

scientific release

ENSURING RELIABLE PALATABILITY MEASUREMENT

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科学发布

确保可靠的适口性测定

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Palatability is a critical attribute that could transform a petfood product launch from top... to flop! That's why petfood manufacturers truly need to have a specific and objective evaluation of their products' palatability. When conducted properly, palatability testing is a useful scientific and marketing tool they can rely on to make strategic decisions related to product development, formula optimization and positioning versus competition.

适口性是一个关键属性。它能够推动宠物食品继续飞跃！这就是宠物食品生产商为何确实需要对它们的产品进行具体和客观的评价。如果步骤得当，适口性测试是一个有用的科学和营销工具。依靠这种工具可以作出与产品的开发、配方的优化、定位与竞争有关的战略决策。

Two-bowl testing and monadic feeding are the main palatability measurement methodologies commonly used by pet food manufacturers. While these methodologies are quite different, they both provide valuable information when using specific and controlled parameters to ensure maximum testing reliability. For instance, environmental control and stability, combined with the protocol's accuracy, are indispensable in attaining consistent palatability results. However, even with the best

management of these critical points, some biases can occur when working with animal panels. These biases, that can appear both in in-home and expert panels, can significantly distort test results.

双碗测试 (Two-bowl testing) 和一元饲喂 (monadic feeding) 是宠物食品制造商普遍使用的适口性测定的主要方法。虽然这些方法有很大的不同，但使用特定的和控制的参数最大程度地确保测试的可靠性时，它们能够提供有价值的信息。例如，环境控制、稳定性结合程序的准确度在实现一致的适口性结果方面是不可缺少的。然而，即使采用这些关键点的最佳管理，使用动物实验时仍然会出现一些偏差。这些偏差会出现在家庭或专家小组中，会显著地影响测试结果。

One of the responsibilities of palatability measurement experts and animal behaviorists is to continuously define preventive and corrective actions to guarantee reliable answers. Panelis has very significant experience in the two-bowl testing methodology and has recently expanded its expertise to the monadic feeding methods. Thanks to this strong know-how in palatability measurement, Panelis

适口性测定的专家和动物行为学家的责任之一是不断对预防和纠正措施进行定义以确保有可靠的答案。Panelis 在双碗检测方法中具有丰富的经验，最近已被应用到了一元饲喂方法

中。这归功于这种强大的适口性测定方法——Panelis。

A large panel size

The fewer animals in a panel, the higher the risk of unreliability! Results of two-bowl palatability tests are usually analyzed using Student test. However, literature about statistical analysis states that this type of parametric test can only be used when mean distribution is normal. In order to obtain a mean's normal distribution, expert statisticians recommend always working with a minimum population of 30.

较大的一个实验组

一组实验中，动物越少，不可靠的风险就越高！双碗适口性检测试验的结果通常用于学生测试的分析。然而，有关统计分析文献指出，这种类型的参数测试只能用于平均分布是正常的组别。为了得到平均的正态分布，统计专家经常建议最小数应为 30。

In the particular case of palatability testing where individual variability is significant, data generally show bimodal distribution. Figure 1 confirms that for this type of data, normal hypothesis is verified when the sample size is above 30.

