

# Poultry farmers' preferences and use of poultry beddings in Austria and Germany

Präferenzen von Geflügelhaltern und Geflügelhalterinnen bei der Nutzung von Geflügeleinstreu in Österreich und Deutschland

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Received: 15 December 2017 – Revised: 5 July 2018 – Accepted: 6 July 2018 – Published: 12 December 2018

## Summary

This study analyzes the preferences of Austrian and German poultry farmers towards several bedding types. Using a web-based analytic hierarchy process survey (AHP) as market research instrument with the five assessment criteria – water holding capacity, drying rate, ammonia content in air, workload and price – we received responses from 281 poultry farmers. The results indicate that chopped straw is used the most, followed by wood shavings and straw granulate/pellets. In contrast, according to the AHP, straw granulate/pellets are the most preferred bedding. The assessment criteria water holding capacity and drying rate explain the highest preference contribution towards straw granulate/pellets.

**Keywords:** analytic hierarchy process, litter, poultry farming, preference measurement

## Zusammenfassung

Der folgende Beitrag behandelt die Präferenzen österreichischer und deutscher Geflügelhalter und Geflügelhalterinnen gegenüber verschiedenen Einstreumaterialien mithilfe einer Onlineumfrage. Dazu wurde das Marktforschungsinstrument des analytischen Hierarchieprozesses (AHP) mit fünf Bewertungskriterien – Wasseraufnahmevermögen, Abtrocknungsgeschwindigkeit, Ammoniakbelastung in der Luft, Arbeitszeitaufwand und Preis – angewandt. 281 Geflügelhalter und -halterinnen nahmen an der Onlineumfrage teil. Die Ergebnisse zeigen, dass Strohhäcksel das meist verwendete Einstreumaterial ist, gefolgt von Hobelspänen und Strohgranulat/-Pellets. Im Vergleich dazu ist nach dem AHP Strohgranulat/-Pellets das bevorzugte Einstreumaterial. Die Bewertungskriterien Wasseraufnahmevermögen und Abtrocknungsgeschwindigkeit erklären den größten Präferenzbeitrag gegenüber Strohgranulat/-Pellets.

**Schlagworte:** Analytischer Hierarchieprozess, Einstreu, Geflügelwirtschaft, Präferenzmessung

## 1 Introduction

According to the First Livestock Husbandry Regulation in Austria (1.THVO, 2004) and the Animal Welfare Husbandry Regulation in Germany (TierSchNutzV, 2006), bedding is a material with loose, friable structure spread on the floor of a poultry shed, which allows the animals to satisfy their ethological needs (e.g. dustbathing, pecking, scratching). This definition leaves widespread possibilities for the use of dif-

ferent kinds of materials but gives no suggestion for a suitable bedding material. Many bedding materials have been used to rear poultry, such as corncobs, sand and shredded newspaper, some of them driven by local recycling purposes and new market development (Ritz et al., 2009). In the literature the choice of bedding has rather heterogeneous effects in preventing problems associated with poor bedding quality. The choice of bedding is not a guarantor for healthy birds but when optimal management conditions are met, a suitable

bedding can lead to a healthier livestock. Therefore, the bedding choice is highly relevant for the economics of poultry production and animal welfare.

There are various veterinarian studies about the influence of bedding on footpad health (Abd El-Wahab et al., 2011; Dunlop et al., 2016). However, the economic assessment of bedding is often overlooked or only mentioned briefly (Garcês et al., 2016; Shepherd et al., 2017), no study has been found in the literature that focus solely on the economic assessment of poultry bedding from a market research point of view. The present study will close this research gap by answering the question: Which bedding types do poultry farmers prefer? Therefore, the objectives of this study are to explore the preferences and purchasing behavior of poultry farmers to determine their needs and explain the decision-making of poultry farmers concerning bedding types.

The article is structured as follows. In the section “Method” we provide a conceptual structure for our assessment. In the section “Results”, we describe the survey results of poultry beddings used in Austria and Germany. In the following section we discuss the obtained results and in the “Conclusions” we draw conclusions.

## 2 Method

A preliminary survey in Austria revealed relevant product properties of poultry bedding. Premised on this data, a quantitative online survey was conducted to explore the preferences and purchasing behavior of poultry farmers in Austria and Germany allowing inter-country comparisons.

### 2.1 Preliminary survey

First, a set of product properties and bedding types was defined. This step was crucial because reliable and valid results

can only be obtained if the determinant product properties and bedding types are assessed. A criteria catalogue summarized the relevant product properties of poultry beddings found in a literature research. This criteria catalogue was assessed in a paper and pencil preliminary survey in order to identify those product properties that poultry farmers valued most in respect to the relevance for preference formation. Furthermore, poultry farmers indicated their used beddings to identify commonly used beddings.

This preliminary survey was conducted in February 2017 at the symposium of poultry farming by the “Ökosoziales Forum Österreich” in Hatzendorf, Austria. The paper and pencil questionnaires were placed on each chair at the symposium, so that poultry farmers could fill them out. The sampling procedure was a convenience sampling. The sample size at the symposium was approximately 180 persons, of which 32 poultry farmers filled out the questionnaire validly (response rate: 18%).

