enhance the provision for stress management to support students through their tertiary education (Grbic & Sondheimer, 2014). In response, many universities have attempted to utilize enhanced social support mechanisms, for example, mentoring programs (Bell, 2013; Chanen, 2011; Lannon & Harrison, 2015). Indeed, social support is a form of coping frequently utilized by students (Ko et al., 1999) derived from the intrinsic human need for relationships to maintain psychological well-being (Fine, 2010). Most humans seek social support to help them deal with challenging situations (Bryant, 2008). Stressful experiences and their outcomes can be mediated through social support thereby reducing or eliminating the stress reaction or by directly influencing physiological processes (Cohen & Wills, 1985). The appraisal of stress can, therefore, be altered by social support, reducing the amount of stress experienced and reducing cardiovascular reactivity to perceived stressful situations (Steptoe & Kivimäki, 2012). However, despite the value of social support, the effectiveness of social support mechanisms is often limited as students may refrain from engaging in interventions that require them to disclose their problems (Kate, Kulkarni, Shetty, Deshmukh, & Moghe, 2010; Ko et al., 1999).

A novel approach to stress management recently utilized in some universities is the use of animal assisted activities (AAA). AAA is a branch of Animal Assisted Therapy (AAT) that provides similar benefits but in a more relaxed setting with a procedure that does not target a specific medical condition or person (AVMA, 2013). AAA attempts to provide opportunities to enhance quality of life through motivation, education, or recreation, and can be delivered in various settings by trained professionals or volunteers with animals that meet the specific criteria (Kruger, Serpell, & Fine, 2006). Since animals are often considered a non-human form of social support, the use of AAA may be beneficial in student samples.

Animals present the potential for an uncomplicated relationship, characterized by acceptance and sharing without fear of rejection or exposure (Bryant, 2008), providing unconditional positive regard (Kruger, Serpell, & Fine, 2006) and fulfilling not only emotional and esteem support as a companion, but also tangible support (McNicholas, Collis, & Fine, 2006). The use of AAA may serve as a distraction for students from problems, facilitating positive mood (Cohen & Wills, 1985). This form of social support may also offer a connectedness that assists in building self-esteem and self-identity, reducing feelings of helplessness (Cohen & Wills, 1985; Urichuk & Anderson, 2003), providing an avenue for stimulation, reciprocal affection, and external validation (Brodie & Biley, 1999). This could serve as a potential buffer against stressful events and challenges (Bryant, 2008) through positive reappraisal and inhibition of maladaptive coping behaviours (Cohen & Wills, 1985). These benefits can be similar to those gained from human social support (Wells, 2009) or, at the very least, supplement existing sources of human support. This is especially relevant for student samples who may be reluctant to disclose their problems. Indeed, pet ownership has been shown to be beneficial amongst the elderly (Siegel, 1990) providing a sense of non-human social support which can enhance psychological well-being and, in turn, physiological health (e.g. McConnell, Brown, Shoda, Stayton & Martin, 2011; Zilcha-Mano, Mikulincer & Shaver, 2012).

Self-esteem plays an important role in the coping process, whereby perceived coping success depends on individual ability or personality traits (Cohen & Wills, 1985). Threats to self-esteem may be counterbalanced by esteem support during stress appraisal. Self-esteem is, therefore, enhanced by esteem support which can be in the form of communication with people who appreciate them and their abilities despite difficulties or faults (Cohen & Wills, 1985), which is similar to the unconditional positive regard associated with animal interaction. AAA may boost self-esteem through positive interaction with animals (Serpell, 2006) and can provide a distraction from stressful events, allowing for reappraisal of stress (Friedmann & Thomas, 1995). Previous studies have observed a negative relationship between self-esteem and both life and academic stress (Abouserie, 1994; Chu, Liu, Sun & Lin, 2009; Zuckerman, 1989). To remedy this, the psychotherapeutic effect of animals can reduce anxiety by promoting self-esteem, confidence and a sense of safety (Kongable, Buckwalter, & Stolley, 1989). Therefore, self-esteem is an important facet of the coping process.

