

Universidade de São Paulo
Instituto de Psicologia

Naila Maui Fukimoto

**Personality and faecal cortisol metabolites levels
of domestic cats (*Felis silvestris catus*)**

**Personalidade e níveis de metabólitos fecais de cortisol
de gatos domésticos (*Felis silvestris catus*)**

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(versão corrigida)

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Área de concentração: Psicologia Experimental
Orientadora: Dra. Olívia de Mendonça-Furtado

São Paulo

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AUTORIZO A REPRODUÇÃO E DIVULGAÇÃO TOTAL OU PARCIAL DESTE TRABALHO, POR QUALQUER MEIO CONVENCIONAL OU ELETRÔNICO, PARA FINS DE ESTUDO E PESQUISA, DESDE QUE CITADA A FONTE.

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To all cats in the world, thank you for existing.

“Time spent with cats is never wasted.”
(Anonymous)

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ABSTRACT

Fukimoto, N. M. (2018). Personality and faecal cortisol metabolites levels of domestic cats (*Felis silvestris catus*) (Dissertação de Mestrado). Instituto de Psicologia, Universidade de São Paulo, São Paulo.

The study of cat personality and behaviour can help minimize potential problems in the relationship between cats and their tutors and decrease relinquishment or maltreatment. Personality in animals is a promising area dedicated to studying characteristics of individuals that describe and account for temporally stable patterns of affection, cognition and behaviour traits. In general, people adopt cats according to their appearance, age or sex. Personality assessments can promote successful adoptions by identifying ideal animals for potential tutors. The American Society for the Prevention of Cruelty to Animals (ASPCA) has implemented a program called Meet Your Match[®] (MYM) which assesses the personality of shelter cats and the life style of adopters. With a better match between cat and tutor, the rate of animals being returned to shelters tend to decrease and cat's welfare and adaptation in new homes tend to improve. To evaluate physiological stress and personality dimension, faecal cortisol metabolites (FCM) levels were measured and a modified MYM protocol was applied in two localities: a shelter and the tutor's home. Our main goals were: 1) verifying the validity of personality dimensions used in a modified MYM assessment in a Brazilian cat shelter sample through an exploratory study of the psychometric properties of the protocol, as well as an exploratory factor and a cluster analysis; 2) verifying the correlation between personality and faecal cortisol levels; 3) checking if MYM assessment is consistent through change of localities; and 4) finding out how moving from the shelter to the tutors' home affects faecal cortisol metabolites levels. We found evidence of validity of the modified MYM assessment based on internal structure to personality dimensions in this sample, although it presented a factorial structure that differs from the original assessment. No correlation was found between personality dimensions and FCM levels, corroborating the literature. There was a slight decrease of FCM levels in homes, but most subjects maintained their FCM levels, showing that cats can cope with stress in both environments – the shelters and the tutors' home. MYM personality assessment was consistent throughout the change of localities, which indicates that it is a good instrument to assess cat personality.

Keywords: Temperament. Individual differences. Cortisol metabolites. Companion animals.

RESUMO

Fukimoto, N. M. (2018). Personalidade e níveis de metabólitos fecais de cortisol de gatos domésticos (*Felis silvestris catus*) (Dissertação de Mestrado). Instituto de Psicologia, Universidade de São Paulo, São Paulo.

O estudo sobre comportamento e personalidade dos gatos pode ajudar a minimizar possíveis problemas na relação entre gatos e seus tutores e diminuir o abandono e os maus tratos. A personalidade em animais é uma área promissora, que estuda características dos indivíduos que descrevem e representam padrões temporais estáveis de afeto, cognição e comportamento. Em geral, as pessoas adotam um gato de acordo com a aparência, idade ou sexo do animal. As avaliações de personalidade podem promover adoções bem-sucedidas, identificando animais ideais para potenciais tutores. A American Society for the Prevention of Cruelty to Animals (ASPCA) implementou um programa chamado Meet Your Match® (MYM), que avalia a personalidade dos gatos e o estilo de vida de futuros tutores. Com uma melhor combinação entre gato e tutor, a taxa de devolução desses animais para abrigos pode diminuir e o bem-estar e a adaptação em novas residências tendem a melhorar. Para avaliar o estresse fisiológico e as dimensões da personalidade, metabólitos fecais de cortisol (MFC) foram medidos e a avaliação MYM foi aplicada em duas localidades: um abrigo e a residência do tutor. Nossos principais objetivos foram: 1) verificar a validade das dimensões de personalidade utilizadas na avaliação do MYM em uma amostra de abrigo brasileiro, por meio de um estudo exploratório das propriedades psicométricas do protocolo, uma análise de fator exploratório e uma análise de *cluster*; 2) verificar a correlação entre os tipos de personalidade e o cortisol fecal; 3) verificar se a avaliação do MYM foi consistente após mudança de localidades (abrigo e casa); e 4) verificar como a mudança do abrigo para a casa do tutor afeta os níveis de cortisol fecal. Encontramos evidências de validade da avaliação MYM modificada, baseadas na estrutura interna das dimensões da personalidade nesta amostra, embora a estrutura fatorial tenha sido diferente da avaliação original. Não foi encontrada correlação entre as dimensões de personalidade e os níveis de MFC, corroborando a literatura. Houve uma discreta diminuição dos níveis de MFC nas casas, mas a maioria dos indivíduos manteve seus níveis de MFC, mostrando que os gatos lidam bem com o estresse nos dois ambientes – o abrigo e a casa do tutor. A avaliação de personalidade do MYM foi consistente na mudança de localidades, o que indica que ela é um bom instrumento para avaliar a personalidade de gatos.

Palavras-chave: Temperamento. Diferenças individuais. Metabólitos de cortisol. Animais de companhia.

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1. INTRODUCTION

1.1 Personality

Personality traits, emotions and cognition are a reality in the research of animals (Bradshaw, 2013). According to a review made by Samuel Gosling and Oliver John in 1999, personality in non-human animals can be common among a wide range of species. Definitions point to those characteristics of individuals that describe and account for spatially and temporally stable patterns of affect, cognition, and behaviour (Siegford et al., 2003; Gosling, 2008; Gartner e Weiss, 2013). Terminology still presents some dissonance and the terms used include temperament, individuality, coping styles and behavioural syndrome (Lowe e Bradshaw, 2001; Siegford et al., 2003; Natoli et al., 2005; Gosling, 2008; Uher, 2011; Gartner e Weiss, 2013; Litchfield et al., 2017). Individual differences in the behaviour of adult animals seem to be a function of biological tendencies and experience of life, as is the case with humans (Weinstein et al., 2008). The term temperament generally implies that the traits are fully inherited, which is not known for sure and even this definition is not adopted uniformly (McCrae et al., 2000). But the term personality has the advantage to transit between human and non-human areas facilitating connections between them (Gosling, 2008).

Personality in animals has been measured dimensionally in the same way that the Five Factor Model or Big Five (John and Srivastava, 1999) does with humans, for mapping personality structures. In a cross-species review, Gosling (1999) suggests that some dimensions may be common to many species (chimpanzees, hyenas, dogs, cats, pigs, etc). He uses the dimensions proposed by the Big Five (John and Srivastava, 1999) to make a comparative approach from a human perspective to social and biological bases of personality. Considering that personality should be monitored with intervals between time and contexts to check for stability, relations between personality dimensions and behaviour (social behaviour, emotionality) and physiological indexes (plasma cortisol concentrations, antibody responses, heart rate) were measured for more than ten years with stable results regarding personality traits and health (Capitano, 1999, 2002, 2004 – *Macaca mulatta*). Vazire et al. (2007) defend the study of personality in animals because the observations of animals' behaviour can be done for more extensive periods than it would be possible with humans. Studies of individual differences in animals allow the use of interventions and measurements of physiological parameters, arranging necessary data to recognize biological mechanisms related to psychological processes. Also, personality assessments can contribute to animal welfare,

enlightening the evolutionary processes that configure personality structures (Weinstein et al., 2008).

Several methods have been used to assess personality in animals. The main ones are: observational tests (observers' coding in response to test situations, e.g., exposing the subject to, for example, a novel stimulus and taking note of their behaviours in an ethogram) and rating of individuals (human interpretation and rating of behaviours based on the knowledge about the subjects, without experimental intervention) (Vazire et al., 2007; Gosling, 2008). Although they are different, both rating and coding appear to be great methods that compare the validity of the predictability and there is strong evidence from converging data (Vazire et al., 2007; Weinstein et al., 2008). In a study with dogs, the two methods classified individuals consistently and in the same personality dimension (McGarrit et al., 2016).

Recent studies have investigated cat personalities dimensions using online surveys with tutors (rating method) (Kaleta et al., 2016; Bennett et al., 2017; Ha & Ha, 2017; Litchfield et al., 2017). They vary on the amount of dimensions found – from three to six. According to a pet personality review, the most common dimensions found are affection, energy, sociability and curiosity (Gartner, 2015). For domestic animals, personality assessments have been growing to help potential tutors identify a pet that is compatible with their expectations and needs, helping shelters with adoption-related decisions (Gosling, 2008).

A program of personality assessments called Meet your Match® (MYM) was developed by American Prevention of Cruelty to Animals Society (ASPCA, 2007; Appendix 1). It assesses cats in shelters and interviews people that want to adopt a pet to make the perfect match between them, increasing the adoption rate and reducing the return or abandonment of adopted animals (Zeigler-Hill e Highfill, 2010; Moore e Bain, 2013). The dimensions used by MYM assessment were valiance (refers to the cat's response to novel stimuli) and independent-gregarious (refers to social interaction) (ASPCA, 2007).

1.2 Stress and Cortisol

There are some ways to measure the stress of an animal, one of them is through physiological measures of glucocorticoids. According to Broom and Johnson, 1993: “Stress implies exposure to unpleasant conditions with adverse effects” (p. 58). It is a physiological response to adverse situations and can be triggered by real stimuli (physical stressor) or by the expectation that this stimulus may occur (psychological stressor) (Möstl and Palme, 2002). When an individual faces a stressful event, the body prepares itself physiologically through a

fight-or-flight reaction. In this process, there is the activation of the sympathetic nervous system and the inhibition of the parasympathetic nervous system. In addition, the hypothalamus induces the pituitary to release adrenocorticotrophic hormone (ACTH), which acts on the adrenal glands, increasing the release of glucocorticoids through the adrenal cortex (Möstl and Palme, 2002). But soon after the stressful event, glucocorticoid levels progress to the basal level (Sapolsky, 1990). Cortisol is a glucocorticoid and one of the major hormones used as an indicator of stress response (Graham and Brown, 1996; Möstl and Palme, 2002) and it is responsible for a large part of the physiological and behavioural responses to stressors (Schatz and Palme, 2001; Gartner and Weiss, 2013). Stress response is adaptive and, therefore, the primary function of cortisol is to provide energy mobilization to the individual. But chronic stress brings consequences such as tissue atrophy, low immunity and stereotypies (Möstl and Palme, 2002). And it is also capable of affecting reproduction, a fact that can be illustrated by the inconsistency observed in the reproduction of some captive species (Graham and Brown, 1996).

Cortisol can be measured in several kinds of matrix: blood, saliva, hair, urine and faeces. As blood collection can induce stress in the individual, non-invasive methods are preferred (Terio et al., 1999; Young et al., 2004; Rehnberg et al., 2015). The most practical and appropriate matrix for the determination of cortisol metabolites in cats would be faeces, since it contains more than 80% of the cortisol metabolites and can be obtained without manipulating the animal (Graham and Brown 1996; Schatz and Palme 2001).

