Journal Articles

### ASSESSING KNOWLEDGE, AWARENESS, AND PERCEPTION OF GENETIC TESTING FOR HEREDITARY DISORDERS IN COMPANION ANIMALS AMONG PET OWNERS IN KLANG VALLEY

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## SUMMARY

To identify hereditary disorders in animals, it is necessary for them to go through genetic testing. When there is low awareness of the importance of genetic testing among pet owners, this will cause an increase in the incidence of hereditary disorders in their pets. The objective of this study was to assess the knowledge, awareness and perception of genetic testing in companion animals among local pet owners in Klang Valley, Malaysia and the potential variables that influence the pet owners 'understanding of animal genetic testing. To achieve our objectives, an online survey was conducted targeting residents of different districts of Klang Valley with a total of 120 respondents gathered within 2 weeks period. Data collected was analysed for a descriptive statistic using IBM SPSS Statistics version 22.0. This questionnaire assessed the public's knowledge, awareness, and perception of genetic testing. The self-administered questionnaire comprised of four sections focusing on the details of the respondents, including demographic characteristics, knowledge of genetic testing, awareness and perception of genetic testing. The results revealed that pet owners have satisfied knowledge and were highly aware of genetic testing in companion animals. The perception of genetic testing of the pet owners in Klang Valley, Malaysia was also generally positive. Based on the result, the variability of demographic background, such as educational background, influences the knowledge (p<0.01) and perception  $(p\leq0.05)$  of genetic testing among pet owners in Klang Valley. Meanwhile, education background does not influence the awareness (p>0.05) of genetic testing among pet owners of Klang Valley, Malaysia.

Keywords: genetic testing, pet owner's knowledge, awareness and perception, Klang Vallley

### **INTRODUCTION**

Genetic testing can provide important information for diagnosing, treating, and preventing hereditary illness. Animal genetic testing, such as DNA testing, karyotyping, identifying hereditary illnesses, and genotyping, is critical for breeding programs in the veterinary sector. An accurate and dependable method of determining an animal's genotype and screening for genetic diseases has grown more common in many companion animal species, as it is an important diagnostic tool for veterinarians (Shukor, 2015).

Genetic diseases should be handled as chronic illnesses and recognized in clinical practice. There are various genetic tests to highlight in companion animals. Around 80 different DNA tests are available for mutations associated with inherited (Mellersh, 2013). To reduce the incidence of congenital and hereditary neurologic disease in pets, it would also help practice veterinarians to discourage reproduction in animals with neurologic alterations for which inherited aetiology is recognized or suspected. Breeders and geneticists work together on the eradication of hereditary anomalies. Genetic tests make possible a rapid, accurate, and early confirmation of the

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Editorial history: Paper received: 04 December 2024 Accepted for publication: 27 December 2024 Issue Online: 31 December 2024 diagnosis in sick animals even before the clinical signs are evident; the carriers can thus be removed from breeding programs (Sargan, 2007).

The Cat Ancestry Test for exotic breeds tracks the cat's genealogy and delivers findings for common physical qualities such as coat colour, fur length, and coat type, which is currently in high demand. Other tests include the detection of hereditary illnesses like spinal muscular atrophy (SMA) and hypertrophic cardiomyopathy (HCM) in Maine Coon Cats for breeding purposes. The most common inherited propensity identified in practice is feline lower urinary tract disease (FLUTD). Although the method of inheritance is uncertain, genetic markers have been identified in cats diagnosed with FLUTD. The significance of a genetic marker is that it aids in identifying genes that cause inherited diseases, such as Diabetes mellitus, which is common in Burmese, Siamese, Norwegian Forest cats, Russian Blue, and Abyssinian cats (Bell, 2016).

Dogs are also susceptible to inherited health issues. Years of careful breeding have predisposed some dog breeds, making them more prone to infections, illnesses, and difficulties. The indications of genetic diseases vary. There were no variations in the prevalence of 13 genetic diseases between purebred and mixed-breed dogs (i.e., hip dysplasia, hypo- and hyperadrenocorticism, cancers, lens luxation, and patellar luxation). Dilated cardiomyopathy, elbow dysplasia, cataracts, and hypothyroidism were all found to be more common in purebred dogs. Mixed-breed dogs had a higher risk of cranial cruciate ligament rupture (Bellumori et al., 2013).