在适口性试验的具体情况下，个体差异是显著，数据一般显示双峰分布。图 1 证实了这种类型的数据，当样本大小在 30 以上的时候，正常的假设被验证。

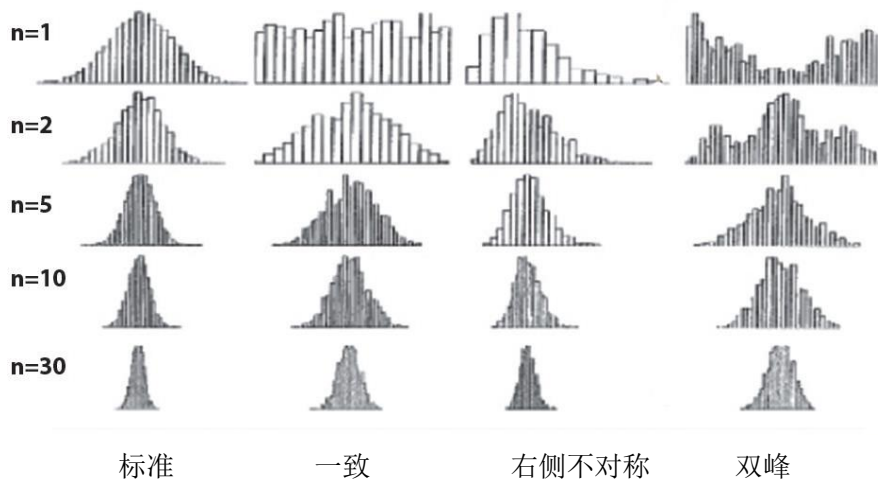


Figure 1: Impact of sample size (n) on distribution

图 1：样品大小对分布的影响

(Source : Pagès J. (2005), Statistiques générales pour utilisateurs – tome 1, méthodologie)

Panelis systematically conducts its palatability tests with 36 dogs or 40 cats. In order to confirm panel size's impact, the results of 3 two-bowl tests conducted with 36 dogs during two days, and 3 two-bowl tests conducted with 40 cats during two days were statistically re-analysed considering only 20 individual animals randomly selected from the initial full panel.

Panelis 使用 36 条狗或 40 只猫系统性地开展适口性试验。为了确定实验组规模的影响，两天内使用 36 条狗进行了三次双碗测试，两天内使用 40 只猫进行了三次双碗测试。考虑到只有 20 只动物从最初的全组中随机选定，这些测试结果进行了统计学的重新分析。

3 categories of tests were chosen for statistical analysis:

- Tests A = B:

same kibbles - no significant difference (NS) expected

- Tests $A > B$:

same kibbles with different palatability enhancer

dosages or nature - significant difference (S) expected

- Tests $A \gg B$:

coated kibble versus uncoated kibble – highly

significant (HS) to very highly significant (VHS) difference expected

选择 3 类测试用于统计分析:

- 测试 $A = B$:

相同的粗粮 --无显著差异 (NS) 预期

- 测试 $A > B$:

相同的粗粮使用不同的口味增强剂

剂量或天然--显著差异 (S) 预期

- 试验 $A \gg B$:

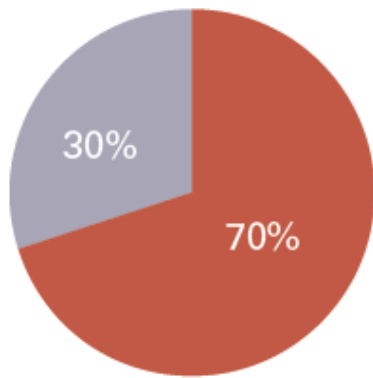
喷涂粗粮与未喷涂粗粮 - 高显著 (HS) 到非常显著 (VHS) 差异预期

For each type of test, 10 000 random samples of 20 individual animals were used to evaluate the answers that would have been obtained with smaller sample. For both cats and dogs, in more than 98 % of cases, the results obtained for $A = B$ and $A \gg B$ trials on small samples were equivalent to those obtained on larger samples.

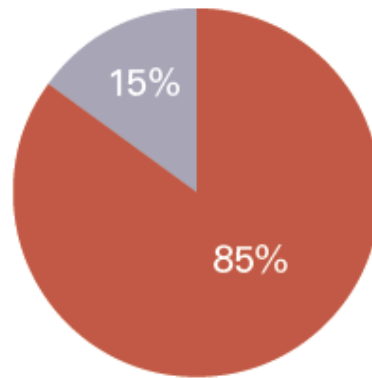
对于每种类型的测试, 有 20 个动物的 1000 个随机样品用于评估结果。这些答案已经从较小的样本中获得。对猫和狗而言, 超过 98% 的例子中, 较小样本的 $A = B$ 和 $A \gg B$ 实验所获得的结果跟大样本中所获得的结果等同。

For $A > B$ trials, 30 % of the simulations with 20 cats led to non significant differences between A and B, while the difference was significant with 40 cats. For dogs, the same discrepancy was observed although less pronounced: 15 % of the simulations with 20 dogs showed non significant differences between A and B, where the result with 40 dogs was significant (figure 2).

