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Hannah G. Clark
Grand Valley State University

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**Shelter Dogs Need A Home: The Effect of Enrichment and Human Contact
on the Welfare and Adoptability of Shelter Dogs**

Hannah G. Clark

Frederik Meijer Honors College, Grand Valley State University

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It comes as no surprise that an animal shelter can be a stressful place for dogs. Most shelters consist of concrete kennels where dogs are housed separately, providing little interaction with humans and other dogs. In addition, shelters are loud environments with noise levels often above 100 decibels, which also adds to stress (Perry et al. 2020). These conditions, accompanied by multiple, novel stimuli, produce a stressful environment that cause hormonal and behavioral responses in dogs housed in shelters. Many of the stereotypical behaviors produced by the stress of living in a shelter, which tend to worsen as length of stay increases, are undesirable to potential adopters. As individual dogs respond differently to stress, this effect can greatly impact rates of adoption based on a variety of factors including morphology and past experiences (Protopopova 2016, Hennessy et al. 2020). However, many studies have shown that enrichment with a variety of toys, exercise, and human interaction can buffer the stress response in shelter dogs and improve their well-being. The aim of improving the lives of dogs living in animal shelters through enhancing their daily activities leads to the ultimate goal of increasing adoption success.

The stress response produced in shelter dogs is caused by a neuroendocrine system called the hypothalamic-pituitary-adrenal axis (Buttner 2016). In response to stress, the hypothalamic-pituitary-adrenal (HPA) axis activity is increased (Beerda et al. 1999 II). This increased stimulation of the HPA axis can result in an increase in cortisol levels, which can be a good indicator of stress in animals (Beerda et al. 1999 II). Although cortisol levels may increase due to a few other factors as well, in general, higher than normal cortisol levels can be interpreted as an increase in stress. There are multiple sampling methods used for measuring cortisol concentrations. Urinary and salivary cortisol both work well in use with shelter dogs because of the noninvasive nature of these tests (Coppola et al. 2006, Gunter et al. 2019). Several

studies have found that dogs housed in animal shelters have higher cortisol levels than those living in private homes (Gunter et al 2019, Hennessy et al, 1997). The consensus of these studies is that cortisol concentrations roughly triple their normal values in the first three days after a dog enters the shelter before slowly declining and evening out to baseline around day nine (Conley et al. 2014, Hennessy et al. 1997). It is unclear whether this decline in cortisol after the first few days in the shelter represents a decrease in stress response to the shelter environment, or habituation and dysregulation of the HPA axis (Protopopova 2016).

Stress in canines can also be observed through their behavior. Some actions that are thought to indicate stress include autogrooming, vocalizing, and paw lifting (Beerda 1999 I). These three behaviors increased in frequency with social and spatial restriction imposed by being kenneled in a shelter (Beerda 1999 I). Other stereotypical behaviors can also manifest in dogs living in an animal shelter. Some common stereotypical behaviors are pacing, licking, and hiding (Sampaio et al. 2019). Dogs living in a restricted environment such as an animal shelter tend to become more excitable and exhibit aggression or uncertainty, especially when they feel challenged (Marston & Bennett 2003). These tendencies and stereotypies increase with time spent housed in a restricted environment (Marston & Bennett 2003). The development of stereotypical behavior problems can become a roadblock to the adoption of these animals, especially for dogs who have spent a greater amount of time living in a shelter. Dogs are particularly negatively affected by the stressors presented to them in an animal shelter including noise, loss of control, unpredictability, and disruption of routines (Willen 2019). These negative stressors can impact the behavior of stressed out, fearful dogs, which can then lower the chances or success of future adoptions (Willen 2019). The undesirable behaviors, such as disobedience or fear-induced aggression, acquired while in the animal shelter could be apparent after adoption as

well. Tests done on laboratory animals suggest that behavioral issues and implications of poor welfare while housed in a shelter could present themselves post adoption when exposed to a stressor such as loud noises (Hennessy et al. 2020).