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With constant public attention on the health of purebred domestic dogs, veterinarians, and dog breeders are increasingly relying on DNA tests to assure their dogs' health. Scientists who discover disease-associated genetic variants must ultimately decide which discoveries are appropriate to develop into commercially available DNA tests for the lay dog breeder, who must strike a balance between the need to improve the genetic health of their breed and the need to maintain genetic diversity.

Awareness of genetic testing is important to see how animal breeders might best reduce or eliminate the development of heritable disease in their offspring due to improper selection and mating of animals with heritable (genetic) abnormalities. It also lays forth breeding procedures that will aid in lowering the heritable defect's prevalence in the animal population. This should be followed by owners and custodians of animals used for breeding that have any heritable defect that causes disease, and they must be observed when breeding animals with heritable (genetic) flaws that cause diseases mentioned in the Act's Schedule (Lyons, 2012). Pet owners must understand and be knowledgeable about genetic testing to avoid unpleasant misconceptions. Hence, pet owners can resort to genetic testing for the welfare of their pets.

Therefore, this study aims to assess the knowledge, awareness, and perception of genetic testing in companion animals among local pet owners in Klang Valley, Malaysia, and to study the potential variables that influence the pet owners' understanding of animal genetic testing.

The null hypothesis for this study is that the local pet owners of Klang Valley, Malaysia, recognize and are aware of genetic testing in companion animals. In contrast, the alternate hypothesis is that Klang Valley, Malaysia's local pet owners, recognize and are unaware of genetic testing in companion animals. Another null hypothesis is that the variability in demographic background influences pet owners' knowledge, awareness, and perception of animal genetic testing. In contrast, the alternate hypothesis is that the variability in demographic background does not influence the knowledge, awareness, and perception of animal genetic testing among pet owners.

### MATERIALS AND METHODS

*Ethical approval:* Ethical approval is obtained from the Ethics Committee for Research involving Human Subjects, University Putra Malaysia (UPM) with the reference number JKEUPM-2021-399.

*Research design:* A quantitative, cross-sectional, questionnaire-based research design on Malaysian pet owners about their awareness toward animal genetic testing.

*Study location:* This study was conducted by distributing questionnaires on Google Form through professional and blasted on personal social media mainly WhatsApp, Facebook, and Instagram.

*Study population:* The target population is Malaysian pet owners who lives in Klang Valley. Pet owners who fulfil the inclusion criteria were invited to participate in the study. All participation is on a voluntary basis.

*Subject criteria:* Inclusion criteria - The respondents must be Malaysian who are older than 17 years old. The respondents must be pet owners of mainly cats or dogs. Exclusion criteria - Respondents who refused to join and fail to fulfil the inclusion criteria are excluded from this study.

*Sample size estimation:* Estimation of sample size is 385 based on 95% confidence interval and 0.5 standard deviation. The calculation is by necessary sample size formula shown in Figure 1.

Necessary Sample Size	(Z-score)2 X StdDev X (1-StdDev)					
	(margin of error)2					

#### Figure 1. Sample size formula

*Method & data collection:* The questionnaire is constructed using Google forms. Data will be expressed in Microsoft Excel and SPSS Statistics version 26. Invitation poster with QR code were distributed online through WhatsApp, Facebook group and Instagram. The respondents were required to read through the consent form before able to proceed to the questionnaire. The questionnaire consists of 4 sections in Table 1.

Table 1. Sections of the survey

1 Demographic information	
2 Knowledge of animal genetic testing	
3 Awareness of animal genetic testing	
4 Perception of animal genetic testing	

*Data analysis:* Data from the questionnaire on Google form are transfer to Microsoft Excel. Descriptive analysis was done on Microsoft Excel while analytical analysis was done by SPSS version 26. Binary logistics regression was used to analyse the categorical data. Five Likert scales were divided into two categorical which are agree and disagree for easier analysis. Agree comprise of strongly agree and agree whilst disagree comprised of maybe, disagree and strongly agree.

