 doi:10.20944/preprints202206.0430.v3

Article

The effect of reducing food waste (organic waste) on the weight of cats (*Felis catus*)

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Simple summary:

Apart from climate changes that occur on a global scale; Economic-social and political events may occur regionally in any society. They may challenge the livelihood of the citizens. Citizens adapt their lifestyles to them. Therefore, the quantity and quality of food (nutrition) of citizens change. Organic waste (discarded food material) thrown into garbage bins is considered animal feed. A study of street cats allows researchers to get a general picture of other members of the urban animal community. Cats are animals living in cities that affect or are affected by other animals (birds, mice, dogs, reptiles, etc.). Responsible citizens and governments take extensive measures to protect the health of animals and respect their rights. But the coexistence of some animals with humans makes them more affected. To better understand the impact of citizens' livelihoods on cats, their weight was measured over a period of 48 months (16 seasons). It was found that the weight of the cats decreased due to the reduction in the production of organic waste (discarded food). Weight loss was different in different periods and urban areas.

Abstract:

This study aimed to investigate the effect of reducing the amount of organic waste on the weight of cats in Tehran. The weight of 4192 cats was measured from spring 2016 to the end of winter 2020. They were classified into 6 age groups, 2 gender groups ,and 13 geographical areas. Their weight was measured for 48 months (16 seasons). The statistical parameters analysis showed no weight loss in 2017, but since 2018, cats have been losing weight every year. They had lost about 178g of their weight in 2018. The sharpest annual decrease was observed in 2019 when about 301g of weight loss was recorded. In the winter of 2020, 115g of weight loss took place. In the spring of 2017, no weight change was observed, but in the spring of 2018, the cats lost 155g of their weight. Their weight loss intensified in the spring of 2019 and about 299g of weight loss was observed. In the summer of 2017, as in the spring of the same year, no weight loss was recorded, but for the summer of 2018, the weight loss was evident and about 205g of the weight of the cats had been reduced. The weight loss in the summer of 2019 not only continued but intensified and about 304g of weight loss was recorded for cats. Weight change was not observed in the fall of 2017 as in the spring and summer of the same year. In the fall of 2018, weight loss was recorded for cats. They had lost about 324g of their weight in the fall of 2018. Also, they experienced a weight loss of about 218g in the fall of 2019. During the spring, summer ,and autumn of 2017, no weight loss was observed in the cats for the winter of 2018, but in the winter of 2019, the cats faced the most severe weight loss (seasonally). They lost

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about 401g of weight in the winter of 2019. Of course, in the winter of 2020, about 186g of weight loss was observed in cats. The results showed that female cats did not lose weight in 2017 but experienced weight loss in 2018 with a weight loss of 181g. The weight loss of females intensified in 2019 and 294g of weight loss was recorded. Female cats lost 186g of their weight in the winter of 2020. Male cats did not lose weight like female cats in 2017. But in 2018, a weight loss of 166g was observed in male cats. The weight loss of male cats continued in 2019 and 311g of weight loss was recorded for them. However, in 2020, unlike females, weight loss was not observed in male cats. It can be said that both sexes lost more weight in the winter of 2019 than in other seasons. In 2017, weight loss was observed only for the region of 10, and in the same year, weight gain was recorded for the region of 15. But in 2018, except for regions 3, 4, 15 ,and 19, weight loss was observed in other regions. In 2019, the weight loss of cats spread and weight loss was observed in all regions except the region of 12. In winter 2020, weight loss was recorded only in the region of 4. In the end, it can be concluded that the weight of cats has decreased since the spring of 2018 because the beginning of the decrease in the amount of organic waste has been recorded since the winter of 2018. So, there is a direct relationship between the weight of cats and the amount of organic waste (access to food). The amount of garbage has been decreasing since the winter of 2018, and the average weight of cats has also been decreasing since the spring of 2018 due to the decrease in access to food.

Keywords: cat, Tehran, weight loss, food access, waste reduction.

1. Introduction

Cat (Felis Catus) is a carnivorous animal whose taxonomy is Animalia, Chordata, Mammalia, Carnivora, Feliformia, Felidae, Felis, and Felis Catus[2 ,1]. Cats have long been attracted to human attention because of their ability to hunt small rodents (such as mice) and other creatures[3]. Cats have evolved by selective breeding, while the results of phylogenetic research show that other species of cats and wild cats have evolved through homologous speciation or parapatric birth[8-4]. About 60 breeds of cats have been registered so far[9].

Scientists believe that cats were domesticated 9,000 years ago for the first time by the people of the Middle East to hunt mice and protect crops[10]. The first signs of the domestication of cats are about 7500[12 ,11]. Egyptian wild cats were later added to the Genial Bank of the cats[13].

In terms of anatomy, cats are very similar to other felines[5 ,4] and their anatomy has undergone minor changes in the process of domestication. So, they can live in nature. At the time of puberty, their average length is about 40-45 cm, their height is about 20-25 cm, and their tail is about 30 cm, and males are longer than females[14]. On average, their weight at the time of puberty is 4 to 5 kg[6]. Their skull and skeleton are smaller than European wild cats[15]. Cats have 7 cervical vertebrae, 13 thoracic vertebrae, 7 lumbar vertebrae, 3 sacral vertebrae, and some tail vertebrae[16]. Their body is flexible so much[17] and due to the suspension of the clavicle bones, they can pass through narrow passages[18]. Cats have skulls with large eye sockets (compared to other mammals), and

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strong jaws armed with sharp teeth suitable for holding, killing, and tearing prey[19]. Their flexible and retractable claws are covered with skin and fur, and when hunting, defending, or climbing surfaces, they can open any or all of their claws at will. In this way, it prevents the claws from being worn and keeps them sharp, and avoids making noise when hunting. The front claws are sharper than the hind ones[23-20].

All species of felines are clawed, and wild, domestic, and street cats are also clawed[24]. They can move their hind paws exactly in place of the front paws[25]. Felines often stay above the ground to monitor territory and hunt, and when they fall from a height of about 3 meters, they land on their paws[27 ,26 ,17].

Cats are animals that are more active from sunset to sunrise and are called nocturnal or nocturnal[29 ,28]. Cats, who spend most of the day resting, also sleep or dream[33-30]. Cats have good night vision[36-34] but their color vision is poor[37]. The sense of smell in them is well developed due to the developed olfactory bulb (5.8 cm2) and wide mucosal surface[42-38].

Cats have a weaker sense of taste than humans and do not have a special understanding of sweet taste[44 ,43]. But they perceive the taste of acids, amino acids (protein), and bitter taste[44]. Also, they prefer a temperature of 38 degrees Celsius for their food and avoid eating cold food[46 ,45].

Also, they can communicate by producing special sounds, and communicating visually with each other with body language. They hear sounds with a frequency higher or lower than the human hearing limit, and due to their movable outer ears (with separate control for each), they can recognize the exact place of sound production[49-47].

Dozens of whiskers on the face of cats help them to have a correct understanding of the position of the head about the body, as well as the width of the slits and the airflow[19]. Their body can withstand a temperature of 44 degrees Celsius and they sweat at a temperature higher than 39 degrees Celsius.

They come from two sexes, male and female, and the male sex reaches maturity after 10 to 12 months. After the age of 6 to 8 months, the female can get pregnant and have 2 to 5 cubs each time. The eyes of the puppies are closed at birth.