One way to mediate the stress response of shelter dogs and improve their overall welfare is to provide various forms of enrichment. Enrichment is effective in improving the welfare of shelter dogs (Amaya et al. 2020, Menor-Campos 2011, Sampaio 2019). Dogs who received twenty-five minute sessions of enrichment had significantly lower salivary cortisol levels after these sessions than the control group (Menor-Campos et al. 2011). The enrichment sessions consisted of outdoor play activities as well as a walk and some work on obedience commands (Menor-Campos et al. 2011). Along with salivary cortisol testing, the dogs were also subject to behavioral testing. The results of the behavioral tests among the dogs who received enrichment improved post-enrichment, while the behavioral results of the dogs who did not receive enrichment remained the same (Menor-Campos et al. 2011). The extremely high levels of salivary cortisol in the control group compared to the experimental group suggest that shelter dogs who do not receive enrichment activities have a lower tolerance to new stimuli presented in the shelter, causing this spike in cortisol (Menor-Campos et al. 2011). Forms of enrichment such as exercise and play can not only greatly improve a dog's welfare, but can also introduce the dog to new stimuli so that they do not cause as much of a stress response.

Toys and activities are another form of environmental enrichment that can improve the welfare of shelter dogs. Sampaio et al. found that enrichment consisting of games with toys and food decreased the depression and stereotypical behaviors shown in dogs living in an animal shelter (Sampaio et al. 2019). The dogs' behaviors were monitored for a week before enrichment began and for three weeks while the dogs received four types of enrichment. The enrichment

rotated between tug of war, a tennis ball, a plastic bottle filled with treats, and frozen food, with each enrichment activity given for ninety minutes a day (Sampaio et al. 2019). Before being presented with different forms of environmental enrichment, dogs were much less active. During the weeks that they received enrichment, the dogs became more active, decreasing the amount of time they spent laying down (Sampaio et al. 2019). The frequency of licking, a behavior that can be a response to stress, also decreased with the use of food and toys for enrichment (Sampaio et al. 2019). The addition of these stimuli to the dogs' otherwise mundane daily lives in the kennel vastly improved their well-being as shown by the changes in their behavior. In such a stressful environment, implementing small changes such as providing games to engage dogs can help to improve their overall welfare.

A study by Amaya et al. on olfactory and auditory enrichment with music, pheromone diffusers, and lavender on shelter dogs found similar results regarding the effects of environmental enrichments on shelter dogs. Dog appeasing pheromone has previously been found to decrease barking and increase rest in dogs housed in shelters (Amaya et al. 2020). Classical music has also been shown to reduce stress-induced behavioral responses in dogs (Amaya et al. 2020). In this experiment, the control dogs, who were not exposed to any form of sensory stimulation, showed significantly higher levels of stress behaviors than the dogs in the three experimental conditions (Amaya et al. 2020). The dogs in each experimental group were exposed to either dog appeasing pheromone, classical music, or lavender essential oil, although dog appeasing pheromone and classical music seem to have been more effective than the lavender. The dogs in all three enrichment groups spent much less time panting and vocalizing than the dogs in the control group (Amaya et al. 2020). The decrease in vocalization seen with enrichment not only indicates a reduction in stress, but it could also be appealing to adopters.

Vocalization was one of the behavioral problems cited by owners as a reason for relinquishment of their dog to an animal shelter, along with hyperactivity and inappropriate chewing or elimination (Marston & Bennett 2003). The auditory and olfactory stimuli received by the shelter dogs in the experimental groups induced more restful behaviors and decreased the frequency of stress-related behaviors shown (Amaya et al. 2020). The reduction in arousal seen by the use of classical music, dog appeasing pheromone, and lavender is important in the animal shelter environment as hyper-arousal is a major concern for shelter dogs and can lead to negative health and behavioral effects (Amaya et al. 2020).