### RESULTS

Surveys were distributed through social media, i.e. WhatsApp, Facebook and Instagram, for approximately 2 weeks. Google Forms collected one hundred and twenty responses. 61.9% of the respondents are female while 38.02% are male. Next, almost half of the respondents which is 44.63% are employed, followed by student status at 32.23%. Other than that, more than half (51.24%) of the respondents obtained a bachelor's degree as their highest educational qualification while a minority (0.83%) of them obtained an ACCA qualification. Other Respondents' demographic backgrounds are shown below (Figure 2).

The results demonstrate that many respondents (80%) are aware that genetic tests allow us to study an animal's DNA to see if it has certain genetic illnesses. Inherited





Figure 4. Have you heard of animal genetic testing?

Figure 2. Respondents' District





Figure 3. Respondents' age Table 2. Knowledge of genetic testing

disorders can be diagnosed through genetic testing. However, a significant number of respondents (39.2%) were doubtful if genetic testing has an age limit. They were also aware (77.5%) that dogs and cats have genetic disorders. Aside from that, half of them (50.0%) think that animal DNA testing has no age restriction.

Ten questions were created to assess pet owners' awareness of genetic testing. Table 2 shows that many respondents (46.7%) have heard of animal genetic testing. Meanwhile, only 36.7% know enough about animal genetic testing. Furthermore, more than half of the respondents (55.0%) are aware that not all hereditary disorders may be healed. Besides, the findings of a genetic test can be utilized to confirm or rule out a suspected hereditary condition, according to a considerable percentage of respondents (58.3%).

Statements		ybe	N	0	Yes	
	Count	%	Count	%	Count	%
1. Do you think that genetic tests allow us to examine an animal's DNA in order to see whether they carry certain genetic diseases.	24	20.0	0	0.0	96	80.0
2. There is no age limit in animal DNA testing	47	39.2	13	10.8	60	50.0
3. Do you think that cats/dogs have genetic diseases/abnormalities?	23	19.2	1	0.8	96	80.0
4. Do you think that DNA testing can also be used to determine the ancestry of an animal.	23	19.2	3	2.5	94	78.3
5. Do you think that genetic testing can be used to diagnose inherited disease?	26	21.7	1	0.8	93	77.5
6. Do you think genetic testing is useful in reducing the prevalence of genetic diseases?	35	29.2	0	0.0	85	70.8
7. Do you think that genetic testing can be used to test for various types of cancer?	35	29.2	7	5.8	78	65.0
8. Do you think that the onset of a certain disease is due to genes, environment and lifestyle?	29	24.2	2	1.7	89	74.2
9. Do you think that knowing more about your pets' genetics can help you reduce the risk of producing puppies/kittens affected by inherited conditions?	22	18.3	1	0.8	97	80.8
10. Do you think that affected animals of any genetic disease should not be used for breeding?	40	33.3	6	5.0	74	61.7

# Table 3. Level of awareness of genetic testing and the descriptive analysis

Awareness							-	D	escriptive an	alysis					
Statements	Stroı Disaş	ngly gree	Disa	gree	Neu	tral	Ag	ree	Strongly	y Agree	Ν	Minimum	Maximum	Mean	Std. Deviation
	Count	%	Count	%	Count	%	Count	%	Count	%					
1. I have heard/read about animal genetic testing.	3	2.5	18	15.0	31	25.8	56	46.7	12	10.0	120	1.00	5.00	4.0250	0.80401
2. I have sufficient knowledge about animal genetic testing.	10	8.3	28	23.3	34	28.3	44	36.7	4	3.3	120	3.00	5.00	4.1250	0.64251
3. I am aware that not all genetic disorder can be cured.	1	0.8	2	1.7	28	23.3	66	55.0	23	19.2	120	3.00	5.00	4.1250	0.64251
4. Genetic testing is closely related to science and medicine.	0	0.0	1	0.8	26	21.7	62	51.7	31	25.8	120	3.00	5.00	4.1667	0.70214
5. The results of a genetic test can be used to confirm or rule out a suspected genetic disease.	0	0.0	0	0.0	26	21.7	70	58.3	24	20.0	120	2.00	5.00	4.0500	0.72006
6. I would let my pet undergo genetic testing.	4	3.3	4	3.3	35	29.2	54	45.0	23	19.2	120	2.00	5.00	4.2250	0.71552
7. Genetic test should only be performed in a clinic/hospital with a veterinarian's prescription.	0	0.0	0	0.0	17	14.2	60	50.0	43	35.8	120	2.00	5.00	3.9917	0.78318
8. Genetic testing tells me the risk of my pet acquiring hereditary disorders.	0	0.0	0	0.0	23	19.2	63	52.5	34	28.3	120	3.00	5.00	4.1417	0.67731
9. Pet owner's view and awareness of genetic testing is important.	0	0.0	0	0.0	19	15.8	55	45.8	46	38.3	120	3.00	5.00	4.1583	0.66099
10. There is significance of genetic testing on my pets.	4	3.3	1	0.8	30	25.0	57	47.5	28	23.3	120	1.00	5.00	2.9083	1.13015