### 2.2 Online survey

Premised on the preliminary survey, an online survey was implemented with the online survey program LimeSurvey to explore the preferences of poultry farmers. The online survey used the analytic hierarchy process (AHP) as market research instrument. For example, Almeida Paz et al. (2010) used AHP to select a bedding for reducing locomotion problems of broilers. AHP collects preferences through pairwise comparisons where the relative advantageousness of one element is compared to another element. This assessment type was implemented in the online survey with bipolar slider questions. The advantage of this assessment type is the higher motivation of respondents due to the lower complexity level of the pairwise comparison tasks in comparison to other preference measurement methods, e.g. conjoint analysis (Scholl et al., 2005). Albeit, to reduce the number of pairwise comparisons and therefore the survey duration and

Table 1: Description of the product properties and beddings

bedding type	description	product property	description
chopped straw	crushed straw	drying rate	evaporation rate of wet bedding
straw granulate/ pellets	into pellets pressed straw, optionally processed to a loose granulate	ammonia content in air	ammonia release capability of wet bedding
wood shavings	dry shavings that result from slicing wood	water holding capacity	water retention capacity
dried sawdust	wet sawdust that results from sawing wood and dried afterwards; sawdust is much smaller than wood shavings	workload	necessary working time for keeping the bedding loose and friable
		bedding price	amount of bedding in the shed multiplied by price per unit

Source: Own illustration

mental depletion of respondents (so-called decision fatigue), only one product property namely “drying rate” (received the highest relevance in the preliminary survey) was used to compare the entire set of bedding types. The entire set of bedding types consists of the six possible combinations between the four bedding types that are included in the AHP. These four bedding types and associated product properties are shortly described in table 1 and will be further explained in the results section.

Drying rate was the only product property where a matrix was composed to calculate the consistency ratio (CR) providing information on the logical consistency among pairwise comparison judgments. For the other product properties, incomplete pairwise comparisons among the bedding types were executed, therefore, it was impossible to calculate a CR for these criteria. There are various methods that can be used to derive the priorities of alternatives from the pairwise comparison tasks within AHP. The eigenvector method is most common and therefore used in this study. For a further description of calculations of the eigenvector method and consistency ratio see Saaty (1980).

After a pre-test, the recruitment was arranged in collaboration with the national poultry association in Austria and four state-level poultry associations in Germany who sent invitation e-mails to poultry farmers<sup>1</sup> (this recruiting procedure was also used by Campe et al. (2013)). The online survey started on 5<sup>th</sup> April 2017 and expired on 15<sup>th</sup> July 2017.

In Austria, 1395 people received an e-mail invitation. 221 respondents opened the survey in a valid manner. Thereof 3 respondents were excluded because they indicated that they are not poultry farmers. Additionally, 4 respondents were excluded because they did not fulfill the minimum requirements of keeping  $\geq 350$  heads of laying hens or  $\geq 500$  heads of poultry kept for meat production. These requirements were derived from the (EU Council Directive 2007/43/EC, 2007) for meat poultry and (EU Council Directive 1999/74/EC, 1999) for laying poultry. Small-size farms below these defined minimum farm sizes, such as hobby poultry farmers, are less important for the consumption of bedding and were therefore excluded. This sampling procedure is called purposive sample (homogenous sampling). The remaining 214 Austrian poultry farmers lead to a response rate of 15.3% with partial responses included. Indeed, not all of the poultry farmers answered every question. In such cases, we report the number (n) of poultry farmers for the particular question.

In Germany, 75 poultry farmers participated to the online survey, with 15 partial responses included. Thereof 8 responses were deleted because they had less than  $\geq 350$  heads of laying hens or  $\geq 500$  heads of poultry kept for meat production. Because of the unknown quantity of sent e-mail

invitations by some poultry associations in Germany, it is impossible to determine a response rate.

Compared to other studies, a response rate of 15.3% in the online survey of Austria is satisfactory. For example, Green et al. (2000) achieved a response rate of 33.6% with a postal survey about laying hens in Great Britain. These authors documented phone calls and letters explaining why the questionnaire had not been completed. Reasons for non-responses were that poultry farmers were farming their first flock, were no longer in egg production, lacked time or the majority of questions was not relevant for them. We also assume similar reasons for non-responses in the present online survey.

### 3 Results

#### 3.1 Preliminary survey

The results of the preliminary survey (product properties that are assessed as relevant by poultry farmers) are presented in figure 1.

According to figure 1, drying rate was assessed most frequently as relevant showing that the core ability of a reasonable drying time is essential for the shed climate. Notable is that bedding price is ranked on the fifth place, showing its relatively low importance. The most relevant five product properties were implemented as criteria in the online survey.

Regarding bedding types, four commercially available beddings that are in demand and easy to obtain in large quantities were implemented in the online survey: two straw products (chopped straw and straw granulate/pellets) and two wood products (wood shavings and dried sawdust). This selection is premised on figure 2, which shows that most poultry farmers indicated to use chopped straw (47.6%) followed by wood shavings (38.1%).