Cats can suffer from various diseases. Fungal infections, parasitic diseases, chronic diseases, kidney failure, thyroid disorders, and arthritis are among them[51 ,50]. Much research has been done on the health status of cats and their diseases (street, domestic, wild)[53 ,52]. About 250 genetic disorders have been identified in them and they can be checked with genetic tests[54]. Also, common diseases between cats and humans have been identified (salmonella, cat scratch disease, and toxoplasmosis) and studies have been carried out[55].

Cats are part of animals living in cities, whose lives have been affected by coexistence with humans. They often suffer from kidney and oral diseases, which makes their life expectancy much shorter than their counterparts who live in houses. Although cats are hunters[56] trash cans are one of the ways to access food for them[58 ,57].

By becoming urban, humans caused changes in the ecosystem around them, and these changes affected the ecology of other animals[59-62]. Although fluctuations in the economic situation are common[63], these fluctuations will affect species that coexist with humans. The secondary effects of economic fluctuations can be seen in the form of changes

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in the quantity and quality of the contents of garbage bins[63], which occur as a result of economic fluctuations[64-68]. There is evidence of changes in the amount of waste in Tehran[69].

The purpose of this study was to better understand the effect of changing the quantity and quality of litter on the weight of cats. The weight of the cats was measured at certain time intervals and specific places. Changes based on the weight component (dependent variable) were measured under the influence of year, season, neighborhood, age, and gender.

2. Materials and Methods

2.1. Materials

2.1.1. Geographical area (independent variable)

The information needed for this research was collected in 13 places in densely populated residential areas of Tehran city. The desired points were selected in such a way that different economic levels of society and geographical areas could participate in it. Therefore, to monitor the city of Tehran, Zafaranieh, Saadat-Abad, and Davodieh neighborhoods in the north of Tehran (citizens with a higher standard of living and more prosperous life than others), Central Janat-Abad and Mortazavi neighborhoods in the west, Abbas-Abad and Shemiran Gate in the center of the city, Haft Hoz, West Tehran-Pars and Parastar neighborhoods in the east and Shush, North Khani-Abad, Firoz-Abadi neighborhoods in the south were selected. Due to urban density and congestion, the radius of each of the selected areas was 110 to 130 meters.

2.1.2. Period of time (independent variable)

The period chosen for data collection (the field observation phase of the research) was chosen based on the common solar calendar in Iran. Therefore, the spring of 2016 was the beginning of primary data collection and this process continued in the summer and autumn. In 2017, 2018, and 2019, data was collected in all four seasons (winter, spring, summer, and autumn). Data collection in 2020 was done only for the winter season, and after the winter of 2020, the initial data collection was finished.

2.1.3. Statistical Society

In the data collection process, 4192 cats were observed. Of these, 2380 samples were less than 18 months old and 1812 samples were more than 18 months old. In 2016, the number of observed cats was 827. 487 of them were less than 18 months old and 340 of them were older than 18 months. 1114 cats were observed in 2017, 635 of them were less than 18 months old and 479 of them were more than 18 months old. In 2018, 983 samples were counted, 559 of which were less than 18 months old and 424 more than 18 months old. The data collected for 2019 also showed that 1044 samples were counted this year, 577 of which were less than 18 months old, and 467 samples were older than 18 months. The winter season of 2020 was the last period for data collection when 224 cats were observed. Of these, 122 samples were less than 18 months old and 102 were more than 18 months old.

2.1.4. Gender (independent variable)

Sex determination was done only for cats that were more than 18 months old. Therefore, 2380 of the samples that were less than 18 months old were not included in this process and only 1812 of the samples were determined by gender, of which 1376 were female

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and 436 were male. In 2016, the number of female samples was 255, of which 84 were in the spring, 84 were in the summer, and 87 were in the fall. The number of male samples was 85, of which 28 males were observed in spring, 28 males in summer, and 29 males in autumn. In 2017, the number of female cats observed was 361 and the number of male samples was 118. 88 females and 28 males were counted in the winter of 2017, 89 females and 32 males in spring, 95 females and 28 males in the summer, and 89 females and 30 males in autumn. However, 320 of the samples in 2018 were female, and this statistic was 80 for winter, 80 for spring, 75 for summer, and 85 for fall. In the same year, 104 male cats were observed, of which 26 were from winter, 26 from spring, 26 from summer, and 26 from autumn 2018. The number of female cats in 2019 was 362, of which 97 were observed in winter, 92 in spring, 87 in summer, and 86 in autumn 2019. In 2019, the number of male cats was 105, with 25 males in winter, 27 males in spring, 28 males in summer, and 25 males in autumn. The winter of 2020 was the last season for data collection, the number of female cats was 78 cases and the number of male cats was 24 cases.

2.1.5. Age (independent variable)

In terms of age, the cats were divided into 6 groups. 2380 cases were less than 18 months old and were placed in the first category. So that 487 cases were observed in 2016, 635 cases in 2017, 559 cases in 2018, 577 cases in 2019, and 122 cases in 2020. Age of 1812 cats were more than 18 months and they were classified in the second to sixth categories. The second group (18 to 24 months) included 588 cats. So that 106 cases were monitored in 2016, 159 cases in 2017, 131 cases in 2018, 159 cases in 2019, and 33 cases in the winter of 2020. The third group (24 to 30 months) included 466 cats. 101 of them were observed in 2016, 120 of them in 2017, 108 of them in 2018, 111 of them in 2019, and 26 of them in the winter of 2020. 315 cats were placed in the fourth category (30 to 36 months). 54 of them were monitored in 2016, 82 of them in 2017, 78 of them in 2018, 82 of them in 2019, and 19 of them in the winter of 2020. Cats aged 36 to 42 months were also in the fifth category, whose number was 239, 40 of them were observed in 2016, 69 of them in 2017, 62 of them in 2018, 56 of them in 2019, and 12 of them in 2020. The sixth group (the last group) was the age group of more than 42 months, whose population was counted as 204 cases. Of this group, 39 cases belong to 2016, 49 cases belong to 2017, 45 cases belong to 2018, 59 cases belong to 2019 and 2 cases belong to 2020.

2.1.6. Garbage (independent variable)

The average weight of food waste reaching the Arad Koh site in the spring, summer, and autumn of 2016 (in tons per day) is 5431.7, 5699, and 5157.3, respectively. For 2017, the winter to the autumn season was 6155.3, 5842, 5904.3, and 5760.3 tons per day respectively. In the winter of 2018, 5917 tons per day, 5652 in spring, 4967 in summer, and 5785.3 tons of food waste were collected per day. 5262.3 tons per day in winter 2019, 5162.7 tons per day in spring, 5078.3 tons per day in summer, 4697 tons per day in autumn 2019, and 3864.3 tons per day in winter 2020 were sent to the Arad Koh site for burial.

2.2. Methods

2.2.1. Determining the geographical area

Considering the size and population of Tehran city, it was decided that more than half of the 22 municipal districts will be included in this research. The selection of the areas was done based on the geographical location and the livelihood level of the citizens living there,

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and the study areas were tried to include different livelihood levels and all geographical directions.

2.2.2. Period of time

The beginning of the research was based on the solar calendar (customary in Iran) and the process of determining the age, sex, and weighing samples were done once every 3 months (seasonally). Due to the coronavirus epidemic, the end of the field monitoring phase was considered in the winter of 2020.

2.2.3. Selection of statistical population

The criteria for the participation of samples in this research were the presence and residence of cats in predetermined places. Because it is very important to determine the territory in animal communities and because it is not possible to determine large territories in a crowded and dense city like Tehran, therefore the radius of 110 to 130 meters was chosen in a way that according to the urban roads, the distance between the neighborhoods and the length of the alleys and streets, the study area should only consider the residential context to produce the maximum number of edibles thrown into the garbage dumps.