# Table 4. Perception of genetic testing and the descriptive analysis

Perception of gene	-	Descriptive analysis								
Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N	Minimum	Maximum	Mean	Std. Deviation
	%	%	%	%	%					
1. Genetic testing is important.	0.8	0.0	25.8	42.5	30.8	120	1.00	5.00	4.0250	0.80401
2. There is possibility of early detection of certain disorders using genetic testing.	0.0	0.0	15.0	57.5	27.5	120	3.00	5.00	4.1250	0.64251
3. Genetic testing aid in improving my pet's quality of life.	0.0	0.0	15.0	57.5	27.5	120	3.00	5.00	4.1250	0.64251
4. It is necessary to raise awareness of genetic testing.	0.0	0.0	17.5	48.3	34.2	120	3.00	5.00	4.1667	0.70214
5. Genetic testing is mainly for preventive purposes.	0.0	1.7	18.3	53.3	26.7	120	2.00	5.00	4.0500	0.72006
6. Genetic tests should be offered to animal breeders.	0.0	0.8	14.2	46.7	38.3	120	2.00	5.00	4.2250	0.71552
7. I have the right to refuse DNA testing on my pets.	0.0	0.8	28.3	41.7	29.2	120	2.00	5.00	3.9917	0.78318
8. I think the development of DNA research is hopeful for the treatment of the disease.	0.0	0.0	16.7	52.5	30.8	120	3.00	5.00	4.1417	0.67731
9. Knowledge of the genetic background of a disease will help my pets live longer.	0.0	0.0	15.0	54.2	30.8	120	3.00	5.00	4.1583	0.66099
10. Genetic testing tampers with nature.	10.8	26.7	32.5	20.8	9.2	120	1.00	5.00	2.9083	1.13015

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# Table 5. Pearson correlation table

		Education	Awareness	Knowledge	Perception
Education	Pearson Correlation	1	043	235**	180*
	Sig. (2-tailed)		.639	.010	.050
	Ν	120	120	120	120
Awareness	Pearson Correlation	043	1	.463**	.690**
	Sig. (2-tailed)	.639		.000	.000
	Ν	120	120	120	120
Knowledge	Pearson Correlation	235**	.463**	1	.468**
	Sig. (2-tailed)	.010	.000		.000
	Ν	120	120	120	120
Perception	Pearson Correlation	180*	.690**	.468**	1
	Sig. (2-tailed)	.050	.000	.000	
	Ν	120	120	120	120

\*\* Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed)

According to Table 3, most respondents (57.5%) believed that genetic testing can help improve their pet's quality of life. Aside from that, many of them agreed that genetic testing may be used to detect some problems early (57.5%). Apart from that, more than half of the respondents (54.2%) felt that knowing about genetic testing would help their pets live longer. When asked whether genetic testing tampers with nature, most respondents (32.5%) remained neutral.

The association between respondent's education background and knowledge and perception of animal genetic testing were analysed. Using bivariate analysis, *p*value of correlations were calculated. From the Pearson correlation in Table 4, there is a correlation between education and knowledge and perception of animal genetic testing which is significant at the 0.01 level and 0.05 level, respectively.