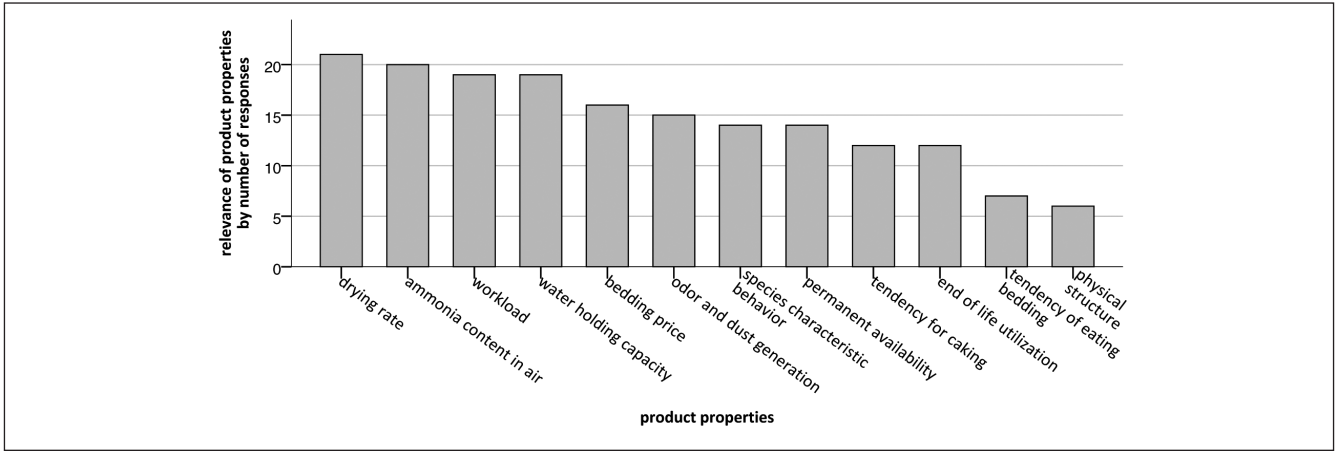
#### 3.2 Online survey

Concerning industry type, the sample consists, in so far as is responded, in Austria of 77 meat poultry farmers and 61 laying poultry farmers and in Germany of 47 meat poultry farmers and 15 laying hen farmers as shown in figure 3 and figure 4 respectively. This shows a relatively balanced ratio between meat poultry farmers and laying hen farmers in Austria, whereas in Germany 75.8% of respondents are meat poultry farmers. The distribution of the broiler farm sizes in the sample from figure 3 and figure 4 corresponds with the distribution in the basic population (Eurostat, 2017), which shows a possible inconspicuous non-response bias regarding farm size. Further, the frequency of used bedding types in the preliminary survey (see figure 2) is in acceptable accordance to the frequency of used bedding types in the online survey for Austria (see figure 5) showing reliable results.

Figure 5 and figure 6 describe poultry farmers' use of beddings in Austria and Germany respectively. Most Austrian poultry farmers use chopped straw as bedding (67.6%),

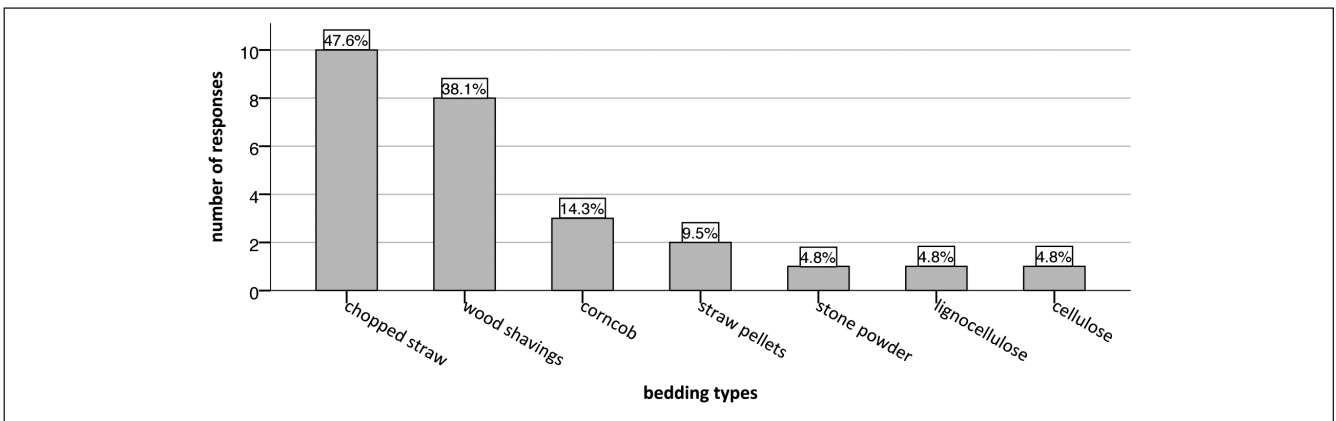
<sup>1</sup> Involved poultry associations: Zentrale Arbeitsgemeinschaft der Österreichischen Geflügelwirtschaft, Geflügelwirtschaftsverband Baden-Württemberg e.V., Niedersächsische Geflügelwirtschaft Landesverband e.V., Geflügelwirtschaftsverband Brandenburg e.V., Geflügelwirtschaftsverband Nordrhein-Westfalen e.V., Geflügelwirtschaftsverband Mecklenburg-Vorpommern e.V.

Figure 1: Frequency of product properties that are assessed as relevant in the preliminary survey (n=32). The data were gathered from a multiple response question.