Prior utilization of AAA, although limited, has been seemingly successful. Young (2012) observed a reduction in self-reported test anxiety in students following an AAA session with dogs. In addition, Morgan (2008) found that AAA participation reduced subjective anxiety, and measures of heart rate and blood pressure when compared to a control session. Similar effects were observed when comparing interactions with a dog, with reading aloud or reading quietly (Wilson, 1987; 1991) or when compared to quiet study (Bajorek, 2014). Somervill, Kruglikova, Robertson, Hanson, and MacLin (2008) observed that participation in an AAA program with dogs and cats was effective in reducing diastolic blood pressure in a sample of undergraduate students but not significantly. Students, too, have reported AAA to be effective in providing comfort and support during stressful periods (Adamle, Riley, & Carlson, 2009) and have described the AAA as relaxing and stress reducing (Wiscovitch, 2014). Although, there is some support for the benefits of AAA in terms of reducing anxiety and physiological stress reactivity, few studies have explored the moderating effects of self-esteem on AAA effectiveness. Changes in self-esteem have been explored in older adult populations whereby AAA has been found to elevate self-esteem (Dookie, 2013). However, whether this applies to student samples and further, whether self-esteem can moderate the effectiveness of AAA has not been tested.

Despite there being little in terms of empirical support for the effectiveness of AAA as an intervention beyond anecdotal feedback from students, several universities throughout North America have incorporated therapy dogs into the school support system (Bell, 2013; Ertl, 2010; Hernandez, 2014; Loren, 2012). More recently, Yale Law School took a novel approach utilizing a therapy dog to promote emotional well-being in their students (Chanen, 2011). AAA in Singapore is fairly new, with very few organizations offering this type of program. Consequently, the benefits of AAA in Singapore are largely untested. In light of this, the current study aimed to assess the effectiveness of AAA in a sample of undergraduate students. Specifically, changes in perceived anxiety, self-esteem and measured blood pressure (BP) were assessed before and after engaging in an AAA session. A subset of participants also participated in a quiet reading task to serve as a comparison session. It was hypothesized that taking part in the AAA session would lead to a reduction in perceived anxiety and blood pressure. Since previous research has yielded inconsistent results, the potential for self-esteem, attitudes towards the use of animals and perceived stress to moderate this relationship was explored. It is reasonable to suggest that holding a positive attitude towards animals is an important determinant of whether someone will engage in an animal assisted activity. Indeed, pet owners have been found to hold a more positive attitude towards animals than non-pet owners (Kidd & Kidd, 1989). This could, consequently, influence the potential benefit of engaging with therapy dogs. Further, those experiencing greater perceived stress may represent a vulnerable sample and may, consequently, experience a greater reduction in anxiety, BP and increase in self-esteem (Wiscovitch, 2014).

# Method

## Sample

Sixty-two Singaporean Chinese undergraduate students from National University Singapore (NUS) (n=40, 6 males and 34 females, average age of 21.45 ± 2.32 years) and James Cook University, Singapore (JCUS) (n=22, 5 males and 17 females, average age of 22.14 ± 2.49 years) participated in the study. The majority of students were full time (98.4%) with only one part-time student. Of those who participated, 35.5% were pet owners. Of these pet owners, the majority owned a dog (75%, or 24.2% of the entire sample). The NUS students had previously signed up to participate in two separate AAA sessions organized by the University and Therapy Dogs Singapore (TDS). The JCUS students participated in one AAA session and were recruited via posters around campus, which informed them of the study and presence of dogs on campus. This was required for religious reasons as some students may wish to avoid the sites where dogs would be present. Participants were informed that participation in the study was entirely voluntary and refusal to participate did not preclude them from participating in the AAA session. A subset of students from JCUS participated in an additional comparison session (n=13) which took the form of a quiet reading session as well as the AAA session. The James Cook University Human Research Ethics Committee (HREC) approved the study and all participants gave informed consent prior to participation.