For some animals, personality can be related to cortisol levels and stress (Gartner, 2015). Capitanio et al. (2004) also affirms that personality characteristics are related to hypothalamic-pituitary-adrenal function. Clouded leopards (*Neofelis nebulosa*) had higher rates on personality dimension called fearful/tense that relates to chronic stress measured on faecal corticoids (Wielebnowski et al., 2002). For tufted capuchins (*Cebus apella*) (Byrne and Suomi, 2002), personality traits that refer to fearful, insecure, submissive and tense behaviours were associated with high cortisol reactivity (blood samples). Capitanio et al., (2004), showed that in rhesus macaques (*Macaca mulatta*) the sociability dimension was not related to cortisol levels, but high excitable animals had lower basal cortisol concentrations during the afternoon (plasma cortisol). Personality may have implications in health too (Gartner, 2015). Monkeys who rate high in sociability dimension show an increase in antibodies (T-cell immune response) during social stress (Cohen et al., 1992). Proactive male

cats were more likely to have feline immunodeficiency virus (FIV) (Natoli et al., 2005). And in gorillas, extraversion dimension predicts a longer life (Weiss et al., 2013).

For cats, researchers suggest that there is no correlation between personality and cortisol levels. Siegford et al. (2003) found no relationship between a Feline Temperament Profile (FTP) and salivary cortisol levels. Iki et al. (2011) found no correlation between blood cortisol levels and a Feline Temperament Profile (FTP) and Ramos et al. (2013) found that faecal cortisol metabolites did not vary according to personality as well. A study conducted by Finkler and Terkel (2010) shows another point of view: intact female cats that exhibit more agonistic encounters had higher hair cortisol levels (agonistic behaviour and personality are different, but more aggressiveness can relate to individual differences in coping with the environment). When the females were neutered, the aggressiveness was reduced as well as the cortisol levels (Finkler and Terkel, 2010). Lichtsteiner and Turner (2008) suggest a social compensatory mechanism to explain the non-correlation between urinary cortisol levels and dominance status among cats. Someway, cats organize themselves in a social hierarchy to compensate for stress.

1.3 Cats

Cats were domesticated about 8000 to 13000 years ago (Vigne et al. 2004; Linseele et al. 2007; Driscoll et al., 2007), in a process that was initiated primarily in the region that is now Egypt, on the banks of the Nile (Genaro, 2005; Bradshaw, 2013). The most likely ancestor of the domestic cat (*Felis silvestris catus*) is the African wildcat (*Felis silvestris lybica*) (Serpell, 1988; Genaro, 2005). The domestic cat differs very little from its wild ancestors and is apparently resistant to extreme modification in terms of genetics and morphology (Serpell, 1988). Cats were very useful to the population of the region because they killed rats, which were eating stocked grains, and hunted snakes that lived near the river – the relationship established then was of utilitarianism, with an active approach by the animal (Genaro, 2004; Bradshaw, 2013).

Today, the domestic cat is the second most popular companion animal in Brazil, 22 million cats compared to 52 million dogs in Brazilian households (PNS, 2015). The population of cats, mainly in houses of large and medium-sized cities, has led to a greater concern about the welfare and quality of life of these animals, as we see an increasingly closer relationship between humans and companion animals. The study of cat behavior can minimize possible problems in the relationship between cats and their tutors, which can lead

to abandonment or mistreatment (Genaro, 2004). Furthermore, cats exhibit a highly distinctive range of behaviors (Bradshaw, 2013) and to increase successful adoptions, it would be necessary to ensure compatibility between cats and tutors (Siegford et al., 2003). A large population of cats is abandoned into shelters or streets every year (Siegford et al., 2003). In the UK, 6,089 cats were relinquished and returned to a shelter in one year. The main reasons for the abandonment were changes in family circumstances, tutor's unmet expectations, and cat behaviour (e.g., aggression between cats) (Shore, 2005; Casey et al., 2009). The population of sheltered cats is enormous and most returned cats end up in shelters again, which only increases the number of animals under their care. Shelters appear to be potentially stressful environments, since there are many people working, little attention focused on individuals and high density of animals. Despite a certain routine regarding food, environmental enrichment, affectionate volunteers, we positively believe that a household environment is more suitable for a cat.

1.4 Goals of this study and hypotheses

The study of personality in cats is intriguing and needed because this is an increasingly popular animal in large cities. Cat studies are still growing, at the same time, as overpopulations of abandoned cats are enormous. People usually adopt or buy animals according to appearance, age or sex. Personality assessments add a new layer in the decision process that tutors can leverage to find out the ideal animal for them (Gosling, 2008). In general, tutors end up presenting more positive attitudes toward their animals when their behavioural style complement their own personal styles (Zeigler-Hill e Highfill, 2010; Litchfield et al., 2017).

In an effort to improve adoption, cats' adaptation in new homes and physiological levels of stress, the objectives of this study are: 1) verifying the validity evidence based on the internal structure of the MYM protocol adapted to a Brazilian cat shelter sample (Fukimoto et al., submitted – Chapter I); 2) verifying if there is a correlation between personality dimensions and levels of cortisol; 3) finding out how cortisol levels relate to shelter and tutor's homes and 4) verifying if MYM assessment was consistent through localities (last three in Fukimoto et al., in preparation – Chapter II).

My hypotheses are (respectively to the objectives): 1) the assessment would present evidence of validity and the items would group the same as the original MYM assessment,

indicating that the same dimensions were being measured the same way; 2) a non-correlation between personality and cortisol levels, corroborating the existing literature for cats; 3) cortisol levels would decrease in homes, since shelters are apparently more stressful environments and 4) personality dimensions would not change between shelter and home.

2. CHAPTER I

Does Meet your Match[®] protocol measure personality? An exploratory factor analysis in a Brazilian sample of sheltered domestic cats

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Abstract

Personality in animals is a promising area which studies temporally stable patterns of affect, cognition and behaviour. Regarding companion animals, personality assessments can promote successful adoptions based on more than just the subjects' physical appearance. The American Society for the Prevention of Cruelty to Animals (ASPCA)¹ has implemented a program called Meet your Match[®] (MYM) which assesses shelter cat personality. It allows adopters to choose the cat that fulfils their expectations, decreasing the return rate of these animals to shelters or relinquishment as well as improving their welfare and adaptation in new homes. The MYM assessment evaluated two dimensions of personality: valiance and independent-gregarious. Our objective was to check the validity of the dimensions used in MYM for a Brazilian cat shelter sample. We assessed 71 cats, 32 male and 39 female with ages varying from 5 months to 12 years, all neutered. To verify validity, an exploratory study of the psychometric properties of the protocol was made, as well as an exploratory factor and a cluster analysis. The exploratory factor analysis showed three dimensions qualitatively different from the original assessment: agreeableness, openness and extraversion, presenting a total of 59.4% of explained variance. Cluster analysis divided our sample into two different groups; one with higher average in the dimensions agreeableness and openness, and the other with higher average in the dimension extraversion. The MYM showed evidences of validity based on internal structure to personality traits in a sample of sheltered Brazilian cats, although it presents a factorial structure that differs from the original assessment. Standardisation of terminology as well as fully validated personality dimensions are needed to improve the dialogue between related areas.

Keywords: exploratory factor analysis; *Felis silvestris catus*; temperament; individual differences; protocol validation

¹ *Abbreviations*

MYM: Meet your Match[®]

2.1 Introduction

Until recently, researchers were reluctant to attribute personality traits, emotions and cognition to animals – although they would accept the similarity on the anatomy and physiology of humans and animals (Gosling and John, 1999). However, in 1999 Samuel Gosling and Oliver John published a review that undoubtedly showed that the personality dimension in non-human animals can be common among a wide range of species. Since then, the area has grown, but the terminology still presents disagreements and many are the terms used, i.e., personality, temperament, individuality, coping styles, behavioural tendencies and behavioural syndrome (Lowe and Bradshaw, 2001; Siegford et al., 2003; Natoli et al., 2005; Gosling, 2008; Gartner and Weiss, 2013; Litchfield et al., 2017). Nevertheless, despite small differences, definitions converge to “those characteristics of individuals that describe and account for temporally stable patterns of affect, cognition, and behaviour” (Siegford et al., 2003; Gosling, 2008; Gartner and Weiss, 2013). The Five Factor Model or Big Five is the best known model used to describe personality dimensionally in humans (John and Srivastava, 1999). Animal personality researches base their work on this same model, but there is still no consensus on the terms used: “factors”, “scales”, “traits” and/or “dimensions”. In this article we will use the term “dimension” once it seems to enable a better dialogue with both human and animal personality studies.

A subarea that has received attention encompasses shelter animals’ personality assessments (Siegford et al., 2003; Gosling, 2008; Zeigler-Hill and Highfill, 2010). Its objective is to promote successful adoptions by identifying ideal animals based on potential tutors expectations (Gosling, 2008). Researchers have already shown that tutors end up presenting more positive attitudes toward their animals when the animals’ behavioural style complements their own personal styles (Zeigler-Hill and Highfill, 2010; Litchfield et al., 2017). The ASPCA has implemented a program called Meet your Match[®] (MYM) (ASPCA, 2007) which evaluates cats (and dogs) in shelters and interviews potential tutors to promote the perfect match – thus increasing the adoption rate and decreasing the return of adopted animals (Zeigler-Hill and Highfill, 2010; Moore e Bain, 2013). The research of Siegford et al. (2003) was the foundation for this adoption program.

Most studies that use personality assessments do not present the validation process. The validation process has methodological value because it creates standardised assessments for replication in researches. It is also helpful in theoretical terms, since it standardises the terms and dimensions used even in culturally different samples. Furthermore, statistical

validation points to valid and reliable data that supports the quality of inferences made from the scores measured by the assessments (Chan, 2017).

A huge population of cats is relinquished into shelters every year and most returns are due to the cat's behaviour, tutor's unmet expectations, allergies or change in circumstances, e.g., moving (Shore, 2010; Casey et al., 2015). Shelters in Brazil are normally non-governmental organizations that struggle to make ends meet, a circumstance aggravated by the fact that they keep receiving relinquished animals. In an effort to present a method that could improve the adoption experience by both animal and tutor, we aim at verifying validity evidence based on the internal structure of the MYM protocol adapted to a Brazilian cat sample. We conducted an exploratory study of the psychometric properties of the protocol after applying it to sheltered domestic cats using an exploratory factor analysis and a cluster analysis.

2.2 Methods

2.2.1. Subjects

We applied the Meet Your Match protocol to 71 domestic cats, all from a shelter in São Paulo, Brazil. The shelter is a non-governmental organization, exclusive for cats, called Catland. The cats assessed in the present study live in a house that is 116m² and was adapted to the needs and dynamic of a shelter. For instance, all windows have safety nets to prevent escapes and there are cat trees and shelves in the rooms for environmental enrichment. The animals are unrestrained at all times. Solitary cages are used only when a cat needs to be isolated for health conditions. All animals have access to food and water *ad libitum* and there is a schedule for medication when needed. Also fundamental for the well-being of the animals is the constant presence of caring volunteers who provide opportunities for affectionate interaction. Subjects were 32 male and 39 female with age ranging from 05 months to 12 years, all neutered, most of them rescued from the streets or relinquished. Cats younger than 05 months were not evaluated because the literature says personality is not fully formed until the end of the third month of life (Lowe and Bradshaw, 2001).