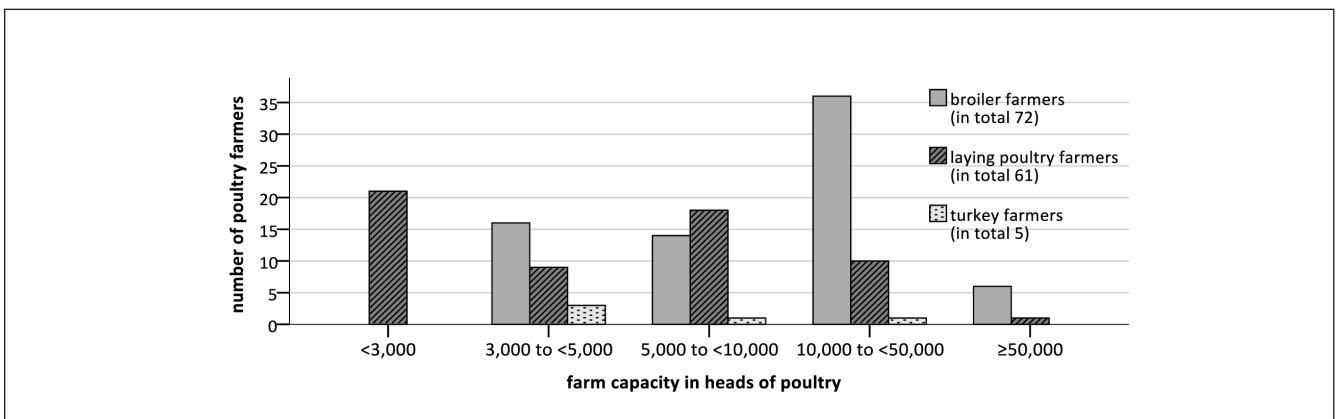
Source: Own illustration

Figure 2: Absolute number of poultry farmers who use the certain bedding type in the preliminary survey (n=21). The data were gathered from a multiple response question. Thus, the percentages over the bars will add to more than 100%. The percentages indicate the share of poultry farmers who use this bedding.



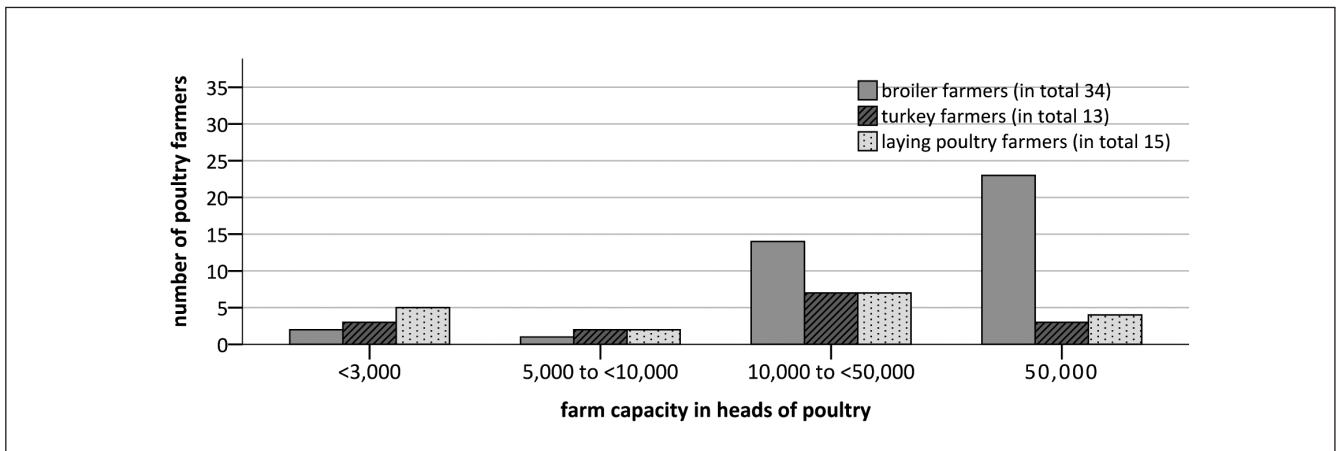
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Figure 3: Number of poultry farmers per farm size and industry type in Austria (n=138)