The Animal-Assisted Activities (AAA) sessions were organized by Therapy Dogs Singapore (TDS) and were conducted in each respective institution in either a lecture hall or large classroom. Each session consisted of approximately 15 dogs and lasted one hour. The dogs included smaller breeds (e.g. Chihuahua, Dachshund, Miniature Schnauzer, Beagle) and also larger breeds (e.g. Golden Retriever, Collie, Chow). The session included general interactions, for example, petting, hugging, feeding, doing tricks, walking, grooming, playing fetch, and photo taking. The dogs involved in the AAA sessions were trained and experienced therapy dogs, working as part of Therapy Dogs Singapore (TDS). Their experience spans several years, in various contexts, and with individuals from a variety of backgrounds.

## Comparison Session

The comparison session served to test whether the effects of AAA were over and above those which would normally be observed after engaging in a relaxing activity. The comparison session involved quiet reading, and was held either before or after the AAA session (in a counterbalanced order, and on a different day to the AAA). The comparison session was matched with the AAA session for duration and location.

## Psychological measures

The Animal Attitudes Scale (AAS) is designed to assess individual differences in attitudes towards the treatment of animals (Herzog, Harold, Betchart, & Pittman, 1991), and consists of 20-items utilizing a five-point Likert scale response (i.e. strongly agree to strongly disagree), for example, “*Too much fuss is made over the welfare of animals these days when there are many human problems that need to be solved*”. Scores range from 20 to 100 with high scores indicating pro-animal welfare attitudes. Previous studies have found the scale to have high internal consistency with a Cronbach’s alpha of 0.91 (Mathews & Herzog, 1997).

The Perceived Stress Scale (PSS) is a ten-item scale assessing the extent to which a person perceives his/her life as being stressful (Cohen, 1988), for example, “*In the last month, how often have you felt that you were unable to control the important things in your life?*”. Responses are made on five-point Likert scale (i.e. never to very often), with high scores indicating higher perceived stress. The scale has previously shown high internal consistency with a Cronbach’s alpha of 0.85 (Cohen, Kamarck & Mermelstein, 1983).

The state component of the State Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used to measure perceived anxiety. The measure consists of 20-items designed to assess state anxiety i.e. transitory conditions due to specific situations, for example, “*I feel at ease*”. Items are rated using a 4-point scale (i.e. from not at all to very much so), whereby higher scores indicate greater anxiety. Previous research has demonstrated good internal consistency and test-retest reliability (Shahid, Wilkinson, Marcu, & Shapiro, 2012). Evidence of construct and concurrent validity has been reported by both Spielberger (1989) and Spielberger, Sydeman, Owen and Marsh (1999).

The State Self Esteem Scale (SSES) is a 20-item scale measuring a participant’s self-esteem at a given point in time (Heatherton & Polivy, 1991), for example, “*I feel confident about my abilities*”. Items are scored using a 5-point Likert scale (i.e. not at all to extremely). High scores indicate higher levels of self-esteem. Previous studies have shown high internal consistency with Cronbach’s α = 0.92 (Heatherton & Polivy, 1991).

All questionnaires were administered in English as Singaporeans are largely English language speakers.

## Physiological measures

Systolic and diastolic blood pressure was recorded twice, both pre and post session using an Omron™ wrist based blood pressure monitor. Systolic blood pressure (SBP) refers to the maximum pressure the heart employs while beating, whereas, diastolic blood pressure (DBP) is the arterial pressure between beats. The difference between these is the pulse pressure. Two readings were taken at each time point (pre and post) to avoid inflated results due to unfamiliarity. Only the second reading was used in the analysis (Trochim, 2003).

Procedure

All participants were provided with information sheets prior to the start of the study and were informed that participation was completely voluntary. Informed consent was provided prior to participation. All participants were asked to complete a background demographics questionnaire, consisting of questions to assess age, gender, ethnicity, whether they own a pet, like dogs and full-time or part-time student. Participants then completed the PSS and AAS. Prior to entering the AAA session, participants were asked to complete the STAI and SSES and blood pressure (SBP and DBP) was recorded. Participants then engaged with the dogs during the session. Once the session was complete, participants were asked to complete the STAI and SSES again and blood pressure (SBP and DBP) was recorded.