2.2.2. Meet Your Match

The MYM personality assessment consists of 11 experimental circumstances (that will be referred to as "items" from now on) that should be presented to the subject, a list of behaviours that should be observed and measured during these procedures, and their respective scores (Table 1). Each item scores points to one or two dimensions assessed.

Crossing the total score of each dimension determines the subject's personality. If the cat has negative scores on several items, the assessment should be terminated before all items are performed. For the complete assessment, see ASPCA (2007). The subjects were selected by convenience sampling, and we tested on average 6 cats per day.

Table 1 - Items of the feline personality assessment of the *Meet your Match*[®] program

Items	Researcher	Listed possible behaviors	Scores
1. Body posture	Observation of the cat's posture when in it's cage <i>Adaptation:</i> observation of the cat's posture when standing in the shelter	- Soft and relaxed - Tense body with twitching tail - Flattened body with dilated pupils	+1 +2 -1
2. Greeting approach	Observation of the cat's response when the researcher came at the front of the cage <i>Adaptation:</i> observation of the cat's response when the researcher came towards and stands in front of him	- The cat comes at the front of the cage, soliciting attention by rubbing, chirping, etc - Comes to the front of cage after the researcher's encourage - Does not approach but meows, chirps or blinks - Does not approach - Attempts to hide - Hisses or growls - Charges	+3 +2 +1 0 -1 -2 -3
3. Cage condition	Silently observation of the cage <i>Adaptation:</i> unrated item	- Bedding/cage paper moved, cat hiding under - Cage rearranged, cat on top or not hiding - No change - Other, please describe	-1 +1 0 0
4. Social response when door is opened	Calmly and slowly opens the door of the cage and just observe the cat, no talking <i>Adaptation:</i> put the cat in the carrier, transported it to a novel room, slowly opens the door and observe the cat	- Remains relaxed and soft, approaches the researcher - Remains relaxed and soft, does not approach - Becomes stiff with tight tail flicks and standing - Crouches, body stiff	+1 0 +1 -1
5. (a-b) Introduction to novel room	Observation of the cat in the novel room Sit in a chair and observe for 5 minutes, do not interact with the cat	a) Exits carrier in 25 seconds or less with: - tall body posture - crouched body posture - quickly scoots to hiding place, keeping body low to the ground - does not exit the carrier b) Time spent with the researcher and for how long: - More than 60 seconds - 30-60 seconds - Less than 30 seconds	+1 +0,5 -0,5 0 +0,5 +1 0
6. Call and approach	Crouch down opposite the cat and softly call him several times using his name or an endearment. Extend a	- Makes eye contact - Does not make eye contact - Approaches	+1 -1 +3

	closed hand toward the cat and observe his response	<ul style="list-style-type: none"> - Sniffs or head butts +3 - Rolls on back or rolls over +2 - Meows, purrs and/or chirps +1 - Watches with no approach 0 - Retreats -1 - Hisses or growls -2
7. Open hand	Crouch next to the cat, extend an open hand (palm up and lower than the cat's head) and observe his response	<ul style="list-style-type: none"> - Sniffs or head butts +3 - Licks or rubs on hand +3 - Rolls on back or rolls over +2 - Meows, purrs and/or chirps +2 - Retreats/defensive position -1 - Hisses and/or growls -2 - Swats/attempts to swat hand -2 - Bites/attempts to bite hand -3
8. Stroking	Sit or crouch on the floor next to the cat and begin stroking for four or five long, slow strokes beginning at the head and ending at the base of the tail	<ul style="list-style-type: none"> - Rubs against legs or hand +3 - Head butts +3 - Circles the researcher attentively +2 - Meows, purrs and/or chirps +2 - Rolls onto back or rolls over +2 - Shows initial fear but then relaxes 0 - Retreats/defensive position -1 - Hisses and/or growls -2 - Swats or attempts to swat hand -2 - Bites or attempts to bite hand -3
9. Play	Slowly move a piece of string along the floor to initiate play, observe the cat's reaction then try to engage the cat in play with two other toys	<ul style="list-style-type: none"> - Watches toy intently +3 - Chases toy +3 - Comes back for stroking +2 - Ignores toys 0 - Attends to something else -1 - Avoids eye contact -1
10. Hug	Call the cat over or approach slowly if the doesn't respond. Stroke the cat a few times and pick him up and hold him upright with the side of his body held against the researcher's chest for two seconds and return him to the floor	<ul style="list-style-type: none"> - The cat is relaxed +3 - Extends paw to the researcher's neck or shoulder in an affiliative manner +3 - Meows, purrs and/or chirps +2 - Accepts hold but remains a bit tense +2 - Struggles to escape -1 - Hisses/growls -2 - Stiffens and extends claws -2 - Swats/attempts to swat -3 - Bites/attempts to bite -3
11. Sensitivity	Sit on the ground and allow the cat to approach, then stroke the cat along the base of the tail and pull up with a steady pressure just enough to almost, but not quite, move his back feet off the floor and hold for one second	<ul style="list-style-type: none"> - Rolls onto back or rolls over +3 - Shows no reaction +3 - Meows, purrs and/or chirps +1 - Struggles/tries to escape 0 - Hisses/growls -1 - Swats/attempts to swat -2 - Bites/attempts to bite -3

2.2.3. MYM Assessment modifications

We used the MYM assessment described above with few modifications described next. Four items had to be adapted due to structural differences between Brazilian and American shelters. In Brazil, shelters normally consist of a house where cats have free access to every room and there are no cages. In the United States, each cat has its own cage. Therefore, items 01 to 04 were modified: 1) item 01 “body posture” and item 02 “greeting approach” were performed through the observation of the cat in the shelter. After picking a subject to be assessed, the researcher (all evaluations carried out by NF) would find it in the shelter and take a quick mental snapshot of the cat’s body posture. Then, she would get closer to the cat and begin to speak with it; 2) item 03 “cage condition” was excluded from the protocol, as there were no cages to be observed. So after speaking with the cat, the researcher would place it in a carrier and take it to the novel room (a small room whose cats had no access); 3) item 04 “social response when door is opened” was measured considering carrier’s door, already in the novel room.

The novel room was a little bit smaller than suggested (5 feet x 10 feet, instead of 10 feet x 10 feet) and not so quiet, as it was possible to hear people passing by or talking.

2.2.4. Ethical and data collection procedures

This research complied with protocols approved by the Animal Research Ethics Committee of the Institute of Psychology of the University of São Paulo (CEUA/IPUSP nº 2309091116) and with the current Brazilian laws on ethical standards, as well as with the rules issued by the National Council for Control of Animal Experimentation (CONCEA). The study met the ethical guidelines of the International Society for Applied Ethology for conducting research with animals (Sherwin et al., 2003).

2.2.5. Data analysis

An Exploratory Factor Analysis (principal component analysis with oblique rotation method – Promax) was used in order to verify data factorization. We tested the internal consistency calculating the Cronbach’s alpha reliability indexes for each of the independent factors. Factor indicators were then submitted to a Cluster Analysis to identify homogeneous groups according to their characteristics (Hair et al., 1998). The factor analysis, the reliability indexes calculation and the cluster analyses were performed by SPSS software version 16.

It is noteworthy that, for statistical purposes, we considered item 05 “introduction to novel room” as three different items. Originally this item had two sub-items, “a” and “b”, but

sub-item “a” had two levels of answer so we sub-divided it into “a1” and “a2”. Hence, instead of item 05, we had items 05a1, 05a2 and 05b. Unfortunately, we do not know how this item was treated during the original MYM statistical validation.

2.3 Results

2.3.1. Exploratory factor analysis

The data presented acceptable indexes for performing factor analysis [KMO = 0.765; Bartlett’s sphericity test: χ^2 (66, N=71)=313.438; $p < 0.001$]. Three factors were found with *eigenvalues* greater than 1: 4.72; 1.76; 1.15; presenting a total of 59.391% of explained variance. The verification of the *scree plot* also suggested a three-factor solution (Figure 1), differently from the two-factor solution indicated by the assessment (ASPCA, 2007).

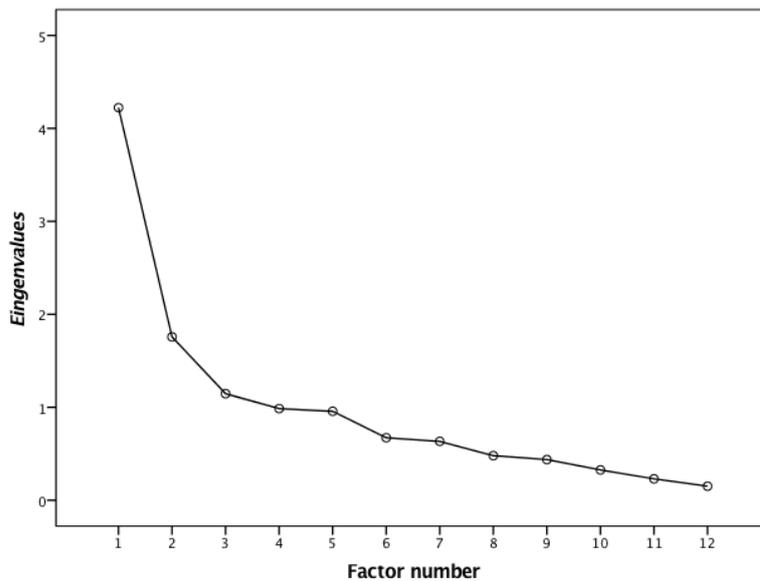


Figure 1: Cattell's *scree plot* showing the exploratory factor analysis result i.e. amount of factors and their related *eigenvalues*.

According to the information presented in Table 2, factorial loads varied between 0.51 and 0.92, communalities between 0.42 and 0.84 and reliability indexes ranged from 0.632 to 0.825. The correlations between dimensions were: dimension 1 x dimension 2 ($r = 0.26$); dimension 1 x dimension 3 ($r = 0.42$); dimension 2 x dimension 3 ($r = 0.28$).

Table 2

Extracted dimensions (Agreeableness, Openness and Extraversion) and their factorial coefficients and communalities (h^2) for each assessment item. At the bottom, number of items, percentage of variance explained by each dimension and Cronbach's alpha reliability indexes from Scale by the Principal Component's extraction method and Promax rotation.

Items	Dimensions			Communalities
	1. Agreeableness	2. Openness	3. Extraversion	
Item 7 – Open Hand	0.917			0.843
Item 8 – Stroking	0.831			0.796
Item 6 – Call and approach	0.708			0.769
Item 5b – Introduction to novel room	0.594			0.418
Item 5a1 – Introduction to novel room		0.777		0.657
Item 5a2 – Introduction to novel room		0.735		0.520
Item 1 – Body posture		0.639		0.457
Item 4 – Social response when door is opened		0.562		0.574
Item 9 – Play			0.725	0.491
Item 11 – Sensitivity			0.671	0.554
Item 10 – Hug			0.644	0.528
Item 2 – Greeting approach			0.514	0.520
Number of items	4	4	4	
Explained variation %	35.19	14.65	9.55	
Cronbach's alfa	0.825	0.674	0.632	

2.3.2. Discriminating validity

Cluster analysis using the *Between-groups* standardisation method, the Euclidean quadratic distance and the three-factor score as the base variables for the analysis showed that our sample should be divided into two groups (cluster 1 and cluster 2; Figure 2). The scores

factors were adequate ($p < 0.001$) for the discrimination of the two clusters, according to Table 3.

Table 3

Description of the two clusters regarding the average of each dimension, standard deviation (sd), overall characteristics and number of cases.