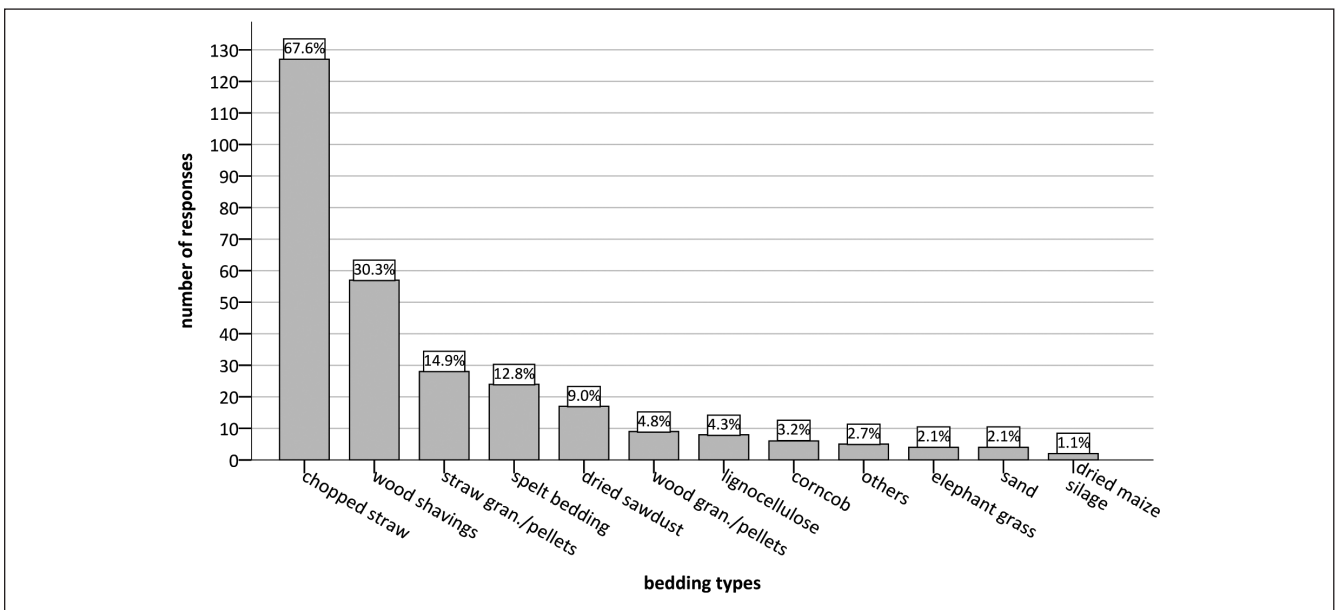
Source: Own illustration

Figure 4: Number of poultry farmers per farm size and industry type in Germany (n=62). The category 3,000 to > 5,000 is omitted because there are no responses.



Source: Own illustration

Figure 5: Absolute number of poultry farmers who use the certain bedding type in Austria (n=188). The data were gathered from a multiple response question with the possibility to choose maximal two beddings. Thus, the percentages over the bars will add to more than 100%. The percentages indicate the share of poultry farmers who use this bedding.



Source: Own illustration

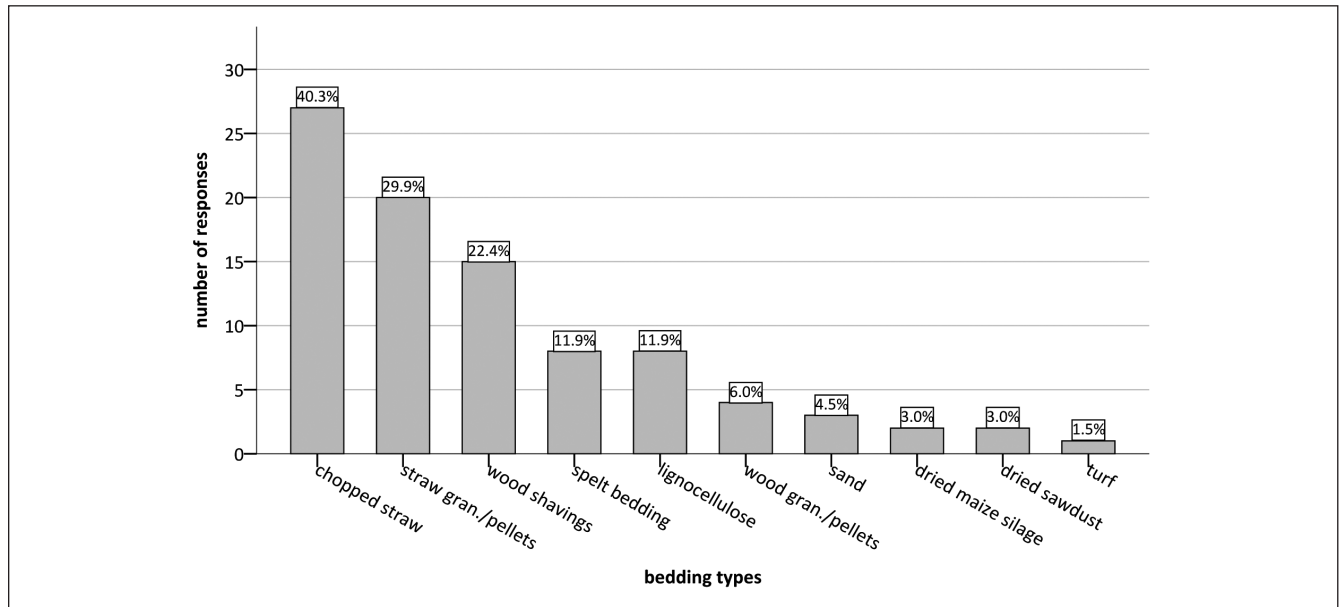
followed by wood shavings (30.3%) and straw granulate/pellets (14.9%). Also German poultry farmers use mostly chopped straw (40.3%), followed by straw granulate/pellets (29.9%) and wood shavings (22.4%).

Regarding to the preferences of poultry farmers collected with the AHP, figure 7 shows the global priorities of the four selected bedding types in Austria. Straw granulate/pellets obtained the highest overall priority (0.296) followed by wood shavings (0.275), dried sawdust (0.234) and chopped straw (0.196). Regarding to the most important criterion within

the AHP, the water holding capacity<sup>2</sup>, straw granulate/pellets obtained the highest priority of nearly 0.094. This means that 31.9% of the overall priority of straw granulate/pellets originates from the high priority of the criterion water holding capacity. The values in square brackets next to the legend show the priorities of the criteria in figure 7 and figure 8.