2.2.4. Weight measurement

To measure the weight of the cats, a digital store scale of Mahak model MDS9800 with a capacity of 15 kg was used. This scale has a compact ABS plastic body with an iron sole, measuring 11*35*35 cm, and a stainless-steel edged tray measuring 5*23*37 cm, with an electric power source or battery and LCD screen, whose accuracy/error coefficient is ±1 gram.

To preserve and observe ethics in the research (not separating the animal from the environment), "canned tuna" was used as an edible material with a strong aroma to attract the attention of cats. 116 cans of canned tuna, each containing 120 grams (± 5 grams) of light tuna meat (Hoover-Gaider) with a drained weight of 70%, immersed in vegetable oil 18%, along with refined edible salt 1.5%, with the logo of the standard organization and the health license number 10053/63, the product of Fadalak Food Industry Company with the Polk brand name was used. Each 1 gram of canned fish (equal to the manufacturer's declaration) contained 2250 calories of energy, no sugar, 0.175 grams of fat, 0.015 grams of salt, and 0.001 grams of trans fatty acids. Pieces of canned fish (less than 1 cubic centimeter - about 2-3 grams) were placed on the scale tray and each cat was given only one piece of canned fish of the mentioned size and weight. The weight of the cat was measured and recorded while swallowing a 1 cubic cm piece of fish placed in the middle of the scale tray.

2.2.5. Gender Verification

kittens are completely dependent on their mother at birth and do not leave the nest environment even for a while. Because none of the samples were separated from their environment during the initial data collection for this research, it was possible to determine their gender only after 2 to 4 weeks of age, and this work was done by A vet was done. Observing the sexual organs of cats was considered as a criterion for determining their gender. Sex detection in male cats was done visually. By touching and caressing the end part of the vertebral column and raising the animal's tail upwards (in order from top to bottom - from under the tail to the feet), first the anus, then the two protrusions of the testicles (Scrotum) and finally, the penis hole was visible. Determining the sex of female cats was done in the same way. Observing the anus and the open urinary tract/vagina

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(Vulva Urinary Tract Opening) in the form of a line was considered an argument to determine the female's gender. The verification criterion in determining the gender of female cats through visual signs was the absence of male sexual organs (testicles). To maintain health and avoid nervous stress in cats, cats less than 18 months of age were not subjected to the sex determination process. Also, no cat was separated from the habitat by a veterinarian or researcher, and no drugs or traps were used.

2.2.6. Age determination

Considering that all permanent teeth have grown in cats around 6 months of age, therefore, the presence of milk teeth is considered to mean an age of fewer than 6 months. Therefore, determining the age of cats, independently by a veterinarian by checking the condition of milk teeth, checking the permanent teeth, checking the mass or stains on the teeth, checking the status of oral and dental diseases, and checking the body dimensions and physical condition of the cat, puberty, sexual activities, examination of the eyes, examination of the fur skin of cats, etc. were done. To maintain health and due to the special sensitivities of cats whose age is less than 18 months, this age group was not evaluated by the weight component, and only cats whose age was more than 18 months were weighed. became It is obvious that when measuring the weight, the animal was not separated from its habitat, and no drugs or traps were used.

2.2.7. Extracting data from the municipal waste management organization under the supervision of the municipality

The waste data collected in Tehran city includes food waste dumped in landfills, sanitary-hospital waste, and industrial-construction waste. According to the waste management organization under the supervision of Tehran municipality, food waste is sent to the Arad Koh site located in the south of Tehran province to be burned or buried. The information related to the food waste sent to the Arad Koh site from the beginning of spring 2016 to the end of winter 2020 was requested from the mentioned organization and was extracted from the website of that organization (Table 1)[69].

Table 1: The amount of waste collected from the city of Tehran and sent to the Arad Koh site (thousand tons/day)

	2016*		2017		2018		2019		2020***	
Winter	-**	-**	6155	-	5917	-3.87%	5262	-11.06%	3864	-26.57%
Spring	5432	-	5842	7.55%	5652	-3.25%	5163	-8.66%	-	-
Summer	5699	-	5904	3.60%	4967	-15.88%	5078	2.24%	-	-
Autumn/Fall	5157	-	5760	11.69%	5785	0.43%	4697	-18.81%	-	-
Total	5429	-	5916	8.95%	5580	-5.67%	5050	-9.50%	-	-

*- The beginning of the field phase to collect primary data **- Jan., Febr., and Mar. of 2016 were not part of the study and therefore no data was recorded for it. ***- The winter of 2020 was the end of the field phase of primary data collection.

2.3. Statistical analysis

Age, gender, weight, and number were part of the primary data collected. Excel - Microsoft Office Professional Plus 2019 and IBM SPSS Statistics 26 software were used to save, and categorize collected data, process and analyze data, perform statistical tests, and draw tables and graphs Normality was confirmed based on the central limit theorem. The equality of variances was checked with Levene's test. If the results of Levene's test were

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significant (p>0.05), the weight change of cats was checked with Independent-Samples T-test and Equal variances assumed statistic was used. If the results of Levene's test were not significant (p<0.05), the Equal variances not assumed index, was used in the Independent-Samples T-test. The significance level for the Independent-Samples T-test was defined as p<0.05.

3. Results

3.1. Annual results

The analysis of the obtained data shows that the change in the weight of cats in 2017 compared to 2016 was not significant (P=0.896) and the average difference obtained from their weight was only 2.84g. While the results show that the weight loss of cats started from 2018 onwards (P=0.000, which was significant). The obtained results indicate that the weight loss of cats in 2018 was 177.3g compared to the previous year. The results show that the weight loss of cats in 2019 was also significant (P=0.000) and continued, and on average, 300.82g of the weight of cats was reduced in 2019. In the continuation of the investigation process, it was found that 114.29g of the weight of cats was reduced in 2020 compared to 2019 (P<0.002). (Table 2).

Table 2: The results of the Independent-Samples T-test for the years 2016 to 2020 based on the results of Levene's test

Group Statistics

	Year	N*	Mean**	Percentage***	p-Value****	Std. Deviation	Std. Error Mean
Weight	2016	340	3330.35	-	-	307.974	16.702
	2017	479	3333.19	0.09%	.896[a]	305.159	13.943
Weight	2017	479	3333.19	-	-	305.159	13.943
	2018	424	3155.89	-5.32%	.000[b]	355.295	17.255
Weight	2018	424	3155.89	-	-	355.295	17.255
	2019	467	2855.07	-9.53%	.000[c]	361.646	16.735
Weight	2019	467	2855.07	-	-	361.646	16.735
	2020	102	2740.78	-4%	.002[d]	323.901	32.071

*- The number of company samples given in the statistical analysis based on the year **- The average weight of the analyzed cats in the statistical analysis in grams. ***- The amount of weight changes compared to the previous year. ****- The limit of significance was defined in the independent-samples T-test as p<0.05, which was meaningless (p>0.05) and showed that no change occurred. b, c, and d were significant and the weight change occurred in 2018, 2019, and 2020.

3.2. Seasonal results

The results show that although the average weight of cats increased by 42.58g in the spring of 2017 compared to the same period last year, it was not significant (P=0.317). But the average weight changes in the spring of 2018 were significant (P>0.001) and decreased by 155.09g compared to the spring of the previous year. Also, 298.77g of the average weight of cats in the spring of 2019 compared to the spring of 2018 was reduced, which was significant (P=0.000).