Group	Dimension	Average (sd)	Description	# of cases
Cluster 1	Agreeableness	43.72 (7.35)	The first conglomerate is related to cases with higher average in dimension agreeableness and openness compared to cluster 2.	43
	Openness	14.62 (2.12)		
	Extraversion	21.95 (5.43)		
Cluster 2	Agreeableness	17.00 (7.52)	The second conglomerate grouped cases with higher average in dimension extraversion compared to cluster 1.	28
	Openness	13.57 (3.00)		
	Extraversion	25.00 (16.86)		

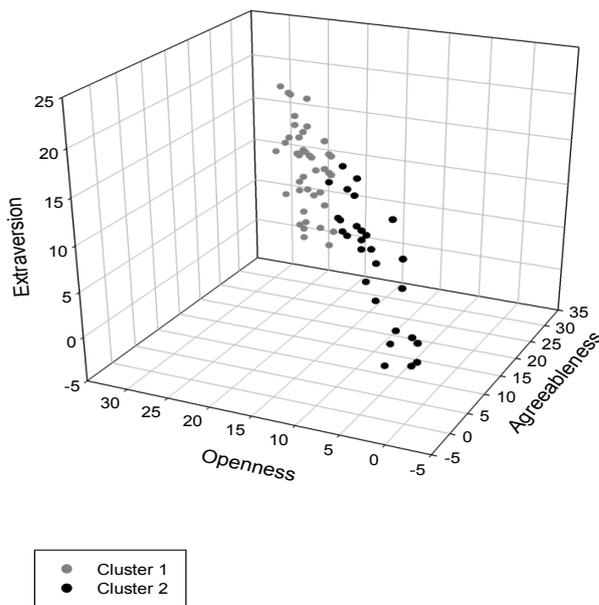


Figure 2: Scores of the 71 subjects in each dimension. Subjects that were included in cluster 1 are in grey while subjects in cluster 2 are in black.

2.4 Discussion

Our objective was to check the validity of the MYM assessment in a Brazilian shelter cat population. We made an exploratory factor analysis on the data collected from 71 subjects. Our data showed validity evidence based on the internal structure of the adapted version of MYM assessment when applied to a Brazilian cat shelter sample. The items were distributed in three dimensions.

Dimension 1 grouped items that refer to time of interaction with the researcher and reactions to: call and approach, researcher's open hand and stroking. Dimension 2 grouped items that relate to body tension or relaxation of the cat in shelter and their first moments in the novel room (time to leave the carrier and posture). Dimension 3 grouped items related to greeting approach, play and stronger affection (i.e. hugs). As cat personality is a recent research area, there is still no agreement on the names of the dimensions or which dimensions actually belong or relate to personality.

Some studies make analogies with human personality dimensions using the Five Factor Model or Big Five (John and Srivastava, 1999) and/or suggest names based on the characteristics that the dimension presents, therefore, researchers vary on the amount of suggested dimensions that compound cat personality (from three to six dimensions). To name two of the dimensions, we rely on the work of Litchfield et al. (2017) for being the most robust study of cats' personality, with the largest sample size to date. This work found five dimensions: neuroticism, extraversion, dominance, impulsiveness and agreeableness. According to the descriptions used in their work, we find some similarities with the characteristics of our dimension 1 (Agreeableness: affectionate, friendly to people and gentle) and dimension 3 (Extraversion: active, vigilant, curious, inquisitive, inventive and smart). But no description of Litchfield et al. (2017) suited the characteristics of dimension 2. However, the work of Kaleta et al. (2016) presented a dimension with characteristics that resembled our dimension 2. This study found five dimensions – openness, quietness, affiliation, activity and anthroaffiliation. Openness reflects the attitudes towards new places and new people, no fear of confrontation with new objects and situations, just like it is characteristic of dimension 2.

The dimensions used by MYM assessment were valiance (that grouped the items that related to the novel room – time to leave the carrier, call and approach and play) and independent-gregarious (that grouped items related to body posture, greeting, call, play, and hug) (ASPCA, 2007). However, the dimensions found in our study show similarities with dimensions found in other studies, such as affection, energy, sociability and curiosity (Gartner, 2015). And we point out two possibilities for the differences in the factorial structure. The first relates to validation data (Chan, 2017). Although the MYM assessment relies on the validated Feline Temperament Profile (FTP; Siegford et al. 2003), it is not clear how each item refers to each dimension and why some items score differently. To our knowledge, there is no validation of MYM assessment, which hinders a replication of the statistical treatment provided to the original data and, consequently, to compare the statistical data found in the sample studied. The other possibility is that the adaptations made in the

assessment (more details in the Method section) changed the dimensions being evaluated. In any case, these adaptations were necessary to the viability of the assessment in this sample.

On cluster analysis, cats were grouped as follows: cases with higher average in dimension agreeableness and openness (1 and 2) and cases with higher average in dimension extraversion (3). Cluster 1 grouped cats that are affectionate, friendly and fearless of new situations. Cluster 2 grouped cats that are more active, curious and open to new experiences, but a little less affectionate. Since there are few studies with cats that define how personalities are distributed within a sample or which cat personalities are the most frequently encountered, it is difficult to affirm that the two clusters actually define two types of personality, but they do indicate two patterns of cats that behave in a similar way in our sample. In a survey conducted by the creator of MYM, Weiss et al. (2015), it was found that the most common personalities in a shelter were: sociable, affectionate and open cats. Despite using different dimensions, the personalities found in Weiss et al. (2015) overlap the patterns found by our cluster analysis. We need studies that can define cat personalities more clearly, with larger samples, to increase consistency and obtain more robust data.

Although cats are generally considered to be difficult subjects to study (Grimm, 2014), research regarding their personality is essential, since their population has been growing both in houses and on the streets and in shelters. Our study is an indicative of the potential of the MYM assessment and shows the importance of any assessment validation in order to guarantee that the dimensions being measured are standard and/or to prevent cultural differences from interfering with the applicability of the assessment (e.g. our sample did not assess less affectionate or very fearful cats). The adapted MYM presented validity evidence of internal structure to personality traits in this sample, although with a factorial structure that was different from the original. Literature points to several personality dimensions, indicating the need for standardisation of terms as well as the need of validated personality assessments. Most likely some personality dimensions of cats have not yet been identified and it is possible that different cultures perceive personality traits differently.

2.4.1. Conclusions

A greater knowledge of cat personality is indispensable for many reasons: helping shelters adequately rehome more cats, decreasing return and relinquishment of cats, improving the welfare of cats, and helping with adaptation of these animals in new homes. It is also useful when managing multi-cat households. Even though MYM is a great tool to

analyse cat personality, we need to advance studies in this field. Investigating the validity of personality assessments more broadly is imperative to guarantee their efficiency.

Conflict of interest

The authors declare that they have no conflict of interest.

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3. CHAPTER II

Are cats less stressed in homes than in shelters? A study of personality dimensions and faecal cortisol metabolites levels

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Abstract

Personality is defined by characteristics of individuals that describe and account for temporally stable patterns of affection, cognition and behaviour traits. The study of cat behaviour and personality can minimize possible problems in the relationship between cats and their tutors and decrease abandonment or maltreatment. People generally adopt according to the individual's appearance, age or sex. Personality assessments can help make adoptions successful by identifying ideal subjects for potential tutors. A personality assessment called Meet Your Match® (MYM), developed by the American Society for the Prevention of Cruelty to Animals (ASPCA) and validated to our cat sample was used in this study. To evaluate stress, we measured faecal cortisol metabolites (FCM) of cats in shelters and after adoption. In an effort to improve adoptions and cat's adaptation in new homes, our goals were to verify a correlation between personality cortisol levels, to verify if MYM assessment is consistent through situations, and to find out how moving from the shelter to the tutors' homes affects cortisol metabolites levels. Subjects were 53 sheltered cats and 15 of them were followed post adoption. No correlation was found between personality dimensions (agreeableness $p=0.878$; openness $p=0.141$; extraversion $p=0.942$) and FCM levels. MYM assessment was consistent through different localities. There was a slight, but significant ($p = 0.0072$), decrease of FCM levels at tutors' home. Most subjects ($n=11$) did not change their FCM levels, which points to a social organization that compensates for the stress. Although the environment of the shelter seems to be potentially stressful (many people working, many visitors, high density), cats are physiologically able to cope with stress there as well as they do in their tutors' home.

Keywords: temperament; individual differences; cortisol metabolites; companion animals

3.1 Introduction

Personality traits, emotions and cognition are a reality in animals' research (Bradshaw, 2013). According to a review made by Samuel Gosling and Oliver John in 1999, personality in non-human animals can be common among a wide range of species. Definitions point to those characteristics of individuals that describe and account for temporally stable patterns of affection, cognition, and behaviour (Siegford et al., 2003; Gosling, 2008; Gartner and Weiss, 2013). Despite the persistent disagreements in terminology, terms such as temperament, individuality, coping styles and behavioural syndrome are used (Lowe and Bradshaw, 2001; Siegford et al., 2003; Natoli et al., 2005; Gosling, 2008; Gartner and Weiss, 2013; Litchfield et al., 2017). In this study, we will adopt the term personality for being the most comprehensive and able to integrate areas of study (Gosling, 2008; Gosling and John, 1999).

The study of cat behaviour and personality can minimize possible problems in the relationship between cats and their tutors – such as abandonment or mistreatment (Genaro, 2004). Most relinquishments are due to cat's behaviour, unmet tutor's expectations, allergies or tutor's circumstances, e.g. moving (Siegford et al., 2003; Shore, 2005; Casey et al., 2015). Most returned cats go back to shelters, which already receive a lot of abandoned animals. This leads to an overpopulation that directly impacts the welfare of the animals cared for in shelters. The lack of personality assessments in cats can make people adopt or buy according to the individual's appearance, age or sex (Fantuzzi et al., 2010). Personality assessments can help adoptions be successful by identifying ideal subjects for potential tutors (Gosling, 2008). In general, tutors end up presenting more positive attitudes toward their animals when their behavioural style complement their own personal styles (Zeigler-Hill and Highfill, 2010; Litchfield et al., 2017).

A program of personality assessments called Meet Your Match® (MYM) (ASPCA, 2007) was developed by the American Society for the Prevention of Cruelty to Animals (ASPCA). It consists on cats' personality assessments and interviews of potential tutors to make the perfect match, increasing the adoption rate and decreasing the return of adopted animals (Zeigler-Hill and Highfill, 2010; Moore and Bain, 2013). An exploratory factor analysis was made in a modified MYM assessment in a Brazilian shelter sample (Fukimoto et al., submitted) and, unlike the original version that has two dimensions (valiance and independent-gregarious), three dimensions were found (agreeableness, openness and extraversion). Personality in animals has been measured dimensionally, similarly to what Five Factor Model or Big Five (John and Srivastava, 1999) does with humans, to map personality structures. Recent studies have been investigating cat personalities dimensions (Gartner and

Weiss, 2013; Gartner et al., 2014; Kaleta et al., 2016; Bennett et al., 2017; Ha & Ha, 2017; Litchfield et al., 2017) and, so far, they unfolded several dimensions that personality presents, such as affection, energy, sociability and curiosity (Gartner, 2015).