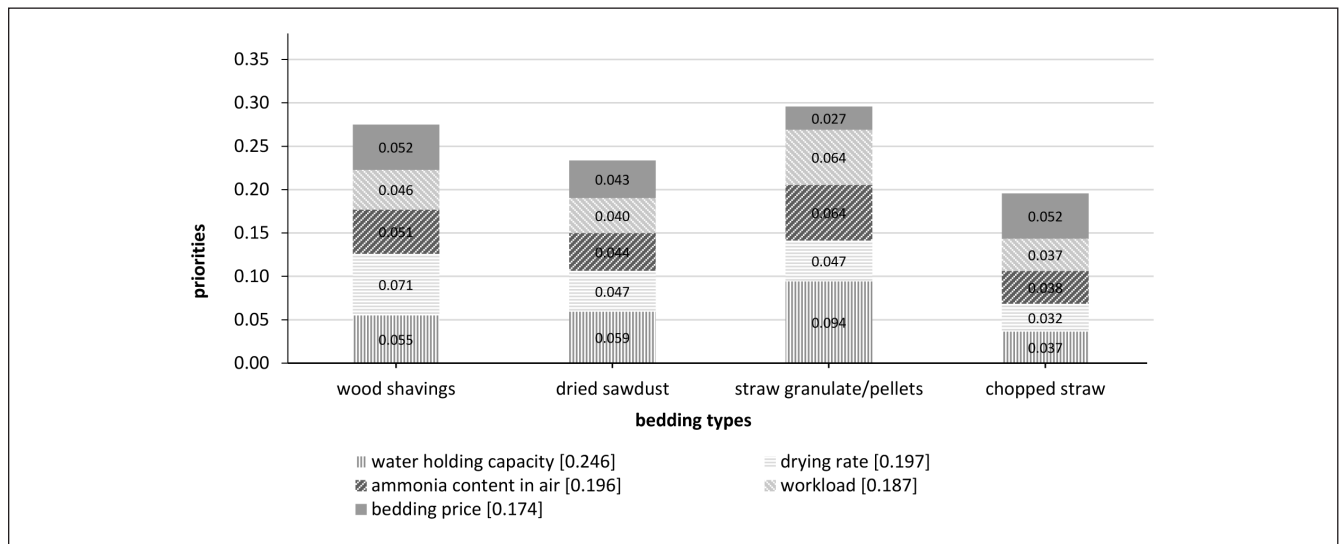
2 The priorities of the criteria can be calculated by summing the partworth contributions of the four bedding types of the respective criterion, e.g. in Austria for the criterion water holding capacity (figure 7):  $0.055 + 0.059 + 0.094 + 0.037 \approx 0.246$ .

Figure 6: Absolute number of poultry farmers who use the certain bedding type in Germany (n=67). The data were gathered from a multiple response question with the possibility to choose maximal two beddings, for this reason the percentages over the bars will add to more than 100%. The percentages indicate the share of poultry farmers who use this bedding.



Source: Own illustration

Figure 7: Global priorities for poultry farmers in Austria (n=99)



Source: Own illustration

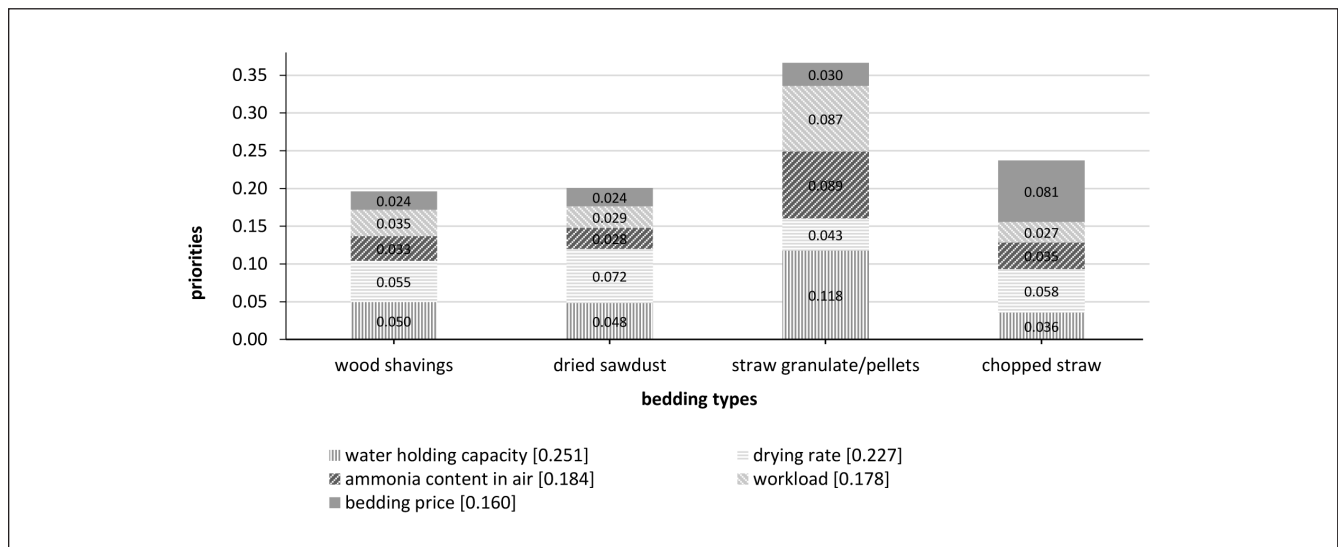
Same as in Austria, straw granulate/pellets is the bedding with the highest global priority and therefore the most preferred bedding in Germany, depicted in figure 8. However, the overall priority of straw granulate/pellets in Germany is with 0.366 clearly higher than in Austria with 0.296.