The results of the statistical tests performed on the data showed that the average weight decrease for the summer of 2017 compared to the summer of 2016 was insignificant (P=0.758). Of course, in the summer of 2017, the average weight of cats was reduced by 11.74g. But the comparison results for summer 2018 and summer 2017 were different.

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Because the cats lost 204.73g of weight in the summer of 2018 compared to the summer of 2017, and the parameters of the statistical analysis showed the significance of the average weight changes (P=0.000). According to the significant limitations in the summer of 2019 (P=0.000), the cats weighed 303.37g less than in the summer of 2018 and it can be said that they have faced a significant change.

In the fall of 2017, as in spring and summer, the changes in the average weight compared to the fall of the previous year were not significant (P=0.354), while 36.29g of the weight of the cats had been reduced. The analysis of the results for the fall of 2018 compared to the fall of 2017 showed a significant decrease in the average weight and its value was 323.22g (P=0.000). Also, in the fall of 2019, the average weight decrease was significant (P=0.000) and its value was recorded as 217.77g.

Winter seasons were also compared point by point. The analysis for the winter of 2018 indicated that the changes were not significant (P=0.611). In the winter of 2018, the average weight of cats decreased by 21.91g compared to 2017. The result of data processing in the winter of 2019 was significant (P=0.000) and indicated a 400.16g decrease in average weight compared to the winter of 2018. The winter of 2020 was also significant with 185.99g decrease compared to the winter of 2019 (P=0.000). (Table 3).

Table 3: The results of the Independent-Samples T-test by four seasons and based on the results of Levene's test

Group Statistics (Spring)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	112	3314.71	-	-	321.226	30.353
	2017	121	3357.29	1.28%	.317[a]	326.602	29.691
Weight	2017	121	3357.29	-	-	326.602	29.691
	2018	106	3202.28	-4.62%	.001[b]	339.807	33.005
Weight	2018	106	3202.28	-	-	339.807	33.005
	2019	119	2903.51	-9.33%	.000[b]	412.556	37.819

Group Statistics (Summer)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	112	3320.90	-	-	304.507	28.773
	2017	123	3309.16	-0.35%	.758[a]	278.437	25.106
Weight	2017	123	3309.16	-	-	278.437	25.106
	2018	101	3104.43	-6.19%	.000[b]	335.101	33.344
Weight	2018	101	3104.43	-	-	335.101	33.344
	2019	115	2801.06	-9.77%	.000[b]	327.305	30.521

Group Statistics (Fall)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	116	3354.57	-	-	299.302	27.790
	2017	119	3318.28	-1.08%	.354[a]	299.836	27.486
Weight	2017	119	3318.28	-	-	299.836	27.486
	2018	111	2995.06	-9.74%	.000[c]	337.889	32.071
Weight	2018	111	2995.06	-	-	337.889	32.071
	2019	111	2780.29	-7.17%	.000[c]	331.402	31.455

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Group Statistics (Winter)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2017	116	3348.84	-	-	315.527	29.296
	2018	106	3326.93	-0.65%	.611[a]	323.925	31.462
Weight	2018	106	3326.93	-	-	323.925	31.462
	2019	122	2926.77	-12.03%	.000[c]	348.633	31.564
Weight	2019	122	2926.77	-	-	348.633	31.564
	2020	102	2740.78	-6.35%	.000[c]	323.901	32.071

*- The number of samples given in the test is based on each season. **- Explanation in Table 2. ***- Explanation in Table 2. ****- P<0.05 / Explanation in Table 2. a was non-significant and no change was observed in 2017 (p>0.05). b and c were significant (p<0.05) and weight change was observed in 2018 and 2019 by season.

3.3. *Results by Gender*

The significance of changes in the weight of cats was also investigated in terms of gender. In the analysis of the data obtained from the weight of female cats, the results showed that the changes in their average weight for 2017 compared to 2016 were insignificant (P=0.729), but their weight in 2018 was Compared to 2017, there was a significant change (P=0.000) and it was 181g less. Female cats in 2019 also faced significant weight loss (P=0.000). In 2019, their weight was reduced by 294g compared to 2018. The changes in their weight index for the winter of 2020 were still significant and 185.99g of weight loss was observed in female cats (P<0.007).

Analysis of the data related to male cats showed that weight changes in 2017 compared to 2016 were not significant (P=0.824). But in 2018, while the changes were significant (P<0.001), the average weight of male cats decreased by 166g compared to 2017. Also, their average weight in 2019 was reduced by 311g (P=0.000). Meanwhile, the changes in the winter of 2020 compared to 2019 were not significant (P=0.182). (Table 4).

Table 4: Independent-Samples T-test results by gender and based on Levene's test results

Group Statistics (Female)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	255	3287.41	-	-	288.285	18.053
	2017	361	3295.50	0.25%	.729[a]	283.031	14.896
Weight	2017	361	3295.50	-	-	283.031	14.896
	2018	320	3114.73	-5.49%	.000[b]	340.462	19.032
Weight	2018	320	3114.73	-	-	340.462	19.032
	2019	362	2821.31	-9.42%	.000[c]	355.574	18.689
Weight	2019	362	2821.31	-	-	355.574	18.689
	2020	78	2703.23	-4.19%	.007[d]	309.225	35.013

Group Statistics (Male)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	85	3459.16	-	-	330.284	35.824
	2017	118	3448.51	-0.31	.824[a]	340.836	31.376
Weight	2017	118	3448.51	-	-	340.836	31.376

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	2018	104	3282.53	-4.81%	.001[b]	371.439	36.423
Weight	2018	104	3282.53	-	-	371.439	36.423
	2019	105	2971.47	-9.48%	.000[c]	359.886	35.121
Weight	2019	105	2971.47	-	-	359.886	35.121
	2020	24	2862.83	-3.66%	.182[e]	346.776	70.785

*- The number of samples examined in statistical tests in terms of gender. **- Explanation in Table 2. ***- Explanation in Table 2. ****- p<0.05 / Explanation in Table 2. a was meaningless and no change was observed for males and females in 2017 (p>0.05). b, c and d were significant (p<0.05), and in 2018 and 2019 in both sexes (male and female) and 2020 only female cats' weight change was observed. e that in 2020 weight change was not observed in male cats / it was insignificant (p>0.05).

3.4. Results by year/season/gender

Spring. Analysis of the data obtained in the spring seasons was done for female cats. Changes in the spring of 2017 compared to 2016 were meaningless for them (P=0.313). But in 2018, they faced a significant decrease of 153g, and in 2019, a significant decrease of 280g (P<0.001 and P=0.000). The data collected for male cats were also analyzed. The results showed that the changes in spring 2017 compared to spring 2016 (P=0.786) and in spring 2018 compared to 2017 (P=0.152) are not significant. While male cats had a significant weight loss of 350g in 2019 (P<0.001). (Table 5).