Another important aspect of improving the lives of shelter dogs is human contact. Interaction with people is a vital part of canine prosperity and many dogs prefer the company of people over conspecifics when given the choice (McGowan et al. 2018). Interaction with people while living in an animal shelter could lead to more positive interactions with future owners and could help facilitate a successful adoption. Human contact is not only critical for the well-being of shelter dogs, but social interactions can also improve adoption success (Marson & Bennett 2003).

The importance of human contact is based in the human-canine attachment bonds. The attachment bonds created between dogs and humans were shaped through changes to the stress response system during domestication and are mediated by socialization to humans during specific stages in development (Buttner 2016). One of the hormones that plays a role in this bond is oxytocin. Following positive interactions between dogs and humans, both species exhibit elevated levels of oxytocin (Buttner 2016). The release of oxytocin is stimulated by social behaviors such as gentle petting (Hennessy et al. 2020). In a study conducted by Ogi et al., salivary oxytocin levels of dogs increased significantly directly following five minutes of human

interaction which included gentle stroking and speaking calmly to the dog (Ogi et al. 2020). Because oxytocin is an inhibitor of the HPA axis, this means that a release of oxytocin in response to human interactions could reduce stress in dogs. Even small amounts of human contact a day can stimulate production of hormones to quell the effects of the HPA axis's stress response and improve the well-being of animals occupying an animal shelter.

The effect of human contact on the cortisol response can also be used to proactively alleviate the aforementioned behavioral problems that could occur after adoption as well. A study in which canine laboratory subjects were housed in a shelter for eight weeks demonstrated the importance of human contact on these reactions (Hennessy et al. 2020). Dogs were subjected to novel stressors before and after the eight weeks of sheltering. The dogs that received regular human interaction sessions throughout the sheltering experience showed similar plasma cortisol levels after the stressful situation both before and after sheltering (Hennessy et al. 2020). Dogs who were deprived of additional human contact while housed in the animal shelter, however, exhibited a significantly greater plasma cortisol response to the stressor after the eight weeks spent in the shelter (Hennessy et al. 2020).

Coppola et al. discovered that the dogs who received an enrichment session via human contact for an average of forty-five minutes on their second day in the shelter did not show the expected spike in salivary cortisol that typically occurs on day three of living in the animal shelter (Coppola et al. 2006). These findings demonstrate the importance of the time period directly after dogs enter an animal shelter. With a new environment and many new stimuli to adjust to, interaction with a person for longer than the quick maintenance activities of shelter staff could curb the initial stress of these dogs.

Hennessy, Willen, and Schiml (2020) concluded that human interaction was most effective as a form of stress relief for shelter dogs when the interaction was gentle and occurred in a calm, quiet environment. In their first attempt to buffer the stress response in shelter dogs via petting for twenty minutes, they found that the dogs who interacted with women had buffered glucocorticoid responses, while the dogs who interacted with men did not (Hennessy et al. 2020). After the men had been instructed to pet the dogs gently and quietly, the results based on the sex of the researcher evened out (Hennessy et al. 2020). They also found that if the dogs were brought to a quiet room away from the commotion of the shelter environment, they experienced a reduction in plasma cortisol levels in the presence of a person whether the dog was petted, played with, or simply sat in proximity to the person (Hennessy et al. 2020). This evidence suggests that time away from the external stimulations of the kennel during human interaction helps to combat the psychological stress faced by shelter dogs. Time spent with people in a calmer place away from the main shelter area for a short period of time every day or multiple times a week could therefore greatly increase the overall welfare of dogs living in an animal shelter.