One way to measure the stress of an animal is through physiological measures of glucocorticoids. According to Broom and Johnson, 1993: “Stress implies exposure to unpleasant conditions with adverse effects” (p. 58) and is a physiological response to adverse situations (Möstl and Palme, 2002). Stress response is adaptive and therefore the primary function of cortisol is to provide energy mobilization to the individual. But chronic stress brings consequences such as tissue atrophy, low immunity and stereotypies (Möstl and Palme, 2002). Cortisol can be measured in blood, saliva, hair, urine and faeces. As blood collection can induce stress in the individual, non-invasive methods are preferred (Terio et al., 1999, Young et al., 2004; Rehnberg et al., 2015). The most practical and appropriate matrix for the determination of cortisol metabolites in cats would be faeces, since it contains more than 80% of the cortisol metabolites and can be obtained without manipulating the animal (Graham and Brown 1996; Schatz and Palme 2001).

For some animals, personality can be related to cortisol levels and stress (Gartner, 2015). Capitanio et al. (2004) also affirms that personality characteristics are related to hypothalamic-pituitary-adrenal function. However, researchers suggest that, in cats, there is no correlation between personality and cortisol levels. Siegford et al. (2003) found no relationship between a Feline Temperament Profile (FTP) and salivary cortisol levels. Iki et al. (2011) found no correlation between blood cortisol levels and the FTP and Ramos et al. (2013) found that faecal cortisol metabolites did not vary according to personality either.

In an effort to improve adoptions, cat's adaptation in new homes and knowledge about physiological levels of stress, the objectives of the study are: a) verifying if there is a correlation between the three personality dimensions measured by the modified MYM assessment (agreeableness, openness and extraversion) and levels of cortisol; b) verifying if MYM assessment is consistent through localities (shelter vs. tutor's home); and c) finding out how moving from shelter to tutors' home affects faecal cortisol metabolites levels. Our hypotheses are: a) there is no correlation between personality dimensions and faecal cortisol, which corroborates with literature (Siegford et al., 2003; Ramos et al., 2013); b) scores of MYM assessment are similar in shelter and in tutors' homes (as personality is defined as stable and consistent through time and situations, we expect the results will be maintained); c) there will be a decrease in the levels of faecal cortisol metabolites in tutors' home (since shelters are apparently more stressful environments than households).

3.2 Methods

3.2.1. Subjects

Subjects were 53 domestic cats (supplementary material), all from Catland, a cat-exclusive shelter in São Paulo, Brazil. The cats assessed in the present study live in a house that is 116m² and was adapted to the needs and dynamic of a shelter. For instance, all windows have safety nets to prevent escapes and there are cat trees and shelves in the rooms for environmental enrichment. The animals are unrestrained at all times. Solitary cages are used only when a cat needs to be isolated for health conditions. All animals have access to food and water *ad libitum* and there is a schedule for medication when needed. Also fundamental for the well-being of the animals is the constant presence of caring volunteers who provide opportunities for affectionate interaction. They were about 05 months to 12 years of age, 29 female and 24 male, all neutered, all rescued from the streets or relinquished. Only cats that had been in the shelter for more than a week were assessed. Cats younger than 05 months were not evaluated because the literature says personality is not fully formed until the end of third month of life (Lowe e Bradshaw, 2001).

Subjects had their personality assessed twice: once in the shelter and once after the adoption. On average, cats were assessed three months after being rehomed.

The adoption was conducted by the shelter and, during the process, the adopters were informed that the cats were participating in a research and asked if the researcher could contact them. When consent was granted, the researcher opened a communication channel explaining the purpose of the research and instructing tutors on how to collect faecal samples (more details in sub item 3.2.3). The researcher also asked tutors to report any unusual activity in their home. We were able to follow 15 of these subjects post-adoption (i.e., in the tutors' home). All tutors agreed and signed the informed consent form.

3.2.2. Personality assessment: Modified Meet Your Match

The MYM personality assessment ASPCA (2007) was designed for North American shelters. In this study, we used a validated (Fukimoto et al., submitted) version of the MYM assessment modified for application in Brazilian shelters. The assessment consists of 11 experimental circumstances (that will be referred to as “items” from now on) that should be presented to the subject, a list of behaviours that should be observed and measured during these procedures, and their respective scores (Table 1). Each item scores points to one of the three dimensions assessed (agreeableness – items 5b, 6, 7, 8; openness – items 1, 4, 5a and extraversion – items 2, 9, 10, 11). If the cat has negative scores on several items (i.e.

presented aggressive behaviour towards the researcher), the assessment is terminated before all items are performed.

The novel room used to make the assessment was a bathroom to which cats did not have access. In homes the assessment also happened in bathrooms, because they are smaller rooms with fewer places for the cat to hide.

Table 1 - Items of the feline personality assessment of the *Meet your Match*[®] program

Items	Researcher	Listed possible behaviors	Scores
1. Body posture	Observation of the cat's posture when in it's cage <i>Adaptation:</i> observation of the cat's posture when standing in the shelter	- Soft and relaxed - Tense body with twitching tail - Flattened body with dilated pupils	+1 +2 -1
2. Greeting approach	Observation of the cat's response when the researcher came at the front of the cage <i>Adaptation:</i> observation of the cat's response when the researcher came towards and stands in front of him	- The cat comes at the front of the cage, soliciting attention by rubbing, chirping, etc - Comes to the front of cage after the researcher's encourage - Does not approach but meows, chirps or blinks - Does not approach - Attempts to hide - Hisses or growls - Charges	+3 +2 +1 0 -1 -2 -3
3. Cage condition	Silently observation of the cage <i>Adaptation:</i> unrated item	- Bedding/cage paper moved, cat hiding under - Cage rearranged, cat on top or not hiding - No change - Other, please describe	-1 +1 0 0
4. Social response when door is opened	Calmly and slowly opens the door of the cage and just observe the cat, no talking <i>Adaptation:</i> put the cat in the carrier, transported it to a novel room, slowly opens the door and observe the cat	- Remains relaxed and soft, approaches the researcher - Remains relaxed and soft, does not approach - Becomes stiff with tight tail flicks and standing - Crouches, body stiff	+1 0 +1 -1
5. (a-b) Introduction to novel room	Observation of the cat in the novel room Sit in a chair and observe for 5 minutes, do not interact with the cat	a) Exits carrier in 25 seconds or less with: - tall body posture - crouched body posture - quickly scoots to hiding place, keeping body low to the ground - does not exit the carrier b) Time spent with the researcher and for how long: - More than 60 seconds - 30-60 seconds - Less than 30 seconds	+1 +0,5 -0,5 0 +0,5 +1 0

6. Call and approach	Crouch down opposite the cat and softly call him several times using his name or an endearment. Extend a closed hand toward the cat and observe his response	<ul style="list-style-type: none"> - Makes eye contact +1 - Does not make eye contact -1 - Approaches +3 - Sniffs or head butts +3 - Rolls on back or rolls over +2 - Meows, purrs and/or chirps +1 - Watches with no approach 0 - Retreats -1 - Hisses or growls -2
7. Open hand	Crouch next to the cat, extend an open hand (palm up and lower than the cat's head) and observe his response	<ul style="list-style-type: none"> - Sniffs or head butts +3 - Licks or rubs on hand +3 - Rolls on back or rolls over +2 - Meows, purrs and/or chirps +2 Retreats/defensive position -1 - Hisses and/or growls -2 - Swats/attempts to swat hand -2 - Bites/attempts to bite hand -3
8. Stroking	Sit or crouch on the floor next to the cat and begin stroking for four or five long, slow strokes beginning at the head and ending at the base of the tail	<ul style="list-style-type: none"> - Rubs against legs or hand +3 - Head butts +3 - Circles the researcher attentively +2 - Meows, purrs and/or chirps +2 - Rolls onto back or rolls over +2 - Shows initial fear but then relaxes 0 - Retreats/defensive position -1 - Hisses and/or growls -2 - Swats or attempts to swat hand -2 - Bites or attempts to bite hand -3
9. Play	Slowly move a piece of string along the floor to initiate play, observe the cat's reaction then try to engage the cat in play with two other toys	<ul style="list-style-type: none"> - Watches toy intently +3 - Chases toy +3 - Comes back for stroking +2 - Ignores toys 0 - Attends to something else -1 - Avoids eye contact -1
10. Hug	Call the cat over or approach slowly if the doesn't respond. Stroke the cat a few times and pick him up and hold him upright with the side of his body held against the researcher's chest for two seconds and return him to the floor	<ul style="list-style-type: none"> - The cat is relaxed +3 - Extends paw to the researcher's neck or shoulder in an affiliative manner +3 - Meows, purrs and/or chirps +2 - Accepts hold but remains a bit tense +2 - Struggles to escape -1 - Hisses/growls -2 - Stiffens and extends claws -2 - Swats/attempts to swat -3 - Bites/attempts to bite -3
11. Sensitivity	Sit on the ground and allow the cat to approach, then stroke the cat along the base of the tail and pull up with a steady pressure just enough to almost, but not quite, move his back feet off the floor and hold for one second	<ul style="list-style-type: none"> - Rolls onto back or rolls over +3 - Shows no reaction +3 - Meows, purrs and/or chirps +1 - Struggles/tries to escape 0 - Hisses/growls -1 - Swats/attempts to swat -2 - Bites/attempts to bite -3

3.2.3. Faecal samples

We collected faecal samples in the shelter from August 2016 to April 2017. Litter boxes were observed by the researcher (NF) and two research assistants every weekday in the morning (from 8:00 a.m. – after the shelter staff cleaned the litter boxes – to 11:00 a.m.). Faecal collection happened immediately after defecation. All samples were identified with the subjects' name and date/time of collection. We collected a total of 466 samples from the 53 subjects with an average of eight samples per subject.

On average, tutors that collaborated with the research started the collection three months after the adoption and ended it three months later. They were instructed to collect samples immediately after defecation two to three times a week, identify them with name, date and time and keep them in the freezer until the researcher withdrew them. A total of 137 samples were collected in homes, with an average of 10 samples per subject. Tutors collected samples until October 2017.

After the withdrawal, all faeces were immediately frozen at -20°C and transported in a Styrofoam box with ice to the Laboratory of Behavioural Endocrinology at the Institute of Psychology of the University of São Paulo where they were kept frozen until FCM extraction and dosage.

3.2.4. Extraction and dosage of Faecal Cortisol Metabolites

Faecal cortisol metabolites extraction was performed following the protocol described in Palme (2005). Briefly, 2mL of methanol 80% were added to an aliquot of 0.2g of homogenized sample, shaken in a multivortex for 30 minutes and then centrifuged for 10 minutes at 1500 rpm. The supernatant was stored at -20°C until assayed. FCM were measured in a 50µL aliquot of the extract (diluted 1:10) with a cortisol (11-oxo-aetiocholanolone) enzyme immunoassay (EIA), validated to *Felis silvestris catus* by Schatz and Palme (2001, modified protocol). This assay was carried out at the Department of Preventive Veterinary Medicine and Animal Health of School of Veterinary Medicine and Animal Science of University of São Paulo and on the Laboratory of Experimental Endocrinology at the Institute of Psychology of the University of São Paulo. All intra-and inter-assay coefficients of variation of pool samples were less than 15%. All samples were assayed in duplicate. Concentrations of hormone metabolites are expressed as nanogram per gram of wet faecal matter.

3.2.5. *Ethical and data collection procedures*

This research complied with protocols approved by the Animal Research Ethics Committee of the Institute of Psychology of the University of São Paulo (CEUA/IPUSP n° 2309091116) and with the current Brazilian laws on ethical standards, as well as with the rules issued by the National Council for Control of Animal Experimentation (CONCEA). This research also complied with protocols approved by Operational Standard of CNS/CONEP no 01/2013 and Ethics Committee in Research with Human Beings - CEPH-IPUSP with the Certificate of Presentation for Ethical Consideration CAAE: 64700817.8.0000.5561.