Table 5: The results of the Independent-Samples T-test by gender in the spring season and based on the results of Levene's test

Group Statistics (Female)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	84	3268.71	-	-	292.464	31.910
	2017	89	3313.19	1.36%	.313[a]	285.251	30.237
Weight	2017	89	3313.19	-	-	285.251	30.237
	2018	80	3160.30	-4.61%	.001[b]	321.016	35.891
Weight	2018	80	3160.30	-	-	321.016	35.891
	2019	92	2880.49	-8.85%	.000[d]	420.988	43.891

Group Statistics (Male)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	28	3452.71	-	-	367.337	69.420
	2017	32	3479.94	0.79%	.786[a]	401.023	70.891
Weight	2017	32	3479.94	-	-	401.023	70.891
	2018	26	3331.46	-4.27%	.152[c]	369.230	72.412
Weight	2018	26	3331.46	-	-	369.230	72.412
	2019	27	2981.96	-10.49%	.001[d]	379.318	73.000

*- The number of samples taken in the test. **- Explanation in Table 2. ***- Explanation in Table 2. ****- p<0.05 / explanation in column 2. a was meaningless and no change was observed for males and females in the spring of 2017 (p>0.05). b and d were significant (p<0.05) and weight change was observed for female cats in the spring of 2018 and male and female cats in the spring of 2019. c that in the spring of 2018, weight change was not observed in male cats / it was insignificant (p>0.05).

Summer. The results obtained for female cats in the summer of 2017 compared to 2016 were not significant (P=0.884). But the changes in 2018 compared to 2017 were significant (P=0.000) and 214g of reduction was observed. In 2019, the changes compared to the previous year were significant (P=0.000) and a decrease of 309g was recorded. The results

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showed that the changes for male cats in the summer season of 2017 were not significant (P=0.847). But the changes in 2018 (P<0.050) and 2019 (P>0.007) were significant. Thus, in the summer of 2018 compared to the previous year, a decrease of 194g was observed, and in the summer of 2019 compared to 2018, a decrease of 277g was observed. (Table 6).

Table 6: The results of the Independent-Samples T-test by gender in the summer season and based on the results of the Levene test

Group Statistics (Female)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	84	3284.24	-	-	290.632	31.711
	2017	95	3278.29	0.18%	.884[a]	253.490	26.008
Weight	2017	95	3278.29	-	-	253.490	26.008
	2018	75	3064.47	-6.52%	.000[b]	312.125	36.041
Weight	2018	75	3064.47	-	-	312.125	36.041
	2019	87	2755.56	-10.08%	.000[b]	310.741	33.315

Group Statistics (Male)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	28	3430.89	-	-	323.749	61.183
	2017	28	3413.89	-0.5%	.847[a]	334.470	63.209
Weight	2017	28	3413.89	-	-	334.470	63.209
	2018	26	3219.69	-5.69%	.050[c]	377.084	73.952
Weight	2018	26	3219.69	-	-	377.084	73.952
	2019	28	2942.43	-8.61%	.007[b]	342.584	64.742

*- The number of samples taken in the test. **- Explanation in Table 2. ***- Explanation in Table 2. ****- p<0.05 / Explanation in Table 2. a was meaningless and no change was observed for males and females in the summer of 2017 (p>0.05). b and c were significant (p<=0.05) and weight change was observed for each gender (male and female) in the summer of 2018 and 2019.

Autumn/Fall. The results showed that the weight of female cats did not change significantly in the fall of 2017 (P=0.508). But the changes in autumn 2018 were significant (P=0.000) and 319g of weight loss was observed. Considering the significance of changes in 2019 compared to 2018, 216g of weight loss was observed for female cats (P=0.000). The results were similar for male cats. That is, no significant change was observed for them in the fall of 2017 (P=0.455), but the changes in the fall of 2018 were significant compared to 2017 (P<0.001), and 327g of weight loss was observed. Also, the results for 2019 showed a significant decrease of 203g (P<0.048). (Table 7).

Table 7: The results of the Independent-Samples T-test by gender in the autumn season and based on the results of Levene's test

Group Statistics (Female)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	87	3308.53	-	-	283.874	30.435
	2017	89	3279.99	-.86%	.508[a]	286.567	30.376
Weight	2017	89	3279.99	-	-	286.567	30.376
	2018	85	2961.41	-9.71%	.000[b]	325.165	35.269
Weight	2018	85	2961.41	-	-	325.165	35.269
	2019	86	2744.95	-7.31%	.000[b]	317.616	34.249

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Group Statistics (Male)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2016	29	3492.69	-	-	306.709	56.954
	2017	30	3431.87	-1.74%	.455[a]	314.271	57.378
Weight	2017	30	3431.87	-	-	314.271	57.378
	2018	26	3105.08	-9.52%	.001[b]	361.449	70.886
Weight	2018	26	3105.08	-	-	361.449	70.886
	2019	25	2901.84	-6.55%	.048[b]	355.284	71.057

*- The number of samples taken in the test. **- Explanation in Table 2. ***- Explanation in Table 2. ****- p<0.05 / Explanation in Table 2. a was meaningless and no change was observed for males and females in the fall of 2017 (p>0.05). b was significant (p<0.05) and weight change was observed for each gender (male and female) in the fall of 2018 and 2019.

Winter. The data collected for the winter seasons were also analyzed based on gender. For gender of the female, the data analysis had a significant level only for the winter of 2019 (P=0.000) and 2020 (P=0.000). That is, in the winter of 2019, compared to 2018, female cats lost 387g of weight. Also, the weight loss of female cats for the winter of 2020 was 189g. The results showed that the weight change among the population of male cats was significant only in the winter of 2019 (P=0.000). They were faced with 412g of weight loss in the winter of 2019. (Table 8).

Table 8: The results of the Independent-Samples T-test by gender in the winter season and based on the results of Levene's test

Group Statistics (Female)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2017	88	3311.88	-	-	309.064	32.946
	2018	80	3279.18	-.99%	.503[a]	322.722	36.081
Weight	2018	80	3279.18	-	-	322.722	36.081
	2019	97	2891.85	-11.81%	.000[b]	337.776	34.296
Weight	2019	97	2891.85	-	-	337.776	34.296
	2020	78	2703.23	-6.52%	.000[b]	309.225	35.013

Group Statistics (Male)

	Year	N*	Mean**	Percentage***	p-Value***	Std. Deviation	Std. Error Mean
Weight	2017	28	3465.04	-	-	312.725	59.100
	2018	26	3473.88	0.26%	.914[a]	286.053	56.100
Weight	2018	26	3473.88	-	-	286.053	56.100
	2019	25	3062.28	-11.85%	.000[b]	363.815	72.763
Weight	2019	25	3062.28	-	-	363.815	72.763
	2020	24	2862.83	-6.51%	.056[c]	346.776	70.785

*- The number of samples taken in the test. **- Explanation in Table 2. ***- Explanation in Table 2. ****- p<0.05 / explanation in dol 2. a was meaningless and no change was observed for males and females in the winter of 2018 (p>0.05). b was significant (p<0.05) and weight change was observed for both males and females in the winter of 2019 and for female cats in the winter of 2020. c that in the winter of 2020, no weight change was observed in male cats / it was meaningless (p>0.05).

3.5. Results by locality

In the analysis of the data collected by localities, it was found that in 2017, the weight component of the cats in the region of Ten had a significant change (P<0.041) and was faced

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with a decrease of 80g. Also, the weight change of the cats of the region of Fifteen in 2017 compared to 2016 was significant (P<0.003) and they experienced 161g of weight gain. But the weight change in other regions in 2017 was not significant.

In 2018, the change in the weight of cats in the region of Three (P=0.187), region of Four (P=0.210), region of Fifteen (P=0.619), and region of Nineteen (P=0.126) was not significant. But in the rest of the regions, the change in the weight of cats was significant and was always recorded as a decrease. So that the amount of weight loss observed in the samples of the region of one is 181g (P<0.045), region of Two is 285g (P<0.006), region of Five is 282g (P<0.004), region of Seven is 317g (P=0.000), region of Eight 209g (P<0.004), region of Ten 208g (P=0.000), region of Twelve 253g (P=0.000), region of Fourteen 159g (P<0.001) and finally it was 239g (P<0.002) for the samples observed in the region of Twenty.