The effects of human interaction on the behavior and health of shelter dogs can be seen even with as little as fifteen minutes of interaction. In an experiment conducted by McGowan et al., volunteers spent fifteen minutes one-on-one with a shelter dog. The dogs were petted when they voluntarily made contact with the volunteer. Based on how the dogs interacted with the volunteers and for how long, they were categorized as highly engaged, moderately engaged, or indifferent (McGowan et al. 2018). The dogs that spent the most time with the volunteer (highly engaged or moderately engaged) exhibited a decrease in salivary cortisol concentrations, although not statistically significant (McGowan et al. 2018). This may suggest that a longer

amount of time spent with a person could further decrease cortisol to a statistically significant change. The dogs also wore monitors which tracked their heart rates throughout the human interaction session as well as five minutes before and after. The dogs' average heart rates decreased from the beginning of the session to the end of the session and their heart rate variability increased (McGowan et al. 2018). The decrease and greater variability of the dogs' heart rates is indicative of greater relaxation and therefore improved well-being (McGowan et al. 2018). This effect was shown in a previous study in which an increase in total heart rate variability was exhibited during human-dog contact while the dog was being petted in certain areas of the body such as the chest (Kuhne et al. 2014). It was concluded that the cardiac variability seen indicated a lack of acute stress during this interaction (Kuhne et al. 2014).

A study done by Gunter et al. investigating the effects of human contact in the form of temporary fostering found similar effects on cortisol levels of shelter dogs. In this study, dogs from five different animal shelters spent one or two nights with a foster volunteer in their home. During their "sleepovers" with the foster volunteers, the dogs' urinary cortisol levels were significantly lower compared to the same dogs while they were at the shelter (Gunter et al. 2019). The dogs also wore health monitoring collars which recorded heart rates, respiration rates, and overall activity levels, among other variables (Gunter et al. 2019). Dogs rested more during the foster "sleepovers" than they did in the shelter before the "sleepover" (Gunter et al. 2019). After returning to the shelter, dogs rested for longer periods than before their "sleepovers" as well, although not as long as during the foster "sleepover" (Gunter et al 2019). These findings suggest that dogs may not be getting quite enough sleep in a shelter setting, which could contribute to poor welfare. By implementing programs such as this temporary fostering program to have dogs sleep over at a volunteer's house, the welfare of shelter dogs could be improved.

Temporary fostering also has the potential to increase the rates of successful adoption outcomes. Dogs who participate in such programs are less likely to be returned to the shelter after adoption (Gunter et al. 2019). This could be due to the impact that the temporary fostering has on the dogs' behavior due to a reduction in stress and increased welfare. Temporary fostering programs may also be a form of preparing dogs for adoption through positive experiences in a private home.

Fear is a common response invoked by the stressful shelter environment for many dogs. This creates the potential to elicit negative behavioral responses such as fear induced aggression. With careful human interaction beginning when dogs first enter the shelter, these fearful dogs can show less fear induced aggression and more desirable behaviors. Willen, Schiml, and Hennessy tested this hypothesis by providing dogs with fifteen minute enrichment sessions twice a day starting on the first full day that a dog was in the shelter. The enrichment sessions were performed by a Certified Applied Animal Behaviorist and started out with coaxing the animal to the front of the kennel using small treats for the fearful group (Willen et al. 2019). Both fearful and non-fearful dogs were then taken to a furnished room where they were petted and played with if the dog permitted. All dogs were evaluated by a test called the Safety Assessment for Evaluating Rehoming (SAFER), which is used to identify aggressive dogs, before and after the experiment (Willen et al. 2019). This twice daily enrichment and human contact for five days in a row increased the number of fearful dogs who passed the SAFER test (Willen et al. 2019). Although fearful dogs who received this enrichment still displayed more fearful behaviors than the non-fearful dogs, the benefits of the enrichment program reduced their fear enough for the dogs to be placed for adoption (Willen et al. 2019). When the fearful dogs performed well enough to be placed up for adoption, they would continue to receive further human interaction in

the form of volunteers and potential adopters, which would further decrease their fearfulness (Willen et al. 2019).