为 $A > B$ 试验中, 使用 20 只猫的模拟实验, 30% 的实验结果是 A 和 B 之间无显著差异。而使用 40 只猫, 结果则是显著差异。对狗而言, 也观察到了相同的差异, 但较不明显。使用 20 条狗的模拟实验, 15% 的实验结果是 A 和 B 之间无显著差异。而使用 40 条狗, 结果则具有显著差异 (图 2)。



A 产品跟 B 产品之间检测出明显差异



A 产品跟 B 产品之间未检测出明显差异

Figure 2: Percentage of test results showing significant or non significant difference between A and B when running simulations with n = 20 animals.

Expected result is a significant difference between A and B (A>B).

图 2: 检测结果的比例显示出 A 产品和 B 产品之间显著或无显著差异, 模拟实验使用的动物数量 n = 20

A 和 B(A>B) 之间的差异的期望结果

These results confirmed the need to work with the highest number of pets to get an accurate palatability measurement, especially when difference between products is small. This panel-size effect is observed in both two-bowl and monadic feeding methodologies and is even stronger for trials performed with in-home panels due to the owner's interaction with animal and other environmental effects.

这些结果证实有必要使用最高数量的宠物来进行精确的适口性测定, 特别是产品间差异小的时候。双碗和一元饲喂方法中都观察到了这种实验组的规模效应。这种效应在家庭里进行试验时更为强烈, 因为宠物主人会与动物互动, 还有其它环境效应。

According to Panelis' experience, palatability tests conducted in expert panels should include a minimum of 30 individual animals while palatability tests conducted in home should include around 100 animals to avoid biases.

据 Panelis 的经验, 在专家小组进行适口性试验应至少包括 30 只动物, 而家庭里进行的适口性试验应包括约 100 只动物以避免偏差。

The more pets, the better!

- Expert panels: 30 individuals minimum
- In home panels: 100 individuals minimum
- Individual variability counts: when assessing palatability difference between 2 products, 2-day testing with 40 pets is much more powerful and representative than 4-day testing with 20 pets!

宠物越多越好！

- 专家小组：最低 30
- 家庭小组：最低 100
- 个体差异数：两种产品之间评估适口性差异，40 只宠物测试 2 天要比 20 只宠物测试 4 天的数据更有力、更具代表性。

A representative population

Pet food market segmentation according to size and breed is a global and lasting trend, especially in dog food.

代表性群体

宠物食品根据大小和品种市场细分是一个全球性的和持久的趋势，尤其是狗粮。

With 600 cats and 250 dogs worldwide representing more than 60 breeds, Panelis is a unique expert “collection” of pet food’s final consumers. Conscious of the importance of preparing well balanced dog-panels in terms of size category, Panelis created panels that are most representative of targeted populations.

Panelis 使用世界各地代表 60 多个品种的 600 只猫和 250 条狗，是“搜集”宠物食品最终消费者的独特专家。考虑到在规模种类方面准备均衡的狗分组的重要性，Panelis 创建的小组最能代表目标群体。

In particular, toy dogs have recently been introduced into Panelis’ existing multibreed dog-panels in order to follow the growing importance of the small dogs segment in pet food market. Small and toy breeds are known as fussy dogs. This may be partly explained by their living environment and their “education”, however, even in expert panels, they express specific feeding behaviors.

特别是，玩具犬最近被引入 Panelis 现有的多品种狗分组中，以满足宠物食品市场小型犬的市场日益增长的重要性。小型犬和玩具犬被认为是挑剔的狗。这其中的部分原因是它们的生活环境，它们所受到的“教育”。不过，即使在专家组中，它们仍然表现出来特别的采食行为。

In order to objectively evaluate this difference in feeding behavior, Panelis decided to analyse the results of 1 329 twobowl tests conducted between January and June 2012 in its multibreed dog panels. Results of the study are presented in figure 3.