Table 5 shows the *p*-value for relationship between education background, knowledge about animal genetic testing, and perceptions of animal genetic testing.

### DISCUSSIONS

From the study, it shows that majority of the pet owners in Klang Valley have sufficient knowledge of genetic testing. However, most respondents were unaware that genetic testing has no age limit. In fact, the greatest magnitude of age-related change was detected between late senior and geriatric ages, likely caused by compensatory behavioural changes to biological ageing and owner attitudes to ageing (Lyons, 2012). according to the study, it is likely to be caused by compensatory behavioural changes to biological aging, and also could be influenced by the owner's attitude to their aging dog (geriatric dogs received less activity/interaction/training with the owner than other age groups).

However, as stated in a study conducted in the United States that examined public awareness of basic genetic ideas, strong knowledge or public familiarity does not always imply actual understanding (Lanie et al., 2004). Although the respondents may accurately describe certain scientific concepts, they will likely be unable to apply their basic understanding of genetic testing to decision-making. According to a recent survey, having more information does not always imply having a more positive view since people with the highest degree of knowledge are more likely to have critical and sceptical reactions (Jallinoja & Aro, 2000).

Nearly half of the respondents (45.0%) showed a willingness to undergo genetic testing, whereas a minority (3.3%) of the respondents gave a negative response, and 29.2% of the respondents gave a neutral response. Moreover, half of the respondents are aware that not all genetic diseases can be cured. Since the development of the first canine DNA test, breeders have been able to lower the occurrence of inherited disorders (Mellersh, 2013). Over 120 distinct dog breeds currently have access to at least one DNA test, with some breeds having multiple options. Besides, the entire genome DNA sequencing can be used to find novel causes of suspected inherited disorders in cats as a sort of genetic testing (Lyons & Buckley, 2020).

There was also a significant number of respondents (45.8%) agrees that pet owner's view and awareness of genetic testing is important. As a result, pet owners will be better equipped to correct any misconceptions they may have about genetic testing, allowing them to make more educated health decisions for their pets. Furthermore, the majority of respondents believe that genetic testing should only be done in hospitals with a veterinarian's prescription.

More than half of pet owners (53.3%) understood the value of genetic testing and its application in preventative medicine. Besides, the pet owners agreed that genetic testing should be offered to animal breeders. History has shown that breeders can be successful in reducing breedwide genetic disease through testing and making informed breeding choices (Bell, 2016).

Aside from that, a majority (53.3%) of respondents agreed that genetic testing is mainly for preventive purpose. Genetic testing can be used as a prophylactic measure as well as a potential remedy (Lyons & Buckley, 2020). Genetic diagnostic tests, on the other hand, may be new to many veterinary practitioners, and their use in the clinic requires the same level of scrutiny as any other diagnostic method. Nonetheless, when asked whether genetic testing interferes with nature, majority of respondents remained neutral.

Despite the high recognition of the importance of genetic testing, majority of respondents mentioned that more awareness of the topic is needed because they believe that a lack of education and knowledge of genetics and available tests leads to ethical concerns about genetic testing.

Association between educational background with the pet owners' knowledge about animal genetic testing showed significant relation. Based on the result, the variability of demographic background such as educational background influences the knowledge (p<0.01), and perception (p≤ 0.05) of genetic testing. While education background does not influence the awareness (p> 0.05) of genetic testing among pet owners of Klang Valley, Malaysia.

#### CONCLUSION

In conclusion, most pet owners in Klang Valley have positive knowledge, awareness, and perception towards animal genetic testing. Malaysian pet owners' knowledge has a significant association with their educational background. Even though most pet owners in Klang Valley have enough knowledge and a positive awareness and perspective of animal genetic testing, a minority of respondents had a negative awareness and attitude. As a result, the public's understanding, awareness, and perception of animal genetic testing should be improved to reduce stigma or taboo associated with it. To this end, media campaigns as well as government and nongovernment activities, such as seminars, should be organized to further educate the public on the health benefits of genetic testing. Furthermore, the government should implement rules and policies to ensure that genetic testing is used safely and efficiently.

# CONFLICT OF INTEREST

None of the authors of this paper has financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of the paper.

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