3.2.6. *Data Analysis*

We performed a Spearman rank correlation to verify the correlation between the three dimensions of personality and FCM. For that test we used personality and FCM data collected in the shelter from 53 subjects. Personality dimensions data was inserted as the sum of values received in each item composing that dimension. Median concentration of FCM was calculated for all samples of each subject in shelter. This statistical analysis was performed using SPSS® (IBM® version 23).

To investigate the relation between locality and cortisol level, we used a subset of 15 individuals that were sampled from the shelter and tutor's home. Using these individuals, we ran two mixed models. Model 1 included a predictor for locality (shelter and home) representing the change in FCM between the two localities, and random intercepts and slopes to account for the repeated measures for each individual and to provide an individual level estimate of the cortisol change. Model 2 was identical to model 1 but it also included predictors for the three personality traits. Before fitting the models, FCM data was log transformed and both log-FCM data and personality dimension data were scaled. Both models were fit in the R statistical computing environment using the rstanarm package. We compared these models using leave-one-out cross validation (Vehtari et al., 2017) and using the loo package (Vehtari et al., 2018). After fitting the models for the full data, we noticed that two individuals that were adopted by the same tutor showed anomalous changes in FMC levels, suggesting some shared unmeasured environmental factor that affected the results (later we found that an aggressive cat went to live with these two subjects during sample collection). Because of this anomaly, we also fitted the models excluding these individuals. We show both fits in the results.

To assess the possible changes in personality between the two localities, we used a regression model for each personality trait, using locality as a predictor.

3.3 Results

3.3.1. Correlations between personality dimensions and faecal cortisol metabolites levels

No correlations were found between the three dimensions of personality (agreeableness $p=0.878$; openness $p=0.141$; extraversion $p=0.942$) and levels of FCM in Spearman correlation test.

3.3.2. Comparison of models using cross validation

Leave-one-out cross validation showed that both models had very similar predictive performance, with the simpler model (that used only locality) being slightly better (expected log pointwise predictive density difference of -0.62 , a statistic comparable to AIC difference). Given that predictive performance was equivalent and the coefficients related to personality traits were not significantly different from zero, we opted to use the results from the model without personality traits.

3.3.3. Faecal cortisol metabolites levels: shelters vs. tutor's home

When we use model 1 to compare the same individuals in the shelter and in tutor's home the mean difference in FCM levels was negative (lower levels in the home) but not statistically significant ($p = 0.0682$). As for individual level estimates, most subjects ($n=11$ out of 15) also showed a lower FCM level in their homes, but only two of these were significantly different from zero (Brigith and Provolone) (Figure 1). Two subjects showed an increase in their FCM levels (Judith and Ursula). Since the two subjects that had an increase in FCM levels were also adopted by the same tutor, we speculated that some unmeasured shared environmental factor was causing this increase (in a follow-up contact with the tutor we found that an aggressive adult cat went to live with them while samples were being collected), and so a new analysis was made without these two subjects. When we excluded the two subjects that had their levels of FCM increased, we found that FCM levels differ significantly from the shelter to the tutor's home ($p = 0.0072$), but most parameter estimates were unaffected (Figure 2).

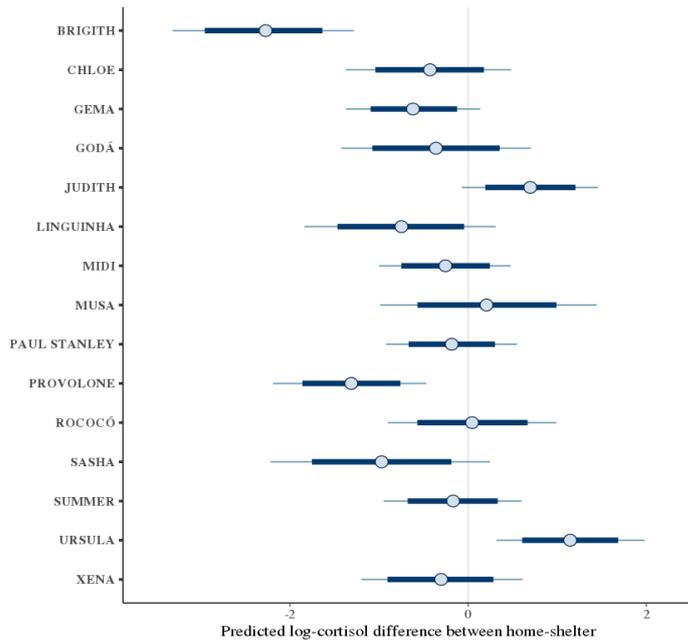


Figure 1: Estimated individual differences in faecal cortisol metabolites (log) levels between shelter and tutor's home (circles), for all 15 cats followed in the shelter and tutor's home. Negative values indicate smaller levels in the home when compared to the shelter. Thick bars show 80% posterior credibility intervals and thin bars show 95% intervals.

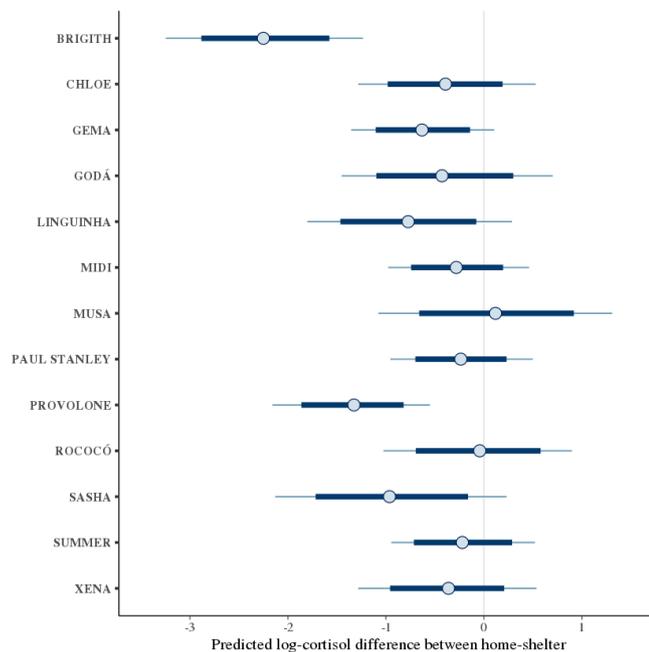


Figure 2: Estimated individual difference in faecal cortisol metabolites (log) levels between shelter and tutor's home (circles), without the two cats that had an unexpected stressor during data collection in the tutor's home. Negative values indicate smaller levels in the home when compared to shelter. Thick bars show 80% posterior credibility intervals and thin bars show 95% intervals.

3.3.4. Consistency of MYM assessment through localities

The personality dimensions of assessed subjects did not change when they moved from the shelter to the tutor's home – all personality dimensions presented only small, non-significant changes in the regression models (agreeableness: $p = 0.31$, openness: $p = 0.15$, extraversion: $p = 0.2$, Figure 3).

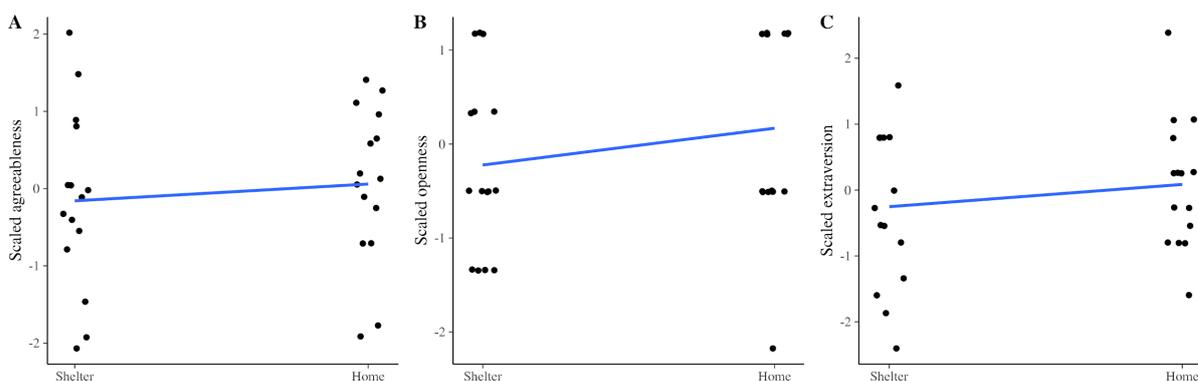


Figure 3: Comparison of each personality dimension (agreeableness, openness and extraversion) of all 15 cats between shelter and tutor's home.

3.4 Discussion

Our study aimed at verifying if there is a correlation between personality dimensions and FCM levels; finding out how moving from shelter to the tutor's home affects FCM levels, and verifying if MYM assessment results are consistent through localities. We found no correlation between personality dimensions and FCM levels. There was a slight, but significantly decrease of FCM levels at tutor's home and MYM assessment seems consistent through localities.

We found no correlation between personality dimensions and FCM levels, which corroborates with the findings of the following studies: Ramos et al. (2013) found that faecal metabolites did not vary in relation to cat personality; Iki et al. (2011) did not find correlation between a Feline Temperament Profile (FTP) and cat blood cortisol levels and Siegford et al. (2003) found no relationship between the FTP and cat basal salivary cortisol concentration either. It is still unclear why there is no correlation between levels of basal cortisol and personality in domestic cats. For a wild feline (clouded leopards, *Neofelis nebulosa*), Wielebnowski et al. (2002) found evidences of correlations between personality traits and corticoid levels. They found higher levels of faecal corticoids metabolites in “nervous” types

of clouded leopards compared to the “calm” ones. It is interesting to note that studies with domestic cats are done with confined, neutered subjects, with predictability of resources and affection. That can explain, in part, the non-correlation between FCM levels on our sample. Also, the measured dimensions might not be related to stress and basal cortisol levels. Another limitation was that our sample did not assess extremely unsociable cats, so all personality assessments had similar results among the subjects. Possibly, for confined cats, cortisol can relate to other factors, such as human activity (Bradshaw, 2016) and the number of people living in the household (Lichtsteiner and Turner, 2008).

When we compare the two models for the change in FCM levels between localities (shelter vs. tutor’s home), models 1 and 2 had very similar results, indicating that personality traits (included in model 2) do not relate to FCM levels. This result corroborates findings from our previous analysis with data from 53 subjects (collected only in the shelter) in which FCM did not correlate with personality dimension, highlighting that personality does not influence FCM levels of the subjects of this research.

The mixed-models aimed at investigating how moving from the shelter to the tutor’s home would interfere in the animal’s stress levels and how they would adapt to the new environment. The variation of FCM levels would show us whether the tutor’s home was a stressful environment or not. In the first analysis we ran with 15 subjects, two subjects presented increased FCM levels between the shelter and the tutor’s home. Something noteworthy caught our attention as the only two subjects that had an increased FCM levels were adopted together. Later, we found that a previously solitary aggressive adult cat went to live with these two subjects during sample collection. Since this study is preliminary, further studies would be needed to check if cats, when adopted, might have increased FCM levels. Our data points to an external stressor (other than adoption and moving to a new environment) as the cause of this increase in our sample. In this case, since the new cat was aggressive to them, maybe there were not enough places for them to hide and avoid encounters, which would have reduced FCM levels. In general, for cat population, the dominance hierarchy is quite stable so aggression rates among group-living cats are low (Knowles et al., 2004; Dantas-Divers et al., 2011).