For those also participating in the comparison session, participants were asked to engage in a quiet reading session on a separate day. The procedure was identical to the AAA session with the exception that quiet reading now replaced the contact with therapy dogs.

Statistical Analysis

All data were analyzed using IBM SPSS version 22 (SPSS, 2013). All measures were assessed for reliability before inclusion in the analysis. To assess the impact of the AAA session (n=62) on anxiety (STAI), self-esteem (SSES) and blood pressure (SBP and DBP) , a series of repeated measures ANOVAs were conducted with time as a within subjects factor (pre and post AAA session). Given that there was a disproportionate number of males and females, gender was included as a covariate. The same analysis was repeated to assess the impact of the quiet reading comparison session on STAI, SSES, SBP and DBP (n=13).

To compare the response to the AAA session (i.e. decrease in anxiety and SBP/DBP and increase in self-esteem) to the response to the comparison session, change from baseline scores were calculated (post session minus pre session), whereby a negative change score indicates a reduction in outcome measure following the session. Change scores were then compared using bonferroni corrected paired samples t-tests.

Finally, to explore the predictors of AAA effectiveness, a series of backward, stepwise, multiple regression analyses were conducted. Age, gender, owns a pet, likes dogs, attitude towards animals score (AAS), perceived stress score (PSS) and state self-esteem score (SSESpre) were included as predictors in addition to the interaction terms, perceived stress (high/low) by self-esteem (high/low) (PSS\*SSES), perceived stress (high/low) by animal attitudes score (high/low) (PSS\*AAS) and finally, self-esteem (high/low) by animal attitudes score (high/low) (SSES\*AAS). Change from baseline score (from the AAA session) for anxiety, SBP and DBP pressure were included as outcome variables. In a backwards stepwise (or backwards elimination) regression, the model begins with all predictors included. Through an automated process, the predictor that is the least significant is removed and the model refitted. On each step, the least significant predictor is removed until all the remaining predictors in the model are significant.

# Results

The internal consistency of all measures was assessed and all measures were found to be reliable (Table 1).

*Insert Table 1 here*

## Change in Psychological and Physiological Measures Pre-Post AAA and Comparison Session

A table of means and standard deviations for STAI, SSES, SBP and DBP both pre and post AAA can be found in Table 2. Participation in the AAA session, was associated with a significant reduction in perceived anxiety (STAI) (*F*(1,60) = 6.164, *ρ* = .016). Further, SBP (*F*(1,57) = 5.083, *ρ* = .028) and DBP (*F*(1,57) = 4.222, *ρ* =.044) reduced significantly from pre to post AAA. Self-esteem (SSES) increased pre to post AAA but the change was not significant (*F*(1,60) = 2.899, *ρ* = .094). No significant changes in STAI (*F*(1,11) = 3.055, *ρ* = .108), SSES (*F*(1,11) = 1.486, *ρ* = .248), SBP (*F*(1,11) = .214, *ρ* = .653) or DBP (*F*(1,11) = .001, *ρ* = .983) were observed following participation in the comparison session.

*Insert Table 2 here*

Change from baseline scores (pre session to post session) for STAI, SSES, SBP and DBP were calculated to assess the degree of change following the AAA session and again for the comparison session. Change scores were then compared using bonferroni corrected paired samples t-tests to see if the change following the AAA session was greater than following the comparison session (indicating greater efficacy) (Table 2). The decrease in STAI was significantly greater following the AAA session than following the comparison session (*t*(12) = -3.671, *ρ* = .003). Greater improvement in SSES was also observed following AAA (*t*(12) = 2.515, *ρ* = .027), however, due to the bonferroni correction, just missed significance. A greater reduction in SBP (*t*(12) = 0.345, *ρ* = .736) and DBP (*t*(12) = -1.143, *ρ* = .275) was also observed following AAA but this did not reach significance.