为了客观地评价采食行为的这种差异，Panelis 决定分析 2012 年 1 月到 6 月期间，多品种狗小组中进行的 1329 次双碗测试的结果。研究结果见图 3。

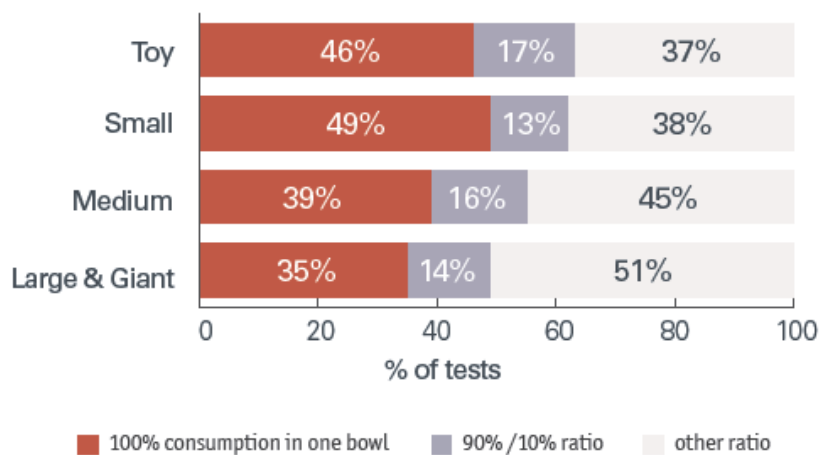


Figure 3: Distribution of high ratios according to dog size

Panelis data - 1329 Tests January-June 2012

图 3: 根据狗的大小的分布比例

Panelis 数据-2012 年 1 月至 6 月的 1329 次测试

Results showed that small and toy dogs make more marked choices compared to bigger dogs; when they prefer a product, they tend to show higher ratio scores. In this study, around 63 % of toy and small dogs' consumption ratio was between 90/10 and 100/0 (1 bowl) while it was 55 % for medium and 49 % for large and giant dogs' ones.

结果表明，与大狗相比，小型犬和玩具犬做出更多明显的选择。当它们喜欢一个产品，它们会表现出更高比率的分數。在这项研究中，63%的玩具犬和小型犬的消费比在 90/10 和 100/0 (1 碗) 之间。中型犬为 55%，而大犬和巨型犬为 49%。

However, it is important to note that no specific preference according to size was identified during this study; the only difference according to size was the degree of discrimination.

不过，需要注意的是，这项研究中，根据规模大小，无法确定具体的偏好。根据大小，唯一的差异是一定程度的歧视。

- Small and toy dogs make more discriminate food choices
- Unbalanced panels in terms of dog-size categories can lead to misinterpretation depending on the targeted population
- Panel's population should be as varied as possible to be representative: males/females, intact/neutered pets, pure breed/mixed breeds...
- 小型和玩具犬对食物选择有更多的歧视
- 按狗的大小进行的分类中，不平衡的实验组会导致因目标群原因引起的误解
- 实验组的动物应尽可能多样化，尽可能具有代表性：公/母，完整/绝育，纯种/混合品种...

Dietary past

When facing a new food, dogs and cats express a more neophilic behavior than a neophobic one; they often prefer novelty, at least as a first spontaneous reaction. Some cats may even show a clear preference for change or variation from familiar food: this phenomenon is called metaphilia.