On the second analysis (without the two subjects discussed above), there was a significant difference between the FCM levels in the shelter and in the homes. There was a slight tendency of reduction in FCM levels between localities, even though most subjects (11

cats) maintained their baseline FCM levels. Two individuals had a greater reduction in FCM levels, showing that the homes are a less challenging environment than the shelter for them, maybe due to differences in density and calmness. Probably in the shelter they were trying to cope with a more challenging environment (too many people working, high density of cats). However, most subjects did not change their FCM levels, which may point to better coping mechanisms. In this case, even with change of localities, the effects of potentially stressful environments are somehow minimized (Lichtsteiner and Turner, 2008). These findings seem a good result for the shelter too, indicating that, although the environment is potentially stressful (a lot of people working, lots of visitors, high density of animals), physiologically cats are able to cope as well as they do in the tutor's home. Despite the high density of cats in this shelter and the large number of people working there, it has some positive influencers that help to relieve some stressors. Some of these things (investments in environmental enrichment, places to hide, affectionate volunteers and a certain routine regarding eating and cleaning) are extremely necessary for the general well-being of sheltered cats (McCobb et al., 2005).

Scores of MYM personality assessment in shelter and in the tutor's home were not significantly different. Even though the assessments were applied only two times (once in the shelter and once in the tutor's home), the results show few changes (not statistically different) between localities, which indicate that MYM is a robust assessment for assessing personality dimensions. Studies using other methods also found consistency between reassessments (Siegford et al., 2003 – with the FTP after 3 and 6 months; Lowe and Bradshaw, 2001 – with behavioural records after 1 and 2 years). As personality is defined as stable individual characteristics, with consistency through time and situations, it was important that the results found in the shelter were maintained in the tutor's home.

All efforts to think about the welfare of cats (sheltered or homed) are necessary and important because their presence in residences is growing quickly. It is interesting to consider improving the compatibility between tutor and cat and the adaptation in new environments, thus enriching their quality of life and benefiting everyone involved. We showed that MYM is consistent between localities, achieving one of the precepts in a personality assessment. We also corroborate with other studies regarding a non-correlation between personality and FCM levels (Iki et al., 2011; Ramos et al., 2013). Furthermore, cats seem to be very resilient and fit well both in the shelter and in the tutor's home, so it appears that a very inadequate

environment is needed for the animals to show physiological stress (with higher levels of FCM) when they are adopted. Therefore, it is important that tutors, who already own a cat, consider its sociability with conspecifics before adopting another one. This way coexistence can be advantageous for both. From our sample of fifteen, only six individuals were adopted alone and went to homes with no more cats. For the remaining nine, two of them were adopted together and all the others went to homes that already had a cat. In general, most cats of our sample coped well after being adopted, even those who moved in with other cats. However, the two subjects that moved in with a non-socialized cat showed influences in their physiological well-being.

Relinquishment was not an issue in our sample, though it is a real problem. Data from shelters that used the MYM program (ASPCA, 2007) saw a reduction of 11% in return rates after its implementation. Not every tutor gets along with certain types of cats and mismatches have the potential to turn into relinquishments. A worrying case to illustrate this situation: an elderly couple adopted a very fearful cat from the shelter. At home, this cat became a very active and curious animal. On one hand, the couple was in love with the cat. On the other hand, they were tired of being bitten and scratched. The cat did this, clearly, for fun and lack of more intense activities, but a regular, more unattached tutor would probably return the animal. Fortunately, the couple worked through the mismatch. This particular cat was lucky, but as we cannot rely on luck, we should do whatever is in our power to minimize relinquishments. MYM program applied both to the cat and the tutor seems to be a good way out of this problem. We were unable to make the tutors' assessments because of the impossibility of fitting the survey into the shelter current adoption scheme, but we recognize the importance of this step and deem it critical to the success of adoptions. Future studies should work on validating the cat adopter survey for Brazilian population and verifying the benefits of this type of intervention so we can see the survey being used on a regular basis in the near future.

Conflict of interest

The authors declare that they have no conflict of interest.

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3.5 Supplementary material

Table 1: Names of the participant subjects, their gender, approximate date of birth and if the subject was followed after being adopted. (unkn=unknown)

<i>Name</i>	<i>Gender</i>	<i>Approximate date of birth (month/year)</i>	<i>Followed on post-adoption (Yes or No)</i>
Brigith	♀	01/2016	Yes
Abra	♂	05/2016	No
Açucena	♀	09/2015	No
Babi	♀	01/2016	No
Baunilha	♀	01/2016	No
Bukowski	♂	unkn./2015	No
Cajuína	♀	03/2016	No
Carrossel	♀	05/2016	No
Chloe	♀	01/2016	Yes
Coca	♀	04/2016	No
Danilo	♂	unkn./2004	No
Diego	♂	01/2016	No
Dora	♀	07/2013	No
Félix	♂	unkn./2016	No
Gema	♀	11/2015	Yes
Godah	♂	02/2016	Yes
Harlequim	♂	unkn./2015	No
Hera	♀	07/2015	No
Ivete	♀	09/2015	No
Jack Johnson	♂	01/2016	No
Judith	♀	08/2015	Yes
Kamikaze	♂	05/2016	No
Kate Moss	♀	07/2015	No
Lili	♀	unkn./2015	No
Linguinha	♀	unkn./2011	Yes
Looping	♂	05/2016	No
Lua	♀	unkn./2015	No
Lucas	♂	01/2016	No

Mariana	♀	07/2014	No
Marte	♂	unkn./2014	No
Mascavo	♂	01/2016	No
Matilde	♀	07/2015	No
Midi	♀	09/2015	Yes
Musa	♂	10/2015	Yes
Natalie	♀	09/2015	No
Ninja	♂	08/2015	No
Nuvem	♂	08/2014	No
Oswaldo	♂	08/2014	No
Paris Black	♀	01/2016	No
Paul	♂	10/2015	Yes
Picolé	♂	unkn./2014	No
Pikachu	♂	unkn./2014	No
Provolone	♀	unkn./2013	Yes
Rococó	♀	unkn./2011	Yes
Sasha	♀	07/2012	Yes
Shitake	♂	unkn./2013	No
Sukhe	♀	08/2015	No
Summer	♂	unkn./2012	Yes
Sundara	♀	01/2015	No
Tasha	♀	06/2015	No
Tauriel	♀	02/2016	No
Ursula	♀	unkn./2015	Yes
Xena	♀	unkn./2012	Yes

4. GENERAL DISCUSSION

More and more people are turning to cats as companion animals because they seem to be a better fit to urban life. Small residences, less leisure time and busier lifestyles call for a small independent pet. But this leaves at least two terms out of the equation: cat personality and the fact that, contrary to what most people believe, cats are not fine being left alone. Every cat is unique and being aware of their particularities can help the adaptation process and the development of the lifelong relationship between cats and their tutors. We believe leveraging assessments like MYM will facilitate the adoption process and increase the success rate of adoptions. To that end, the main objectives of our research were to examine if the MYM personality assessment was valid when adapted to a sample in a Brazilian shelter; to check if there was some correlation between personality types and levels of cortisol; to find out if moving from shelter to a new home impacted cortisol levels and, lastly, to confirm if MYM was consistent in spite of the change in localities (shelter vs. tutor's home).

In chapter I, the main objective was to verify the validity evidence of the MYM assessment when applied to a Brazilian sheltered cat population. The exploratory factor analysis showed evidence of validity based on the internal structure of the items of the modified MYM assessment. Researches regarding personality assessments and personality dimensions are relatively recent, so there is no agreement so far in regard to the name of the dimensions, their quantity and composition. As different methods are used in each research, it is possible that different aspects are being measured and, therefore, dimensions are receiving different names. In addition to that, many studies use the Five Factor Model or Big Five (John and Srivastava, 1999) as common ground to name the dimensions. Researchers suggest from three to six cat personality dimensions. We used the work of Litchfield et al. (2017) and Kaleta et al. (2016) to name the dimensions we found in the factor analysis of the modified MYM assessment. The descriptions of the dimensions used in these two studies had similarities to the description of the three dimensions found, so we named them this way: agreeableness, openness and extraversion. The dimensions used in the original MYM assessment were valiance and independent-gregarious (ASPCA, 2007). We signaled two possibilities for the difference between the assessments. The first relates to data validation (Chan, 2017). It is not clear how the items on the original assessment relate to each dimension (to our knowledge, there is no validation of MYM assessment), therefore, we could not replicate and compare the validation with the original data. The second alternative is that the

adaptations we had to make in the assessment in order to maintain the viability of our data collection might have changed the dimensions being measured.

After the exploratory analysis, a cluster analysis was conducted. The cluster analysis grouped two types of cats: cluster 1 grouped cats that are affectionate, friendly and fearless of new situations and cluster 2 grouped cats that are more active, curious and open to new experiences, but a little less affectionate. These groups indicate two patterns of cats that behave alike in our sample. The most common personalities, assessed by original MYM, found in a North American shelter (Weiss et al., 2015) were: sociable, affectionate and open cats. Despite using different dimensions, the patterns found in our cluster pointed to personalities similar to those present in Weiss et al. (2015).

In chapter II, no correlation between personality dimensions and faecal cortisol metabolites (FCM) levels were found, which corroborates findings of other studies. Siegford et al. (2003) found no relationship between Feline Temperament Profile (FTP) and cat basal salivary cortisol concentration. Iki et al. (2011) also did not find correlation between the same FTP and cat blood cortisol levels, and Ramos et al. (2013) found that faecal metabolites did not vary in relation to cat personality. We raised some possibilities for this lack of correlation. The first relates to the intriguing fact that the subjects of those studies generally live in confinement (laboratory or indoor cats), are neutered, and have predictability of resources and affection (some of them). In the wild, where there is no predictability of resources, felids have shown correlation among physiological and personality data. Wielebnowski et al. (2002) found higher levels of faecal corticoids metabolites in “nervous” types of clouded leopards (*Neofelis nebulosa*) compared to the “calm” ones. The second possibility has to do with the fact that studies generally identify only part of the dimensions that form personality, so it is possible that, although personality is related to cortisol, the dimensions we currently work with are not. We concede that our sample has one important bias – it does not include unsociable and fearful cats. Perhaps, for confined cats, cortisol is more related to other factors – such as human activity (Bradshaw, 2015) and the number of people living in the household (Lichtsteiner and Turner, 2008) – than to the personality dimensions normally assessed.

For the 15 subjects we followed post-adoption, we checked how moving from the shelter to a home affects cortisol levels. The two subjects that had increased FCM levels were adopted together and, during faecal samples collection period, an aggressive adult cat joined the family. This external stressor might be the cause of the FCM increase, but further studies must be carried out to check if cats when adopted together tend to have increased FCM levels.

On a second analysis with 13 subjects (without the two subjects mentioned above), most subjects (11 cats) maintained their baseline FCM levels and two subjects decreased their FCM levels significantly in the homes. Maybe homes are less defiant environments than shelters, as they usually have a lower density of cats and fewer people. Somehow, for the 11 subjects that maintained their baseline FCM levels, the effects of potentially stressful environments are minimized (Lichtsteiner and Turner, 2008). For the shelter, this is a good result because cats seem to do almost equally well (physiologically) in the shelter as they do in the tutor's home. It is important to point out that the shelter that participated in this study invested in environmental enrichment, offered places for the cats to hide, counted on affectionate volunteers, and had a solid routine regarding eating and cleaning. We believe these aspects play a decisive role in the well-being of sheltered cats (McCobb et al., 2005).