## Predicting Response to AAA

Unstandardized (*B*) and standardized (*β*) regression coefficients for each predictor in the final regression model for predicting change in STAI following AAA are reported in Table 3. The final model was significant and accounted for 16.7% of the variability in STAI change scores (*R2* = 0.17, adjusted *R2* = 0.14, *F*(2, 59) = 5.921, *ρ* = .005). SSES was the best predictor of change in STAI post AAA, in that, a greater reduction in STAI was associated with lower SSES. The interaction between perceived stress (PSS) and SSES was also a significant predictor of change in STAI post AAA. The greatest reduction in STAI was observed in those with low SSES and high PSS (-12.95 ± 6.14), which was significantly greater than those with low SSES/low PSS (-8.25 ± 4.49) and greater than those with high SSES/high PSS and high SSES/low PSS (-11.40 ± 5.78 and -6.61 ± 5.44 respectively).

*Insert Table 3 here*

Unstandardized (*B*) and standardized (*β*) regression coefficients for each predictor in the final regression model for predicting change in SBP following AAA are reported in Table 4. The final model was significant and accounted for 35.9% of the variability in SBP (*R2* = 0.36, adjusted *R2* = 0.29, *F*(5, 53) = 5.942, *ρ* < .001). The interaction between PSS and SSES was the best predictor of change in SBP following AAA. Again, the greatest reduction in SBP post AAA was observed in those with high PSS and low SSES (-5.71 ± 7.01), which was significantly greater than those with high PSS and high SSES (.70 ± 6.02) and greater than those with low PSS/low SSES and low PSS/high SSES (-3.08 ± 8.78 and -4.31 ± 5.71 respectively). Whether or not participants liked dogs was also a significant predictor. However, a greater reduction in SBP was associated with a *lower* score for like of dogs, indicating that participants who were unsure about whether they liked dogs or not, experienced a greater reduction in SBP. Perceived stress was also a strong predictor of SBP change in that a higher perceived stress score was associated with a greater reduction in SBP.

*Insert Table 4 here*

A backward stepwise multiple regression was also performed for DBP, however the final model did not reach significance (*R2* = 0.095, adjusted *R2* = 0.063, *F*(2, 56) = 2.951, *ρ* = .06).

# Discussion

The aim of the current study was to explore the benefits of animal assisted activities (AAA) in a sample of undergraduate students in Singapore. It was hypothesized that participation in the AAA session would lead to a decrease in perceived anxiety and blood pressure (systolic and diastolic) and increase in state self-esteem. Further, the potential for state self-esteem, perceived stress and attitude towards animals to moderate the change in perceived anxiety and blood pressure post AAA was explored. The results indicate that AAA had a positive effect on both psychological and physiological markers of stress. Specifically, AAA led to a significant reduction in perceived anxiety and systolic blood pressure and a significant increase in state self-esteem. Further, and importantly, the reduction in anxiety was more so than the reduction in anxiety resulting from participation in a comparison session.

The finding that AAA led to a reduction in anxiety and blood pressure is consistent with previous research and anecdotal evidence which suggests that interacting with dogs can lead to reduced stress and better wellbeing, particularly in a student sample (Armour, 2012; Bajorek, 2014; Morgan, 2008; Wilson, 1991; Wiscovitch, 2014; Young, 2012). These studies have observed significant decreases in blood pressure and anxiety following participation in AAA and further, when compared to a control or comparison session. These findings are mirrored in the results of the current study and are extended with the inclusion of state self-esteem, which was also found to improve. However, although self-esteem increased post AAA, the change in state self-esteem was not necessarily greater than the change observed following participation in a comparison session (quiet reading). This may indicate that AAA was beneficial for students but the suggestion that AAA is more beneficial than participating in any other relaxing activity remains tentative. This finding is consistent with prior research which suggests that the relaxing effect of an AAA session and quiet reading (comparison session) may be similar (Odendaal, 2000), although other studies have found that AAA is still a more powerful form of intervention (Odendaal & Meintjes, 2003). Indeed, previous research has highlighted the potential for animal contact to improve state self-esteem (Urichuk & Anderson, 2003) and this is combined with the observation that previous studies have observed improvement in state self-esteem following AAA but only in elderly populations (Dookie, 2013).