The results in 2019 showed that the change in the weight of cats was significant in all regions (except in the region of 12) and cats in all regions faced weight loss. Samples in the region of One with 290g decrease (P<0.002), region of Two with 506g decrease (P=0.000), region of Three with 378g decrease (P=0.000), region of Four with a decrease of 420g (P=0.000), region of Five with a decrease of 466g (P=0.000), region of Seven with a decrease of 315g (P=0.000), region of Eight with a decrease of 390g (P=0.000), in the region of Ten with a decrease of 220g (P=0.000), in the region of Fourteen with a decrease of 272g (P=0.000), in the region of Fifteen with a decrease of 238g (P=0.000), the region of Nineteen faced a decrease of 240g (P<0.018) and in the region of Twenty, a decrease of 186g (P<0.011). In 2019, the change in the weight of cats in the region of Twelve was not significant (P=0.453).

Based on the obtained results, in 2020 only in the region of Four, the change in the weight of cats was significant (P<0.027). The results show that in that year, 313g of the weight of cats in the region of Four had decreased. Weight changes in other regions under study in the winter of 2020 were not significant based on statistical tables and calculations.

4. Discussion

Apart from genetic and biological characteristics, sufficient food is one of the most important reasons for the continued survival and maintaining the health of cats. The results of this study show that the weakness in supplying the calories needed by cats caused them to lose weight, and this phenomenon was caused by the decrease in access to food[70]. The availability of food and its quality can be very effective on the lifespan of cats (domestic, street, or wild)[71]. Öhlund et al believe that nutrition and environmental factors are effective in the occurrence of type 2 diabetes in cats (like humans)[72]. Even Verlinden and colleagues in a research point out that some types of food (protein) are allergenic for 20-30% of cats. They believe that these types of allergies can be diagnosed and treated[73].

One of the ways for cats to access food is through garbage bins[74]. According to the statistics extracted from the Waste Management Organization of Tehran, the amount of waste collected in this city fluctuated from spring 2016 to winter 2020 (Table 1)[69]. In 2017, the amount of waste sent to the Arad Koh site not only did not decrease but increased by 8.9%. Therefore, the weight loss of cats was not significant. But in 2018, a decrease in the amount of waste was observed. This year, 5.6% reduction in the amount of waste was recorded. The results of the statistical analysis were also significant for the weight loss of cats

 doi:10.20944/preprints202206.0430.v3

in 2018, and cats lost an average of 177.82 grams in the same period. This process was repeated in 2019 and the amount of waste decreased by 9.5%. At this time (2019), the average weight loss of cats decreased by 300.82 grams (the decrease was significant). In the winter of 2020, the amount of garbage decreased by 26% compared to the winter of the previous year, and this decrease caused the cats to continue to lose weight. In 2020, the cats lost 114.29g of their weight significantly (Table 2).

To better understand the changes, the research process should be scrutinized. By comparing the seasons point by point, it became clear that the winter of 2018 was a turning point in the amount of waste. The results show that the beginning of the process of reducing the amount of garbage has been recorded since the winter of 2018 and the beginning of the process of reducing the weight of cats since the spring of 2018[69]. From the spring of 2018 onwards, weight loss in cats was always significant. Also, from the winter of 2018 to the end of the research (winter of 2020), the amount of waste was always decreasing. Of course, in the fall of 2018 and the summer of 2019, the amount of garbage collected did not increase much, and the results of the research showed that this increase in the amount of garbage did not have any effect on preventing or compensating for the weight loss of cats (Tables 1, 3).

Also, according to the data obtained in the field phase of the research and comparing them with the amount of garbage collected, it can be understood that the weight loss of female cats started in the spring of 2018 and continued until the end of the research. Although the male cats started to lose weight significantly in the summer of 2018, the changes were meaningless for them in the winter of 2020, and no evidence of weight loss was observed (Tables 1, and 4).

Blottner and Jewgenow said that the change of seasons can even affect the function of the testicles of male cats[75]. Also, researchers believe that the change of seasons can affect the weight of cats[76]. The findings of the research indicate that the weight loss of female cats compared from season to season in 2017 was meaningless. But from 2018 onwards, their weight loss has been significant (Tables 5 to 8). Female cats have always faced significant weight loss in all four seasons (spring, summer, autumn, and winter) of 2018, 2019, and 2020 compared to the same seasons of 2017. But the weight change of male cats in the spring of 2018 compared to the spring of the previous year (Table 5), and the winter of 2020 compared to the winter of 2019 (Table 8) was meaningless. Sergey V. Naidenko and colleagues stated in research that cats may lose up to 30% of their weight in winter[76]. This is while the greatest weight loss from the perspective of point-to-point seasonal comparison occurred in the winter of 2019 for both male and female groups (Table 8).

Financial crises, political events, changes in social conditions, and epidemics of diseases cause the livelihood of citizens to fluctuate[77-81]. These fluctuations are felt in different areas of the city among rich citizens and other citizens[81 ,78]. Also, Orazio P. Attanasio and Luigi Pistaferri believe that consumption is a function of income[82]. In 2017, only in region 10, the weight loss of cats was significant. Cats in other areas of Tehran did not face significant weight changes. Also, in 2017, a significant increase in the weight of cats was observed only in region 15. In 2018, the weight of cats decreased significantly in all the studied areas except for areas 3, 4, 15, and 19. But the four mentioned areas did not have significant changes. In 2019, the weight changes were meaningless only in the 12th region,

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while the significance of weight loss in other regions (all but 12) was proven. The significance of the weight change of cats in the winter of 2020 was observed only in region 4.

5. Conclusions

The weight loss of cats started in the spring of 2018 and continued until the end of the winter of 2020. In 2019, the most severe weight loss was observed. The greatest amount of weight loss occurred in the winter of 2019. Also, the results showed that females and males experienced the greatest weight loss in the winter of 2019. Also, in the winter of 2019, the largest weight loss occurred and the cats lost weight in 12 of the 13 studied points.

Considering that the decrease in the amount of garbage has been reported since the winter of 2018 and also considering that the weight loss of cats started in the spring of 2018, it can be concluded that the direct relationship between the weight of cats and there is an amount of organic waste (access to food). The amount of garbage has always decreased since the winter of 2018, and the average weight of cats has also been decreasing since the spring of 2018 due to the decrease in access to food.

Author Contributions: The author has read and agreed to the published version of the manuscript.

Funding: This research received no external funding. No financial support was received for this research. The budget of this study was 100% provided by the researcher. The price of scales was $146 and the price of canned fish was $87. This research had a total cost of $233, which was provided by the researcher.

Institutional Review Board Statement: In the research stages, the statements of Nuremberg, Helsinki, and Belmont were taken into consideration. Attention was paid to the instruction "ARRIVE" at https://www.equator-network.org/. The Law on Disciplinary Regulations of the Academic Boards of the Universities and Higher Education and Research Institutions of the country was approved on 12/22/1364 by the Islamic Council and approved by the Council of Ministers of the Islamic Republic of Iran No. 31/44350/85729 dated 4/22/1389 it placed. In the process of collecting information and steps related to communication with animals (whether direct or indirect), regulations, instructions, and protocols were carried out. In this research, the weight of cats was measured without trapping, without hunting, without using medicine, and without tagging or separating from the habitat. So, ethical approval was not required.