MYM personality assessment did not present significant differences when applied in the shelter and in the homes, being consistent through different localities. Personality is defined as stable individual differences even with changes in time, context and situations. The results show that the shelter values were maintained in the homes, indicating that MYM assessment is a good instrument to measure personality dimensions.

The validation of a personality assessment is important in order to guarantee that the dimensions are really being measured. Studies in this field still do not present a consensus about the formative dimensions of cat personality and it is also possible that cultures perceive personality differently. Future studies should continue looking for cat personality dimensions and standardise the terms used to designate them, as well as validate personality assessments to guarantee their efficiency.

4.1 Conclusion

Although cats are considered difficult to study, researches related to cat personality are necessary since cat population has been growing both in residences and in shelters (and on the streets). These studies are also important to help shelters succeed in their adoption campaign, to decrease return rate and relinquishment, to enrich the animal's adaptation in new environments, and to improve compatibility between tutor and cat, positively impacting their general well-being. Cats seem to be very plastic, coping well with shelters and tutor's homes. In order for them to show significant changes in cortisol levels, it seems that an exceptional stressor must be involved (an aggressive and non-socialized cat, for instance). It is also

important that tutors, who already own a cat and want to adopt another one, consider the sociability of the subjects in order to prevent aggressive behaviours. Another great step for future studies is to validate and verify the relevancy of a tutor assessment that checks their life style and expectations and suggest a cat with a good fitting. MYM program applies both cat and tutor's assessments to provide a good match and they have satisfactory results in reducing return rates (ASPCA, 2007). Summing up, in our study we presented a validation of the personality assessment used so we could highlight which personality dimensions were actually being measured in our sample. There was a slight decrease in cortisol levels in homes, but, overall, cats coped well with the shelter environment. As for the results of the personality assessment, they remained stable even after the change of environment. The results we have reached present data to corroborate with studies with cats and personality, and reinforce the concern for their well-being, both in shelters and in the homes where they will live.

Appendix 1

feline-ality™ assessment

MYM
MEET YOUR MATCH®

about the cat

shelter

evaluator

date of arrival to shelter

date of assessment

time a.m.
 p.m.

M MX F FX
sex

cat's name

age

ID #

breed

color

 Y N

declawed

facility requirement checklist

The Novel Room must be free of hiding areas (such as under counters, desks, behind items, etc.)
The room should ideally be 10' x 10', but can be slightly bigger or smaller if necessary. It is important that the area is quiet and free of distractions.

clean hands chair cat toys stopwatches (2) clipboard



All cats to be assessed should have been housed for at least 18 hours post-intake.
Cats should be assessed before spay/neuter surgery.

item #1: body posture

Items # 1 and 2 are to be conducted simultaneously. Be sure to read about how to conduct both items.

Quietly approach the cat's cage door and while standing in front of the cat's cage, take a quick mental snapshot of the cat's body posture.

Choose one of the following responses:

<input type="checkbox"/>	Soft and relaxed	add 1 pt	<input type="text"/>
<input type="checkbox"/>	Tense body with twitching tail	add 1 pt	<input type="text"/>
<input type="checkbox"/>	Flattened body with dilated pupils	subtract 1 pt	<input type="text"/>
total points for item #1			<input type="text"/>

other observations:

item #2: greeting approach

Immediately after taking a mental snapshot of the cat's body posture during item #1, begin to speak to the cat in a soft, normal tone of voice. Observe the cat's response to your presence through the closed cage door.

Choose one of the following responses:

	At front of the cage, soliciting attention by rubbing, chirping, etc.	add 3 pts	
	Comes to front of cage after you encourage	add 2 pts	
	Does not approach but meows, chirps or blinks (circle all that apply)	add 1 pt	
	Does not approach	0 pts	
	Attempts to hide	subtract 1 pt	
	Hisses or growls	subtract 2 pts	
	Charges	subtract 3 pts	
			total points for item #2

other observations:

item #3: cage condition

While quietly standing in front of the cat's cage, observe and note its condition.

Choose one of the following:

	Bedding/cage paper moved, cat hiding under	subtract 1 pt	
	Cage rearranged, cat on top or not hiding	add 1 pt	
	No change	no points	
	Other, please describe	no points	
			total points for item #3

other observations:

item #4: social response when door is opened

After completing items 1 through 3, calmly and slowly open the cage door while watching the cat. This should be done without talking. Observe the cat at the moment the door is initially opened.

Choose one of the following responses:

	Remains relaxed and soft, approaches me	add 1 pt	
	Remains relaxed and soft, does not approach	no points	
	Becomes stiff with tight tail flicks and standing	add 1 pt	
	Crouches, body stiff	subtract 1 pt	
			total points for item #4

other observations:

item #5a-b: introduction to novel room

Take the cat out of the cage and place him into a plastic crate (cleaned and allowed to air) for transport to the Novel Room. Ideally the cat should be loaded into the crate from above (turn crate so door is facing the ceiling). Throughout this item, you will be recording the amount of time the cat is either interacting or not interacting with you. In order to obtain an accurate assessment of time spent in each activity, use two stopwatches — one to keep the total time (start when you open crate door, end at five minutes), and the second to keep track of time interacting with you. Click on the second stopwatch whenever an interaction begins and click it off once the interaction ends.

IMPORTANT: OTHER THAN EYE CONTACT, DO NOT INITIATE, ENGAGE WITH OR RESPOND TO THE CAT. INTERACTION INCLUDES EYE CONTACT OR OTHER BEHAVIOR EVEN WHEN THE CAT IS IN THE CARRIER.

Interactive behaviors include meows, chirps, looks, blinks, rubbing against you, touching you, and being in your lap. Be sure to include those behaviors made while inside the carrier after the door has been opened.

Choose one:

	Exits carrier in 25 seconds or less with tall body posture	add 1 pt	
	Exits the carrier in 25 seconds or less with crouched body posture	add ½ pt	
	Exits carrier within 25 seconds and quickly scoots to hiding place, keeping body low to the ground	subtract ½ pt	
	Does not exit the carrier (choose one): ___ within 25 seconds, or ___ at all	0 pts	

Choose one (if applicable):

	Investigates room while standing tall	add 1 pt	
	Investigates room in a low body posture	add ½ pt	
	Races out of carrier to one spot in the room and stays there	subtract ½ pt	

total points for item #5a

Fill in information:

	Time spent interacting with the evaluator (as determined by second stop watch)		
	Time not spent interacting with the evaluator		

Choose one:

	Interacts for more than 60 seconds	add 1½ pts	
	Interacts for 30-60 seconds	add 1 pt	
	Interacts for less than 30 seconds	0 pts	

total points for item #5b

other observations:



If at the end of item #5 the cat is in the carrier, gently and slowly tip the carrier until the cat exits. Close the carrier door so the cat cannot reenter the carrier, then proceed to item #6.

item #6: call and approach

Crouch down on the opposite side of the room from the cat and about five to six feet away, start the stopwatch, and call the cat several times. Extend one hand, closed in a fist, toward him. Stop the stopwatch when the cat approaches and makes contact with your hand or body. Allow the cat up to 30 seconds to approach. Be sure to talk softly and encourage forward with voice. **Check all behaviors that occur.**

Makes eye contact	add 1 pt	
Does not make eye contact	subtract 1 pt	
Approaches	add 3 pts	
Sniffs or head butts	add 3 pts	
Rolls on back or rolls over	add 2 pts	
Meows, purrs and/or chirps (circle all that apply)	add 1 pt	
Watches with no approach	add 0 pts	
Retreats	subtract 1 pt	
Hisses and/or growls	subtract 2 pts	
total points for item #6		
other observations:		

item #7: open hand

While still crouching, extend an open hand to the cat. Your hand should be lower than the cat's head. If the cat did not approach you in item #6, walk toward and crouch next to the cat. **Check all behaviors that occur.**

Sniffs or head butts	add 3 pts	
Licks or rubs on hand	add 3 pts	
Rolls on back or rolls over	add 2 pts	
Meows, purrs and/or chirps (circle all that apply)	add 2 pts	
Retreats/defensive position	subtract 1 pt	
Hisses and/or growls	subtract 2 pts	
Swats/attempts to swat hand	subtract 2 pts	
Bites/attempts to bite hand	subtract 3 pts	
total points for item #7		
other observations:		



If the cat has been approached and shown no aggressive behavior, proceed. Stop the evaluation if cat displays aggressive behavior.

item #8: stroking

While talking to the cat, use your open hand, slightly cupped, to stroke the cat in long strokes along the head, back and sides. Continue for 4-5 long slow strokes if possible. **Check all behaviors that occur.**

	Rubs against legs or hand	add 3 pts	
	Head butts	add 3 pts	
	Circles you attentively	add 2 pts	
	Meows, purrs and/or chirps (circle all that apply)	add 2 pts	
	Rolls onto back or rolls over	add 2 pts	
	Shows initial fear but then relaxes	0 pts	
	Retreats/defensive position	subtract 1 pt	
	Hisses and/or growls	subtract 2 pts	
	Swats or attempts to swat hand	subtract 2 pts	
	Bites or attempts to bite hand	subtract 3 pts	
total points for item #8			
other observations:			

item #9: play

Beginning a couple of feet away from the cat, slowly move a piece of string/yarn along the floor to initiate play. Observe the cat's reaction. Then try to engage the cat in play with two other toys from the following list (for a total of three different toys): Ball, Toy Mouse, Cat Charmer, and Feather Wand. **Do not use catnip toys during the Feline-ality™ Assessment.**

Check all behaviors that occur. Circle the toy preferences on the score sheet so the adopter will know which toys the cat prefers, if any.

	Watches toy intently	add 3 pts	
	Chases toy	add 3 pts	
	Comes back for stroking	add 2 pts	
	Ignores toys	0 pts	
	Attends to something else	subtract 1 pt	
	Avoids eye contact	subtract 1 pt	
total points for item #9			
other observations:			
toy preference:			
BALL TOY MOUSE CAT CHARMER FEATHER WAND NONE NO PREFERENCE LIKES ALL OTHER			

item #10: hug

Call the cat again until he approaches, or approach him slowly yourself. Begin to stroke the cat again and if he is calm, gently pick him up and cradle him against your chest, his body sideways to your chest for a full two seconds.

Check all behaviors that occur.

	Is relaxed	add 3 pts	
	Extends paw to evaluator's neck or shoulder in an affiliative manner	add 3 pts	
	Meows, purrs and/or chirps (circle all that apply)	add 2 pts	
	Accepts hold but remains a bit tense	add 2 pts	
	Struggles to escape	subtract 1 pt	
	Hisses/growls	subtract 2 pts	
	Stiffens and extends claws	subtract 2 pts	
	Swats/attempts to swat	subtract 3 pts	
	Bites/attempts to bite	subtract 3 pts	
total points for item #10			
other observations:			

item #11: sensitivity

Sit on the ground and allow the cat to approach if he chooses. Wait at least 60 seconds before you stroke the cat along his back and gently grasp the cat's tail firmly at the base and pull up with a steady pressure just enough to almost, but not quite, move his back feet off the floor. Hold for 1 second. **Check all behaviors that occur.**

	Rolls onto back or rolls over	add 3 pts	
	Shows no reaction	add 3 pts	
	Meows, purrs and/or chirps (circle all that apply)	add 1 pt	
	Struggles/tries to escape	0 pts	
	Hisses/growls	subtract 1 pt	
	Swats/attempts to swat	subtract 2 pts	
	Bites/attempts to bite	subtract 3 pts	
total points for item #11			
other observations:			



Allow the cat to settle before returning to the cage.

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