Preferences are rarely definitively fixed and behavior can evolve depending on feeding experiences:

过去的日粮

面对一种新的食物，狗和猫会表现出对新鲜事物更喜欢的偏好。它们通常喜欢新事物，至少是一种自发反应。有些猫甚至会表现出对从熟悉的食品改变或变化为新的食品表现出明显的偏好。这种现象称为 *metaphilia*。偏好很少能够明确固定，行为也可以根据饲养经历而演变。

- Preference can be reinforced by a long exposition to the product (habituation) (Bradshaw et al., 2000)
- Some animals develop weariness towards the usual diet, inducing palatability decrease (O'Malley, 1998)
- Other animals continue to show a stable preference for the usual diet (Bradshaw, 2000, Larose, 2004)
- 偏好可以由长期暴露于一种产品（习惯化）来加强（Bradshaw et al., 2000）
- 有些动物会对平时的日粮产生厌食，诱发适口性下降（O'Malley, 1998）
- 其它动物会对平时的日粮继续显示出稳定的偏好（Bradshaw, 2000, Larose, 2004）

Panelis in partnership with SPF has conducted several studies to evaluate the impact of dietary past on animal feeding preferences. In 2004, they pointed out that strong food habits play an important role in animals' choice (Larose, 2004). In 2010, a new study confirmed the impact of pre and postnatal olfactory-gustatory exposure via maternal ingestion on kittens (Becques et al., 2010).

Panelis 与 SPF 曾多次合作进行研究以评估过去的日粮对动物饲喂喜好的影响。2004 年，他们指出，强烈的食物爱好在动物的选择中发挥重要作用(Larose, 2004)。2010 年，一项新研究证实了产前和产后嗅觉味觉暴露通过母体的摄入对小猫的影响 (Becques et al., 2010)。

In 2012 Panelis and SPF assessed the link between cat's level of exposure to a product variable and its individual preference for this variable (Forges et al., 2012). An extensive statistical analysis was made on 350 000 data collected by Panelis during 28 months of tests conducted on 8 panels of 40 cats. Product variables studied include mainly kibble, fat and palatability enhancer characteristics. Figure 4 shows an example of results obtained during this study.

在 2012 年，Panelis 和 SPF 评估了猫对一种产品变化的暴露的水平跟个体对这种变化的偏好之间的联系 (Forges et al., 2012)。一项广泛的统计分析根据 35 万个搜集到的数据进行。这项由 Panelis 进行的研究进行了 28 个月，测试以 40 只小猫为一组，共进行了 8 组测试。研究的产品差异包括了主要的粗粮、脂肪和适口性增强剂的特性。图 4 显示了本研究中获得的结果的一个例子。

evolution of cat preferences 小猫喜好的演化

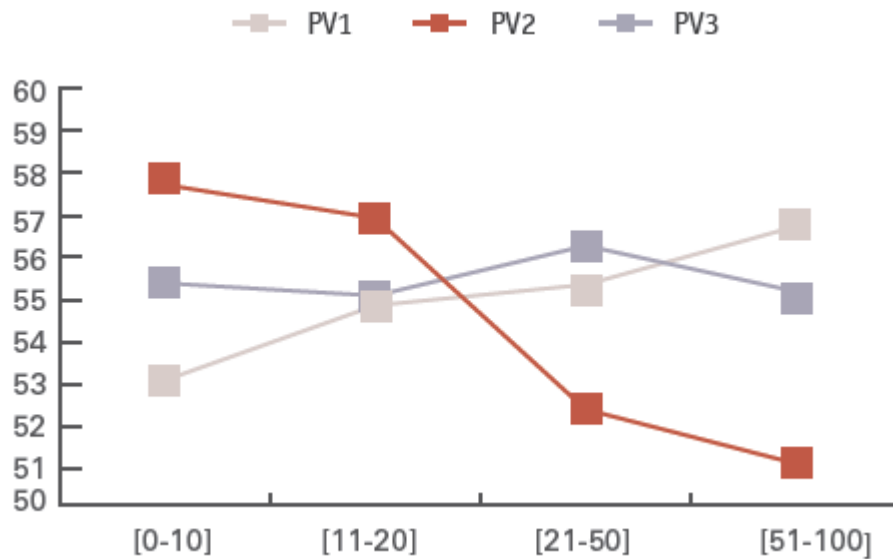


Figure 4: Individual preference evolution in cats according to their exposition degree to 3 product variables