In terms of predicting who would benefit more from AAA, state self-esteem was a prominent predictor. Individuals with low state self-esteem appeared to benefit more from AAA in terms of anxiety reduction. Further, those with low state self-esteem and high perceived stress experienced a greater reduction in anxiety and systolic blood pressure post AAA. Indeed AAA has been found to be beneficial for those with low state self-esteem (Dookie, 2013; Wisdom, Saedi, & Green, 2009) but in elderly populations and not student samples. The combination of state self-esteem and perceived stress has not been tested and is a novel finding of value when evaluating the effectiveness of AAA. This points to a potentially vulnerable sample that could benefit greatly from AAA.

As the appraisal of stress is closely associated with feelings of helplessness and the possible loss of self-esteem (Cohen & Wills, 1985), social support via AAA may assist in attenuating stress appraisal or may reduce or eliminate the stress response. The results of the current study do suggest that AAA could improve self-esteem and further improve the wellbeing of those experiencing high-perceived stress and low self-esteem. Animals can assist in improving self-esteem by providing unconditional positive regard (Kruger et al., 2006) and acceptance (Bardill & Hutchinson, 1997; Bryant, 2008). This companionship develops emotional and esteem support (McNicholas et al., 2006), and this connectedness reduces helplessness thereby building self-esteem and self-identity (Urichuk & Anderson, 2003). AAA esteem support also acts as a buffer for stress by allowing positive reappraisal (Cohen & Wills, 1985; Friedmann & Thomas, 1995). Attachment to animals is positively related to self-esteem as well as general well-being (Brodie & Biley, 1999), and self-esteem is negatively correlated to both life and academic stress (Abouserie, 1994). Therefore, these results illustrate the potential for AAA in not only improving self-esteem, but also possibly reducing academic stress.

Participation in AAA may have afforded students a distraction from anxiety-provoking stimuli (e.g. assignments, exams, classes) by providing a pleasant external focus for attention (Friedmann & Thomas, 1995). This suggestion is in accordance with the Biophilia Hypothesis (Wilson, 1984) which states that humans have an innate proclivity to attend to and be attracted to life and life-like processes, and that through attention to and knowledge of environmental cues, humans improve their chances of survival (Gullone, 2000). However, as animals can provide unconditional positive regard (McCulloch, 1982; Serpell, 2006), exposure to AAA may also assist in reducing stress and feelings of helplessness, which can, in turn, lead to improved self-esteem (Kawachi & Berkman, 2001). In essence, exposure to AAA may enhance a sense of social support, which has been previously shown to facilitate positive mood and wellbeing (Cobb, 1976; Cohen & Syme, 1985).

As anticipated, like of dogs emerged as a significant predictor of change in systolic BP but not in the direction expected. The results indicate that those who were unsure of dogs experienced a greater reduction in systolic BP post AAA. It is possible that this reflects an anticipation effect in those who were unsure about whether they wanted contact with the dogs and, consequently, an elevated systolic blood pressure reading was recorded prior to the AAA session. Indeed anticipation effects in terms of markers of stress are well documented (Bandura, 1988; Flier, Underhill, & McEwen, 1998; Takatsuji et al., 2008). Further, since dogs are less accepted as companion animals in Singapore (compared to Western counterparts), this may have facilitated the apprehension prior to the session (Hood, 1998). An alternative explanation is that those who had a strong liking of dogs had a stronger systolic blood pressure response to the session due to excitement (Piira, Huikuri, & Tulppo, 2011), hence, no reduction was detected. This suggests that further research needs to consider this when selecting the physiological markers used to evaluate the effectiveness of AAA.