Conley et al. also concluded that human contact could mediate the fear responses of shelter dogs. This experiment included a group of dogs that received positive human contact and a toy to play with daily, a group that only received positive human contact daily, and a control group which received no enrichment apart from the routine cleaning and feeding by the shelter staff (Conley et al. 2014). Their results indicated that the dogs receiving human contact seemed to become less fearful as the dogs in these groups increased the time that they spent at the front of the kennel close to the researcher (Conley et al. 2014). If the dogs were in the back of the kennel, dogs receiving human contact were more likely to approach the researcher at the front of the kennel than dogs who did not receive human contact (Conley et al. 2014). A willingness to approach the front of the kennel is especially important in aiding the probability of adoption as potential adopters prefer dogs who come up to the front of the kennel (Conley et al. 2014). Because of this, moving a dog's bed toward the front of the kennel and placing a toy in the kennel increases the dog's probability of being selected for adoption (Marston & Bennett 2003).

Obedience training is a form of human interaction that can be extremely beneficial to dogs living in animal shelters. Behavioral issues largely contribute to dogs entering the shelter through owner surrender and can also lengthen their stays at shelters because undesirable behaviors often dissuade owners or potential adopters (Amaya et al. 2020). Herron et al. investigated the effects of obedience training and enrichment on the behavior of shelter dogs. The dogs received behavioral training twice a day as well as a toy filled with food daily. The training consisted of positive reinforcement for desired behaviors such as sitting, lying down, approaching the front of the kennel, and remaining quiet when approached (Herron et al. 2014).

More of the dogs who received the training and enrichment showed an increase in sitting, lying down, and remaining quiet compared to the dogs in the control group (Herron et al. 2014). The dogs who received training and enrichment also showed a decrease in undesirable behaviors, such as jumping, compared to the control group (Herron et al. 2014). Training also allows for the dog to be able to act with anticipated outcomes, creating predictability and some amount of control (Luescher & Medlock 2009). Since unpredictability and loss of control are factors commonly associated with stimulation of the HPA axis and subsequent stimulation of a stress response in shelter dogs (Coppola et al. 2006), working on obedience may also decrease stress in a shelter environment.

Incorporating simple obedience training into human interaction sessions with shelter dogs could make a difference in adoption rates and the amount of time that a dog lives in the shelter. Bright and Hadden tested this hypothesis by implementing a standardized program called “Safewalk” where volunteers were trained in how to walk dogs and work on obedience. During their interaction time with the dogs, volunteers worked on obedience behaviors including remaining quiet around other dogs. They used positive reinforcement via food and toys and conditioned reinforcement in the form of clickers (Bright & Hadden 2017). After implementing the Safewalk program, they found that the adoption rates for pit bull-type dogs increased significantly up to 96% from 77% of dogs adopted (Bright & Hadden 2017). Although the increase in percentage of non-pit bull type dogs adopted was not statistically significant, the length of stay for dogs of these breeds did decrease to statistical significance (Bright & Hadden 2017).

Luescher and Medlock also conducted a study in regards to effects of training on the adoption rates of shelter dogs. In this study, dogs were randomly assigned to either the training or

control group. Dogs that received training were taught to come to the front of the kennel when a person passed by, to not bark when someone walked past them, to not jump up on an approaching person, to sit on command, and to walk nicely on a leash without pulling (Luescher & Medlock 2009). The dogs in the training group were also provided with a blanket and a toy in their kennel. The results of the study showed that dogs who underwent obedience training were adopted 1.4 times more often than untrained dogs (Luescher & Medlock 2009). Owners want their dogs to be well behaved and adopting a dog who already complies with obedience commands is a definite positive for many people. Incorporating obedience training into enrichment for shelter dogs can be advantageous in multiple ways. In addition, training before adoption seems to have a positive effect on the long term outcomes of adoption success. Luescher and Medlock found that in their study on the effectiveness of training on adoption success, only one out of 116 dogs was returned throughout an almost two year follow-up period (Luescher & Medlock 2009). This is a far smaller percentage of returned dogs than has previously been found, indicating that the obedience training had a beneficial effect.