图 4: 根据对三种产品变量的暴露程度, 猫的个体偏好

In the above example:

- Preference for product variable 1 (PV1) increased through repeated exposure
- Preference for product variable 2 (PV2) decreased through repeated exposure

Product variable 3 (PV3) was preferred from the first exposure and remains stable throughout time
 在上面的例子:

- 偏好的产品变量 1 (PV1) 通过反复暴露增加了
 - 偏好的产品变量 2 (PV2) 通过反复暴露下降了
- 产品变量 3 (PV3) 在首次暴露时就受到了偏爱, 在整个时间段保持稳定

This study pointed out how complex the development of feeding preferences can be. It confirmed that cats' preferences evolve in relation with their feeding experience and that some precautionary measures need to be taken to limit panels' answer bias induced by feeding past.

这项研究指出了饲喂的喜好的发展是多么复杂。据证实, 猫的偏好的发展跟它们的饲喂经历有关。需要采取一些预防措施来限制由过去的饲喂诱导产生的实验组的答案偏差。

- Recruit pets as young as possible and feed them a high diversity of foods = food training
- Perform tests on at least 2 meals for strategic decisions
- Follow-up on quality indicators such as pets' results on qualification trials and on tests performed in external panels for comparison, levels of repeatability...
- Schedule product tests series on different panels
- Regularly reorganize panels by combining sub-groups differently ("standardization")

- 饲养的宠物越年轻越好, 给它们喂多样性的食物=食品培训
- 至少对 2 餐进行测试以便战略决策

- 跟踪质量的指标，如宠物在质量实验上的结果，用于比较的外部实验组进行的测试，可重复性水平
- 对不同的组安排一系列产品测试
- 通过合并不同的亚群组定期重组实验组(“规范化”)

Bowl position eaters bias

During a versus palatability trial, dogs and cats are offered the choice between two products in two bowls. Whatever the products tested, some pets systematically eat from the right or left-hand bowl. They are called “position eater”.

碗的位置食客偏差

在一次适口性试验中，在两碗中提供两种产品供猫和狗选择。无论测试的是何种产品，一些宠物会系统性地吃右边或左边的碗里的食物。它们被称为“位置食客（position eater）”。

Different scientific studies showed that dogs and cats as other species can be lateralized (Pike & Maitland, 1997). In dogs, Wells’ findings revealed that lateralized behavior was highly gender-related (Wells, 2003). Wells established the same link in cats and also pointed out a possible relationship between lateralized behavior and task complexity (Wells and Millsopp, 2009). This lateralized behavior has been examined as a manifestation of cerebral functional asymmetry.

不同的科学研究表明，狗和猫及其它动物可以被偏侧化（Pike & Maitland, 1997）。在狗中，Wells 的调查显示，偏侧行为与性别高度相关（Wells, 2003）。Wells 在猫中建立了相同的联系，也指出了偏侧行为和任务的复杂性可能的关系(Wells and Millsopp, 2009)。这种偏侧行为被认为是脑功能不对称性的表现。

No literature can be found on position eaters in palatability testing centers. However, behavior observed during palatability testing is probably not linked to cerebral functions but might be attributed to several other factors such as the degree of difference between the compared products, product’s nature, test system, type of protocol, health pattern, etc. Since this bias can strongly affect palatability results coming from two-bowl testing, it is important to clearly identify the “true side position eaters” within panels. These “critical” pets, more often cats than dogs, are the ones showing persistent bowl-side bias regardless of the products tested or the environmental conditions.