It is also of interest to note that, although like of dogs emerged as a significant predictor, attitudes towards animals did not. It was expected that those who had more favourable attitudes towards animals would benefit more from AAA. This, however, was not observed. Despite this expectation, this finding is consistent with findings from Shiloh, Sorek and Terkel (2003) who found evidence of the benefits of petting an animal across participants with varied attitudes towards animals. To explain this, it is likely that the scale used to assess attitudes, The Animal Attitudes Scale (AAS) (Herzog et al., 1991), was too broad for the current study. Although relevant, the AAS covers attitudes to a broad range of animals, not only dogs and covers a broad range of scenarios (i.e. animals as food, animals in science). Future research should, therefore, explore the utilization of more specific measures to explore the possibility that attitudes to animals could influence AAA effectiveness.

Since there is very little empirical evidence for the effectiveness of AAA, the current study has expanded current knowledge of the use of AAA as a possible intervention in undergraduate students and further so, students in Singapore. The study had an acceptable sample size, although the sample size of the comparison group was small. However, few studies have utilized a control or comparison group when studying AAA in university students, which highlights a strength of the current study. Further, participants were aware of the AAA session prior to signing up and, consequently, appeared to prioritise completion of the AAA session over the comparison session.

Although the findings of the current study extend those from prior research, some limitations should be addressed. First, is the issue of bias in terms of the likely profile of the participant. Due to the type of session it is unlikely that someone who does not like dogs would participate. Although, the current sample did include those who were unsure of their liking of dogs. Further, participants were exclusively Singaporean Chinese, which limits generalizability. There was also limited opportunity for one to one interaction between participants and the dogs and limited scope for activities undertaken, as each session had only approximately 10 to 15 dogs. Future studies should, therefore, investigate the effect of different types of contact and contact time between each participant and a dog when evaluating the effectiveness of AAA.

A related observation is that exposure to the dogs lasted only one hour and did not include dogs known to the participants, whereas most successful forms of social support typically occur when there is a strong bond (e.g. family, friends, partners) (Perkins, Bartlett, Travers, & Rand, 2008). This would imply the need for continued contact with the dogs in order to determine the relevance of social support as a potential mechanism of effect (Wells & Perrine, 2001; Wells, 2009). Future studies, therefore, need to investigate the effect of repeat exposure to elucidate this suggestion and also to assess the longevity of the benefits of AAA.

A further limitation centres on presence of the dog handler during the AAA sessions. It is possible that the interaction between participant and handler may have been a positive influence (i.e., offering encouragement, talking positively about the dog etc.) and may be, in part, responsible for the observed benefits of participation (this is especially since, the comparison reading session was a solitary task). Unfortunately, it is not possible to determine the extent of this influence, as some handlers were not so proactive in the session, leading to inconsistency. Indeed other researchers have faced similar issues (for a review, see Stern & Chur-Hansen, 2013). Future research should be mindful of such influence and limit or control the involvement of the handler to reduce this risk.

Currently, AAA is under-utilized in Singapore. Although considerably developed as an approach in countries such as the US, animal assisted interventions (AAA/AAI) in Singapore are still in infancy. In many Western cultures the bond between human and companion animal is likened to a surrogate parent-child relationship, which has a strong emotional element. Whereas in Asian cultures, companion animals are often evaluated for their utilitarian capacity (Hood, 1998). This may indicate a differing perspective and attitude towards animals that could explain the lack of animal assisted services. However, there has been a noted increase in the number of organisations offering AAA/AAI in Singapore, which indicates a growing openness to the approach. There remains scope for greater research in the area, both in the perceptions of, receptiveness to and effectiveness of the approach.

Animals provide an opportunity to interact socially and alleviate stress (Barker, Pandurangi, & Best, 2003; Fine, 2010), in a non-judgmental and calming way (Kruger et al., 2006; Pedersen, Nordaunet, Martinsen, Berget, & Braastad, 2011). The beneficial outcomes noted in the current study indicate the potential for AAA to be a successful intervention for stress in university students, particularly in the Singapore context. AAA may be a form of stress intervention which is novel, easy to implement, cost effective and, above all, enjoyable.

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