A consistency test was performed to inspect the quality degree of the assessments. According to Saaty (1980) a consistency ratio (CR),  $CR \leq 0.1$ , is considered as acceptable but other authors suggest a  $CR \leq 0.2$  (Lütters, 2004; Scholl

et al., 2005). A value of  $CR = 0.2$  means that the judgments are 20% as inconsistent as if they had been given randomly. In the present case, the only product property that is possible for a consistency test is drying rate because of complete pairwise comparisons. 50.5% of poultry farmers fulfill the hard criterion of  $CR \leq 0.1$  and 70.7% fulfill the less hard criterion of  $CR \leq 0.2$ , which is defined as the individual consistency limit for the matrix of drying rate.



Figure 7: Global priorities for poultry farmers in Austria (n=99)



Source: Own illustration

#### 4 Discussion

The majority of poultry farmers uses the bedding type chopped straw. Chopped straw has compared to straw granulate/pellets and wood shavings an lower bedding quality with a significant higher risk of footpad dermatitis (Terčič et al., 2015). This drawback is also reflected in the AHP as the part-worth contribution of water holding capacity is the lowest for chopped straw indicating that straw is prone to wet bedding problems. However, using economical beddings, such as chopped straw seems to be reasonable because a total clean-out of the shed has to be performed after each production cycle (EU Council Directive 2007/43/EC, 2007). This is especially relevant for broilers, as they have with 38-45 days the shortest production cycle (EC, 2016). Moreover, straw is a plant residue of arable land easy to obtain in large quantities from neighborhood relations or own plant residues. Surely, the removal of the straw from the field results in carriage cost but the overall affordability and the easy procurement seem to be determinant for the high use of chopped straw. These determinants also appear in the AHP assessment, as chopped straw receives the highest part-worth contribution of the criterion bedding price meaning that it is assessed as most economical.

Generally, the criteria water holding capacity and drying rate received the highest priority in AHP, showing that the capabilities of the bedding to absorb and release moisture are the most important product properties for poultry farmers. This finding is in accordance to Bilgili et al. (2009), who performed experimental trials with beddings in poultry sheds.

Although Austrian and German poultry farmers assess both straw granulate/pellets as first ranked in AHP, the priority of German poultry farmers towards straw granulate/pellets is with 0.366 clearly higher than the priority of Austrian poultry farmers with 0.296. This is due to the higher

proportion of meat poultry farmers and large-sized poultry farmers in Germany, who might have higher requirements on the bedding quality. Whereas in Austria, a voluntary standard called “tierschutzgeprüft” (animal rights tested) (KAN, 2011), which requires the predominant use of chopped straw in the shed, leads to a higher use of chopped straw in Austria than in Germany. This standard is particularly used for laying hens and since the sample in Austria consists relatively more laying poultry farmers than in Germany, this contributes to the higher share of Austrian poultry farmers who use chopped straw. Contrariwise, a further reason for the higher straw granulate/pellets use in Germany might be the possibility of mobile pelletization on a truck trailer whereby pellets and granulate can be directly produced at the farm location. The larger farmland sizes in Germany makes it easier to reach the minimum amount of straw at which a mobile pelletization becomes profitable (Neumann, 2015). As can be expected, straw granulate/pellets and chopped straw, first ranked in AHP respectively in the bedding use frequency, consist both of straw as primary material showing that straw is highly demanded and easy to obtain in large quantities.

The limitation must be made that sequential measurement of part-worth contributions in AHP is made relatively isolated as poultry farmers choose between beddings and not between part-worth contributions. This fact and the possibility of self-report bias, i.e., where respondents might under-report behaviors that may be deemed inappropriate by researchers, are reasons for the undervaluation of the criterion bedding price with a priority of approximately 0.16. Besides, this undervaluation explains also the low use of lignocellulose (4.3% and 11.9% in Austria and Germany respectively) because lignocellulose has a superior bedding quality but a high price (Abd El-Wahab et al., 2011). Further, the response quality in AHP with a consistency ratio of 70.7% could be higher. A larger pool of respondents and a more even farm

size distribution of poultry farms would be necessary to ensure statistical power and generalizability.