没有文献发现适口性测试中存在位置食客。但是，适口性测试中观察到的行为可能与脑功能并没有联系。其可能与其它一些因素有关，如供比较产品的差异程度、产品的性质、测试系统、程序类型、健康图案等。由于这种偏差强烈影响到源自双碗测试的适口性结果，很重要地是清楚地明确实验组内“真正的边缘位置食客”。无论测试产品或环境条件是什么，这些“关键”宠物（通常猫比狗更常见），显示出长期的碗侧偏差。

In order to identify critical cats and dogs within a population, Panelis has set up a specific indicator: the Lateralization Index (IL). Calculated every three months, this index considers the frequency of meals during which a significantly higher intake is observed on one side. Panelis then defined acceptability margins based on knowledge of its pets’ usual feeding behavior (intake levels, reaction to minor palatability differences...) in order to exclude the critical pets’ answers from the data analysis.

为了在群体中找出关键的猫、狗，Panelis 已建立了一个具体的指标：偏侧指数（IL）。每三个月计算，该指数考虑在一侧观察到明显较高的摄入量的那顿饭出现的频率。然后，Panelis 根据宠物通常采食行为（摄入量，对轻微适口性差异的反应）知识来确定可接受的边际值，以便排除源自数据分析的关键宠物的答案。

Several good practices can be followed to avoid bowl position eaters bias. In addition to defining a relevant lateralization index, the regular renewal of pets in panels is an essential preventive action to limit the impact of true side position eaters on palatability results.

可以遵循一些好的做法以避免碗的位置食客的偏差。除了定义相关的偏侧指数，在实验组内定期更新宠物也是一个重要的预防措施以便限制真正的侧位置食客对适口性结果的影响。

- Identify true side position eaters by setting and following a Lateralization Index
- Exclude true side position eaters only
- Renew panels regularly (at least 10 % of the panel/year)
- 通过设置和遵循偏侧指数来确定真正的侧位置食客。
- 仅排除真正的侧位置食客
- 定期更新实验组（一年至少更新实验组的 10%）

Consumption variability

Consumption variability has been observed in both Panelis and other dog panels worldwide. Panelis researchers have clearly noted that consumption variability was sometimes stronger due to parameters such as:

消费差异

在 Panelis 和世界其它狗实验组中已观察到消费差异。Panelis 研究人员已明确指出，由于以下参数，消费的差异有时非常强烈：

- Meal time: morning meals showing lower intake levels than afternoon meals
- Season: lower intake ratios in the summertime, possibly linked with temperature, photoperiod or metabolism regulation
- 进餐时间：早上采食的摄入水平要比下午低
- 季节：夏季摄入量的比例较低，可能与温度、光照或代谢调控有关

Figure 5 illustrates food intake variation observed in Panelis dog panels according to the meal time and the season. The consumption of three dog panels on a three years period were monitored and analysed.

图 5 显示了根据进餐时间和季节，Panelis 狗小组中所观察到的采食量差异。三个狗小组在三年时间内的采食进行监测并分析。

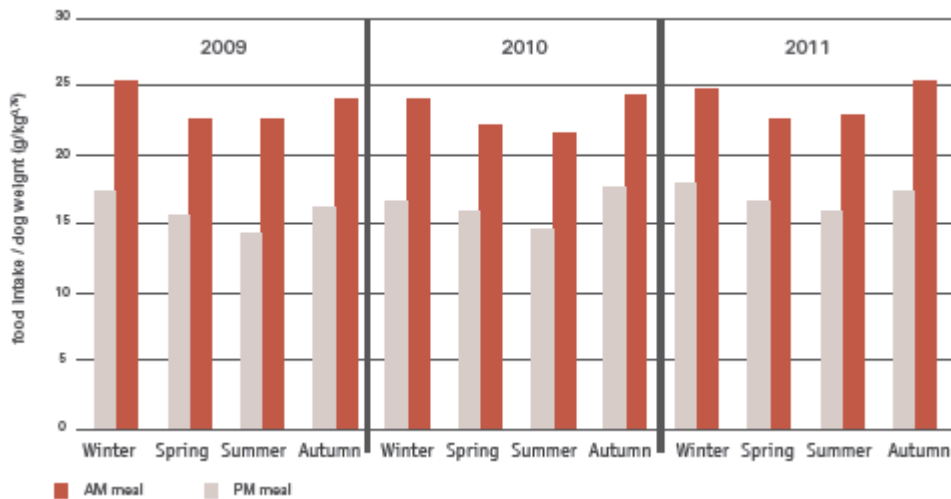


Figure 5: Dog feed intake variation according to meal time and season

(Panelis data)