It is apparent that dogs being adopted is an important goal for animal shelters. It is also important that these adoptions be successful in the long term with the objective of not having dogs be returned to the shelter. About twenty percent of adopted dogs are returned to the shelter, with many of these returns being within the first two months after adoption (Marston & Bennett 2003). Relinquished dogs returned after adoption often face a grim future, including possible euthanasia. Unfortunately, many of these returned dogs are considered to be unreliable behaviorally and hard to place in an adoptive home, which often results in euthanasia due to limited shelter resources (Marston & Bennett 2003). Since behavioral issues are cited as the primary reason for returning an adopted dog (Marston & Bennett 2003), obedience training has

the potential to greatly reduce the rate of relinquishment of adopted dogs. Marston and Bennett suggest that post-adoptive obedience training with the dogs and their adoptive owners may help to both reduce the risk of relinquishment and promote increased emotional attachment between the dogs and their new owners (Marston & Bennett 2003).

Despite patterns that have emerged from studies of shelter dogs, several variables complicate the generalization of which practices are most effective with all shelter dogs. A dog's past experiences with humans and diverse environments are among these factors. Stereotypical stress behaviors can be difficult to interpret as individual dogs may react differently to stressful situations. Dogs may react more strongly to stressful stimuli based on temperament and experience which can impact the dogs vulnerability to stimuli and stress responsiveness (Hennessy et al. 2020). Behavior among shelter dogs might not be consistent throughout the group due to breed differences or individual coping styles (Protopopova 2016). For example, dogs with more proactive temperaments may show aggression in the face of a potentially threatening stimulus whereas dogs with reactive temperaments tend to retreat from a threatening stimulus (Protopopova 2016). The changes in cortisol for these reactive dogs are significant, while dogs displaying the proactive temperament tend not to exhibit cortisol changes in response to these stressors (Protopopova 2016). For this reason, Protopopova suggests a more individualistic approach to assessment of behavior in shelter dogs rather than group averages. This would consist of looking at individual cortisol changes rather than averages (Protopopova 2016).

Another inconsistency throughout the body of literature regarding enrichment and human contact for shelter dogs appears to be the time spent with the dogs. Although many studies provide the canine research subjects with ample time for human interaction and enrichment

activities, some studies only received as little as two or five minutes. With varying results among these studies, this produces a difficulty for interpreting a comprehensive review of available data.

In the future, more studies should be conducted analyzing the individual effects of sheltering on dogs. Several studies have examined cortisol concentrations in shelter dogs, but few have used the same dog as its own control before and after adoption. In future studies, this would be a valuable way to study the effects of sheltering on dogs more individually. Behavior could be examined and cortisol levels could be measured while the dogs are in the shelter. After a dog is adopted, the same recordings could be taken on the dog in its new home for the first few days after adoption and then again several weeks later. It would also be beneficial to further study the relationship between human contact in shelter dogs and adoption success. This would be done with at least thirty minutes of human interaction a day.

Through the addition of enrichment and human contact into the daily lives of shelter dogs, the welfare of these dogs can be vastly improved. Although many animal shelters have access to limited resources, even simple changes could make a beneficial impact on improving the lives of shelter dogs. As little as fifteen minutes a day, although ideally longer than fifteen minutes, spent with volunteers or shelter staff outside of normal shelter duties will promote better welfare for dogs housed in shelters. Implementing obedience training and temporary fostering programs are especially helpful for shelter dogs long term. These enrichment activities and human contact play a substantial role in increasing the likelihood of successful adoptions. Ultimately, there needs to be further research conducted focusing on the welfare of shelter dogs on an individual basis to find the most effective enrichment methods for dogs with different temperaments. These studies can then be used to assist shelters in implementing programs to increase the rates and longevity of adoptions.

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