Data Availability Statement: The data of this research will be available by sending an email to the researcher or MDPI.

Conflicts of Interest: The author declares that there is no conflict of interest.

References

1. Laurentii Salvii.; Linne?, C.v., *Caroli Linnaei...Systema naturae per regna tria naturae ?secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.* Tenth reformed ed. ed. Vol. 1. 1758: Holmiae : Impensis Direct. Laurentii Salvii,.
2. Linnaeus, *Mammal Species of the World (3rd ed.).* A Taxonomic and Geographic Reference, ed. D.E.R. Wilson, D.M (eds.). 1758: Johns Hopkins University Press.
3. Lindahl, J.F. and D. Grace, *The consequences of human actions on risks for infectious diseases: a review.* Infection ecology & epidemiology, 2015. **5**(1): p. 30048.

 doi:10.20944/preprints202206.0430.v3

4. Johnson, W.E. and S.J. O'Brien, *Phylogenetic reconstruction of the felidae using 16S rRNA and NADH-5 mitochondrial genes.* Journal of Molecular Evolution, 1997. **44**(1): p. S98-S116.
5. Johnson, W.E., et al., *The Late Miocene Radiation of Modern Felidae: A Genetic Assessment.* Science, 2006. **311**(5757): p. 73-77.
6. Mattern, M.Y. and D.A. McLennan, *Phylogeny and Speciation of Felids.* Cladistics, 2000. **16**(2): p. 232-253.
7. Nie, W., et al., *The genome phylogeny of domestic cat, red panda and five mustelid species revealed by comparative chromosome painting and G-banding.* Chromosome Research, 2002. **10**(3): p. 209-222.
8. Pontius, J.U., et al., *Initial sequence and comparative analysis of the cat genome.* Genome research, 2007. **17**(11): p. 1675-1689.
9. Driscoll, C.A., et al., *The taming of the cat.* Scientific American, 2009. **300**(6): p. 68.
10. Vigne, J.-D., et al., *Early Taming of the Cat in Cyprus.* Science, 2004. **304**(5668): p. 259-259.
11. Driscoll, C.A., et al., *The Near Eastern Origin of Cat Domestication.* Science, 2007. **317**(5837): p. 519-523.
12. Rochlitz, I., *A review of the housing requirements of domestic cats (Felis silvestris catus) kept in the home.* Applied Animal Behaviour Science, 2005. **93**(1): p. 97-109.
13. Ottoni, C., et al., *The palaeogenetics of cat dispersal in the ancient world.* Nature Ecology & Evolution, 2017. **1**(7): p. 0139.
14. Sunquist, M.E.S., Fiona, *Wild cats of the world*. 2002, Chicago: Chicago : University of Chicago Press. 504.
15. O'Connor, T.P., *Wild or domestic? Biometric variation in the cat Felis silvestris Schreber.* International Journal of Osteoarchaeology, 2007. **17**(6): p. 581-595.
16. Walker, W.F., *A study of the cat, with reference to human beings*, ed. t. edition. 1977, Philadelphia: Saunders College Pub. 244.
17. Zhang, Z., J. Yang, and H. Yu, *Effect of Flexible Back on Energy Absorption during Landing in Cats: A Biomechanical Investigation.* Journal of Bionic Engineering, 2014. **11**(4): p. 506-516.
18. Scott, H., J. Marti, and P. Witte, *Introduction to feline orthopaedic surgery*, in *Feline Orthopaedics*. 2007, CRC Press. p. 1-12.
19. Case, L.P., *The cat: its behavior, nutrition & health*. 2003: Iowa State Press.
20. Kitchener, A., B. Van Valkenburgh, and N. Yamaguchi, *Felid form and function*. 2010. p. 83-106.
21. *The School Journal*. 1900: E.L. Kellogg & Company.
22. DANFORTH, C.H., *HEREDITY OF POLYDACTYLY IN THE CAT.* Journal of Heredity, 1947. **38**(4): p. 107-112.
23. Homberger, D.G., et al., *The structure of the cornified claw sheath in the domesticated cat (Felis catus): implications for the claw-shedding mechanism and the evolution of cornified digital end organs.* Journal of Anatomy, 2009. **214**(4): p. 620-643.
24. Pocock, R.I., *VII.—On the external characters of the Felidæ.* Annals and Magazine of Natural History, 1917. **19**(109): p. 113-136.
25. Christensen, W., *Outwitting cats: tips, tricks, and techniques for persuading the felines in your life that what you want is also what they want*. 2004: Guilford, Conn. : Lyon's Press. 309.
26. Kent, M., S.R. Platt, and S.J. Schatzberg, *The neurology of balance: Function and dysfunction of the vestibular system in dogs and cats.* The Veterinary Journal, 2010. **185**(3): p. 247-258.
27. Wu, X., et al., *Contributions of Limb Joints to Energy Absorption during Landing in Cats.* Applied Bionics and Biomechanics, 2019. **2019**: p. 3815612.
28. Germain, E., S. Benhamou, and M.-L. Poulle, *Spatio-temporal sharing between the European wildcat, the domestic cat and their hybrids.* Journal of Zoology, 2008. **276**(2): p. 195-203.
29. Randall, W., et al., *Circadian rhythms in food intake and activity in domestic cats.* Behavioral neuroscience, 1985. **99**(6): p. 1162.
30. Barratt, D.G., *Home range size, habitat utilisation and movement patterns of suburban and farm cats Felis catus.* Ecography, 1997. **20**(3): p. 271-280.
31. Jouvet, M., *What does a cat dream about?* Trends in Neurosciences, 1979. **2**: p. 280-282.
32. SNYDER, F., *The New Biology of Dreaming.* Archives of General Psychiatry, 1963. **8**(4): p. 381-391.
33. MORRISON, A.A., *Mechanisms underlying oneiric behaviour released in REM sleep by pontine lesions in cats.* Journal of Sleep Research, 1993. **2**(1): p. 4-7.