图 5 在进餐时间和季节方面，狗采食的差异

(Panelis data 数据)

These results also explain why it may sometimes be more difficult to get accurate conclusions with monadic feeding trials than with two-bowl tests. Indeed in versus tests, pets are asked to make a choice between two products offered simultaneously, and the preference does not depend on the total intake. For that reason, Panelis has developed a specific method for its Liking test, taking into account all the possible biases and leading to a reliable single bowl test.

这些结果也解释了为了获得精确的结论为何有时使用一元饲喂实验要比双碗测试更为困难。事实上，在相对的测试中，宠物被要求在同时提供的两种产品做出选择，偏好并不是取决于总的摄入量。出于这个原因，Panelis 开发了一种具体的方法用于喜好测试。这种测试考虑到了所有可能的偏差，是一种可信赖的单碗测试。

Preventive actions to counterbalance consumption variability:

- The more pets the better... again!
- Repeat test on at least 2 meals

预防措施以抵消消费差异

- 越多的宠物越好.....又来了!
- 至少 2 餐的重复测试

Well-being

Last but not least, Panelis has always been strongly committed to pets' well-being within expert testing centers, from first an ethical point of view, but also from a scientific one. Indeed, no reliable information can be expected if animals are stressed. Representative answers can only be obtained with healthy, happy and unstressed pets.

福利

最后一点也很重要，Panelis 在专家测试中心一直坚定地致力于宠物的福祉，不但是从伦理道德角度，这也是一个科学的问题。事实上，如果动物受到应激，并不能预期有可信赖的信息。代表性结果只能从健康、快乐和无应激的宠物中获得。

In “Pets’ Resort by Panelis®”, cats and dogs enjoy living conditions modelled after real-life home environment. They are actively stimulated and socialized through varied activities such as education, grooming, running and also canine and feline shows with skilled and devoted animal technicians.

在 Panelis®的宠物度假村，猫狗享受的条件模拟了家庭环境。它们通过各种活动如教育、疏导、跑步等受到了积极地刺激和社会化。狗和猫也能够表现出是受到了有技术、乐于奉献的动物技术人员的照顾。

Representative and reliable answers can only be obtained with healthy, happy and unstressed pets!

代表性和可靠的答案只能从健康、快乐和无应激的宠物中获得！

Conclusion: Building excellence in palatability measurement

结论：适口性测定建立卓越

The risk of generating false conclusions from palatability trials exists due to biases that can appear if protocols and panels are not properly controlled. However, various solutions exist to minimize this risk of unreliability.

由于如果程序和实验组控制不当，会存在适口性实验因偏差产生错误结论的风险。当然，有各种不同的解决方案来最小化这种不可靠性的风险。

Panelis continuously develops its expertise and understanding of dog and cat feeding behaviors by implementing additional methods such as monadic trials (Liking test), shorter screening trials, and video observations. The combination of all these complementary methods provides us with a deeper understanding of biases and their possible control and allows us to measure new “petcentric” criteria reflecting behaviors identified as meaningful for the pet owners. Panelis expert panels are now measuring pet foods’ palatability not only with intake ratios, but also with innovative criteria identified at home to be significant signs of pets’ satisfaction.

Panelis 通过实施其它方法，例如一元试验（喜好测试），较短的筛选试验和视频观察，不断提升专业技术水平，增强对犬猫采食行为的理解。这些互补性的方法结合在一起给我们提供了对偏差更深的理解以及它们可能的控制措施。也使得我们能够测定新的“宠物中心（petcentric）”标准。这些标准反映的是宠物主人认为有意义的行为。现在 Panelis 专家小组正在测定宠物食品的适口性。这种适口性不仅是摄入量的比例，而是一种创新性的标准，这种标准在家里被认为是宠物满意度的重要表现。

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