## 5 Conclusions

The present study conducted an online survey on poultry beddings by means of AHP. Preference judgements were measured with pairwise comparison tasks. Regarding preferences, poultry farmers prefer straw granulate/pellets. The criteria water holding capacity and drying rate have the highest impact on the preference formation, whereas the criterion bedding price has the lowest impact. This criterion might be underreported by poultry farmers. Despite its relatively low bedding quality, chopped straw is the most used bedding type since the affordability and the easy procurement are advantageous. After chopped straw, the second most used bedding is wood shavings in Austria and straw/granulate in Germany. That said, we must acknowledge that poultry farmers are not a homogenous group. Divergence in bedding choice may arise because a bedding type, e.g. wood shavings, is in the region only scarcely available or because of different needs of poultry farmers, e.g. regarding high or low physicochemical quality of beddings. The amount of bedding used, bedding depth and actual frequency of total clean-outs of the shed are worth exploring further because of their decisive effect on the demanded bedding quantity. Moreover, the procurement of straw between *use own* or *purchase* might be valuable in understanding this make-or-buy decision.

## Acknowledgment

We thank the poultry farmers and unions for their engagement in the conducted surveys.

## References

- Abd El-Wahab, A., Beineke, A., Beyerbach, M., Visscher, C.F., and Kamphues, J. (2011) Effects of floor heating and litter quality on the development and severity of foot pad dermatitis in young turkeys. *Avian Diseases* 55, 429–434.
- Almeida Paz, I.C.L., Garcia, R.G., Bernardi, R., Nääs, I., Caldana, F.R., Freitas, L.W., Seno, L.O., Ferreira, V.M.O.S., Pereira, D.F., and Cavichiolo, F. (2010) Selecting appropriate bedding to reduce locomotion problems in broilers. *Revista Brasileira de Ciência Avícola* 12, 189–195.
- Bilgili, S.F., Hess, J.B., Blake, J.P., Macklin, K.S., Saenmahayak, B., and Sibley, J.L. (2009) Influence of bedding material on footpad dermatitis in broiler chickens. *The Journal of Applied Poultry Research* 18, 583–589.
- Campe, A., Koesters, S., Niemeyer, M., Klose, K., Ruddat, I., Baumgarte, J., and Kreienbrock, L. (2013) Epidemiology of influences on the performance in broiler flocks – A field study in Germany. *Poultry Science* 92, 2576–2587.
- Dunlop, M.W., Moss, A.F., Groves, P.J., Wilkinson, S.J., Stuetz, R.M., and Selle, P.H. (2016) The multidimensional causal factors of ‘wet litter’ in chicken-meat production. *Science of The Total Environment* 562, 766–776.
- EC (European Commission) (2016) Report from the Commission to the European Parliament and the Council on the impact of genetic selection on the welfare of chickens kept for meat production. Brussels.
- EU Council Directive 1999/74/EC (1999) laying down minimum standards for the protection of laying hens.
- EU Council Directive 2007/43/EC (2007) laying down minimum rules for the production of chickens kept for meat production.
- Eurostat (2017) Eurostat Database. Poultry: number of farms and heads by economic size of farm (SO in Euro) and size of broiler flock. Data code: ef\_lsbroiecs. URL: <http://ec.europa.eu/eurostat/web/agriculture/data/database> (10.11.2017).
- Garcês, A., Afonso, S., Chilundo, A., and Jairoce, C. (2016) Evaluation of different litter materials for broiler production in a hot and humid environment: 2. Productive performance and carcass characteristics. *Tropical Animal Health and Production* 1–6.
- Green, L.E., Lewis, K., Kimpton, A., and Nicol, C.J. (2000) Cross-sectional study of the prevalence of feather pecking in laying hens in alternative systems and its association with management and disease. *Veterinary Record* 147, 233–238.
- KAN (Kontrollstelle für artgemäße Nutztierhaltung) (2011) Richtlinien für die Produktion tierschutzgeprüfter Freiland-Masthühner. Bruck an der Mur.
- Lütters, H. (2004) Online-Marktforschung – Eine Positionsbestimmung im Methodenkanon der Marktforschung unter Einsatz eines webbasierten Analytic Hierarch Process (webAHP). Dissertation at the Freie Universität Berlin.
- Neumann, H. (2015) Marktnische – Pelletierung auf Rädern. *Eilbote* 23, 10–11.
- Ritz, C.W., Fairchild, B.D., and Lacy, M.P. (2009) Litter quality and broiler performance. Athens: Cooperative Extension Service. University of Georgia College of Agriculture.
- Saaty, T. (1980) *The Analytic Hierarchy Process – Planning, Priority Setting, Resource Allocation*. New York: McGraw-Hill.
- Scholl, A., Manthey, L., Helm, R., and Steiner, M. (2005) Solving multiattribute design problems with analytic hierarchy process and conjoint analysis: An empirical comparison. *European Journal of Operational Research* 164, 760–777.
- Shepherd, E.M., Fairchild, B.D., and Ritz, C.W. (2017) Alternative bedding materials and litter depth impact litter moisture and footpad dermatitis. *Journal of Applied Poultry Research* 26, 518–528.
- Terčič, D., Žolger, M., and Pestotnik, M. (2015) Effect of different litter materials on foot pad dermatitis, hock burn



and feather coverage in broiler chickens. *Acta Agriculturae Slovenica* 106, 97–101.

TierSchNutzV (Tierschutz-Nutztierhaltungsverordnung) (2006) Verordnung zum Schutz landwirtschaftlicher Nutztiere und anderer zur Erzeugung tierischer Produkte gehaltener Tiere bei ihrer Haltung. BGBl. I S. 2043/2006.  
1.THVO (1. Tierhaltungsverordnung) (2004) BGBl. II Nr. 485/2004.