34. Ollivier, F.J., et al., *Comparative morphology of the tapetum lucidum (among selected species).* Veterinary Ophthalmology, 2004. **7**(1): p. 11-22.
35. Malmström, T. and R.H.H. Kröger, *Pupil shapes and lens optics in the eyes of terrestrial vertebrates.* Journal of Experimental Biology, 2006. **209**(1): p. 18-25.
36. Hammond, P. and G.S.V. Mouat, *The relationship between feline pupil size and luminance.* Experimental Brain Research, 1985. **59**(3): p. 485-490.
37. Loop, M.S. and L.L. Bruce, *Cat Color Vision: The Effect of Stimulus Size.* Science, 1978. **199**(4334): p. 1221-1222.
38. MOULTON, D.G., *Olfaction in Mammals.* American Zoologist, 2015. **7**(3): p. 421-429.
39. Miyazaki, M., et al., *A Major Urinary Protein of the Domestic Cat Regulates the Production of Felinine, a Putative Pheromone Precursor.* Chemistry & Biology, 2006. **13**(10): p. 1071-1079.
40. Sommerville, B.A. and D.M. Broom, *Olfactory awareness.* Applied Animal Behaviour Science, 1998. **57**(3): p. 269-286.
41. Wesson, D.W. and D.A. Wilson, *Sniffing out the contributions of the olfactory tubercle to the sense of smell: Hedonics, sensory integration, and more?* Neuroscience & Biobehavioral Reviews, 2011. **35**(3): p. 655-668.
42. Rodan, I., *Understanding Feline Behavior and Application for Appropriate Handling and Management.* Topics in Companion Animal Medicine, 2010. **25**(4): p. 178-188.
43. Pekel, A.Y., S.B. Mülazımoğlu, and N. Acar, *Taste preferences and diet palatability in cats.* Journal of Applied Animal Research, 2020. **48**(1): p. 281-292.
44. Bradshaw, J.W.S., *The Evolutionary Basis for the Feeding Behavior of Domestic Dogs (Canis familiaris) and Cats (Felis catus).* The Journal of Nutrition, 2006. **136**(7): p. 1927S-1931S.
45. Morelli, G., D. Stefanutti, and R. Ricci, *A Survey among Dog and Cat Owners on Pet Food Storage and Preservation in the Households.* Animals, 2021. **11**(2): p. 273.
46. Serisier, S., et al., *Seasonal Variation in the Voluntary Food Intake of Domesticated Cats (Felis Catus).* PLOS ONE, 2014. **9**(4): p. e96071.
47. Heffner, H.E., *Auditory awareness.* Applied Animal Behaviour Science, 1998. **57**(3): p. 259-268.
48. Heffner, R.S. and H.E. Heffner, *Hearing range of the domestic cat.* Hearing Research, 1985. **19**(1): p. 85-88.
49. Heffner, R.S., *Primate hearing from a mammalian perspective.* The Anatomical Record Part A: Discoveries in Molecular, Cellular, and Evolutionary Biology, 2004. **281A**(1): p. 1111-1122.
50. Marioni-Henry, K., et al., *Prevalence of diseases of the spinal cord of cats.* Journal of Veterinary Internal Medicine, 2004. **18**(6): p. 851-858.
51. Halliwell, R., *Skin diseases of old dogs and cats.* The Veterinary Record, 1990. **126**(16): p. 389-394.
52. Sewell, A.C., M.E. Haskins, and U. Giger, *Inherited metabolic disease in companion animals: Searching for nature's mistakes.* The Veterinary Journal, 2007. **174**(2): p. 252-259.
53. Stephen J. O'Brien, et al., *The Feline Genome Project.* Annual Review of Genetics, 2002. **36**(1): p. 657-686.
54. O'Brien, S.J., et al., *State of cat genomics.* Trends in genetics, 2008. **24**(6): p. 268-279.
55. Goldstein, E.J. and F.M. Abrahamian, *Diseases transmitted by cats.* Infections of Leisure, 2016: p. 133-150.
56. Catling, P.C., *Similarities and contrasts in the diets of foxes, Vulpes vulpes, and cats, Felis catus, relative to fluctuating prey populations and drought.* Wildlife Research, 1988. **15**(3): p. 307-317.
57. Pitcairn, R.H. and S.H. Pitcairn, *Dr. Pitcairn's complete guide to natural health for dogs & cats*. 2017: Rodale.
58. Andrew Knight , L.S., *Vegan versus meat-based pet foods: Owner-reported palatability behaviours and implications for canine and feline welfare.* PLOS ONE, 2021. **16**(11).
59. McKinney, M.L., *Effects of urbanization on species richness: a review of plants and animals.* Urban ecosystems, 2008. **11**(2): p. 161-176.
60. Dammhahn, M., et al., *Of city and village mice: behavioural adjustments of striped field mice to urban environments.* Scientific Reports, 2020. **10**(1): p. 13056.

61. Bradley, C.A. and S. Altizer, *Urbanization and the ecology of wildlife diseases.* Trends in ecology & evolution, 2007. **22**(2): p. 95-102.
62. Cohen, B., *Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability.* Technology in Society, 2006. **28**(1): p. 63-80.
63. Magazzino, C. and P.M. Falcone, *Assessing the relationship among waste generation, wealth, and GHG emissions in Switzerland: Some policy proposals for the optimization of the municipal solid waste in a circular economy perspective.* Journal of Cleaner Production, 2022. **351**: p. 131555.
64. Diao, X.D., et al., *EKC analysis for studying economic growth and environmental quality: a case study in China.* Journal of Cleaner Production, 2009. **17**(5): p. 541-548.
65. Xue, L., et al., *China's food loss and waste embodies increasing environmental impacts.* Nature Food, 2021. **2**(7): p. 519-528.
66. Porter, R.C., *The economics of waste*. 2010: Routledge.
67. Schneider, F., *Review of food waste prevention on an international level.* Proceedings of the Institution of Civil Engineers - Waste and Resource Management, 2013. **166**(4): p. 187-203.
68. Verbrugghe, A. and M. Hesta, *Cats and carbohydrates: the carnivore fantasy?* Veterinary sciences, 2017. **4**(4): p. 55.
69. Organization, W.M., *Average daily waste received in Arad Koh processing units (tons per day)*. 2020, Waste Management Organization: Tehran.
70. Keller, E., et al., *Use of reduced-energy content maintenance diets for modest weight reduction in overweight cats and dogs.* Research in Veterinary Science, 2020. **131**: p. 194-205.
71. Laflamme, D.P., *Nutrition for aging cats and dogs and the importance of body condition.* Veterinary Clinics: Small Animal Practice, 2005. **35**(3): p. 713-742.
72. Öhlund, M., et al., *Environmental Risk Factors for Diabetes Mellitus in Cats.* Journal of Veterinary Internal Medicine, 2017. **31**(1): p. 29-35.
73. Verlinden, A., et al., *Food Allergy in Dogs and Cats: A Review.* Critical Reviews in Food Science and Nutrition, 2006. **46**(3): p. 259-273.
74. Yamane, A., J. Emoto, and N. Ota, *Factors affecting feeding order and social tolerance to kittens in the group-living feral cat (Felis catus).* Applied Animal Behaviour Science, 1997. **52**(1): p. 119-127.
75. Blottner, S. and K. Jewgenow, *Moderate Seasonality in Testis Function of Domestic Cat.* Reproduction in Domestic Animals, 2007. **42**(5): p. 536-540.
76. Naidenko, S.V., E.V. Pavlova, and V.E. Kirilyuk, *DETECTION OF SEASONAL WEIGHT LOSS AND A SEROLOGIC SURVEY OF POTENTIAL PATHOGENS IN WILD PALLAS' CATS (FELIS [OTOCOLOBUS] MANUL) OF THE DAURIAN STEPPE, RUSSIA.* Journal of Wildlife Diseases, 2014. **50**(2): p. 188-194.
77. Kansiime, M.K., et al., *COVID-19 implications on household income and food security in Kenya and Uganda: Findings from a rapid assessment.* World Development, 2021. **137**: p. 105199.
78. Mandal, S.C., et al., *The impact of the COVID-19 pandemic on fish consumption and household food security in Dhaka city, Bangladesh.* Global Food Security, 2021. **29**: p. 100526.
79. Organization, W.H., *The state of food security and nutrition in the world 2019: safeguarding against economic slowdowns and downturns*. Vol. 2019. 2019: Food & Agriculture Org.
80. Aloosh, M., A. Salavati, and A. Aloosh, *Economic sanctions threaten population health: the case of Iran.* Public Health, 2019. **169**: p. 10-13.
81. Afesorgbor, S.K. and R. Mahadevan, *The Impact of Economic Sanctions on Income Inequality of Target States.* World Development, 2016. **83**: p. 1-11.
82. Attanasio, O.P. and L. Pistaferri, *Consumption Inequality*. Journal of Economic Perspectives, 2016. **30**(2): p. 3-28.