Official veterinarians in Europe: Questionnaire-based insights into demographics, work and training

Eduarda Gomes-Neves [a],[*], Margarida F. Cardoso [b], Thomai Lazou [c], Brigita Hengl [d], Silvia Bonardi [e], Bojan Blagojevic [f], Claudia Guldiman [g],[1], Sophia Johler [h],[1]

[a] *Department of Pathology and Molecular Immunology, Instituto de Ciências Biomédicas Abel Salazar (ICBAS), University of Porto, 4050-313, Porto, Portugal*
[b] *Department of Populations Studies, Instituto de Ciências Biomédicas Abel Salazar (ICBAS), University of Porto, 4050-313, Porto, Portugal*
[c] *Department of Animal Food Products Hygiene and Technology, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, 54124, Thessaloniki, Greece*
[d] *Department for Nutrition and Data Management, Center for Food Safety, Croatian Agency for Agriculture and Food, I. Gundulica 36b, 31000, Osijek, Croatia*
[e] *Unit of Inspection of Food of Animal Origin, Department of Veterinary Science, University of Parma, 43126, Parma, Italy*
[f] *Department of Veterinary Medicine, Faculty of Agriculture, University of Novi Sad, Trg D. Obradovica 8, 21000, Novi Sad, Serbia*
[g] *Food Safety and Analytics, Faculty of Veterinary Medicine, Ludwig-Maximilians-University Munich (LMU), Schönleutnerstrasse 8, 85764, Oberschleissheim, Germany*
[h] *Institute for Food Safety and Hygiene, Vetsuisse Faculty, University of Zurich, Winterthurerstrasse 272, 8057, Zurich, Switzerland*

A R T I C L E   I N F O

A B S T R A C T

Proper training of official veterinarians (OVs) is fundamental to achieving their advanced role as risk managers within a risk-based meat safety assurance system (RB-MSAS) addressing the most relevant meat-borne public health hazards. The demography, training opportunities and needs of OVs in Europe remain largely unknown. The objective of this study was to characterise OVs in terms of demography and employment and to identify continuing education and training needs via a survey. An anonymous questionnaire with 32 questions was designed, translated into 17 different languages and disseminated online in 33 countries across Europe. Responses were received from 1786 OVs of 32 nationalities working in 29 countries. The average age of the respondents was 49 years, 54% were male, and their average experience as OVs was 15 years. A minority of 16% held a Master of Science and 10% held a Doctor of Philosophy degree, whereas 36% held a national specialisation diploma and 4% a European one. Professional experience as a veterinarian was reported as a requirement to enter the OV career by 32% of the respondents, with differing training requirements across countries. Regarding continuing education, the last activity was most frequently reported within the last year, on-site practical sessions and direct lectures were the most favoured methods. New EU legislation on official controls was the most reported topic for past and future training activities. A high degree of overall satisfaction with their employment was reported, but nevertheless, 15% of the respondents were dissatisfied. Not all of the respondents were confident with visual meat inspection results or the availability of resources for risk-based meat inspection. Differences were detected between OVs working in the European Union, United Kingdom or European Free Trade Association countries and those working in other European countries. This first characterisation of OVs across Europe suggests a relatively high average age with a low proportion of females compared to the general veterinarian population. These findings indicate upcoming demographic changes that may demand adaptations in education and training. Similar surveys should be carried out periodically to document this process, addressing new professional challenges and demands.

1. Introduction

Veterinarians are experts in animal health and welfare as well as public health, playing an essential role in controlling and assuring the safety and quality of food of animal origin. Official veterinarians (OVs) are a vital part of the food of animal origin's safety assurance, as they

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* Corresponding author.
   E-mail address: emneves@icbas.up.pt (E. Gomes-Neves).
[1] Both authors contributed equally.

perform official controls for the competent authorities (CAs). The regulatory framework for official controls carried out for food in the European Union (EU) has been recently amended by Regulation (EU) 2017/625 (EU, 2017), which lays down rules to verify that food safety complies with EU legislation at all stages of production, processing and distribution. Specifically, official controls for food of animal origin are laid down by its delegated and implementing acts, such as Commission Delegated Regulation (EU) 2019/624 (EU, 2019a), which underlines the crucial role of the OVs in ante-mortem (AMI) and post-mortem inspection (PMI), and Commission Implemented Regulation (EU) 2019/627 (EU, 2019b), which lays down the practical arrangements for AMI and PMI, including cases in which the official controls are performed by official auxiliaries (OAs) under the responsibility of OVs. The new pieces of legislation on official controls currently in force are part of the path towards risk-based meat inspection across the EU and originate from the vision of the European Food Safety Authority (EFSA) for the modernisation of traditional meat safety inspection systems. Starting in 2011, this vision has been unfolded by EFSA in several published scientific opinions on public health-related hazards to be covered by inspection of meat of food-producing animals (swine, poultry, bovine, sheep, goats, solipeds, and farmed game), such as well as in technical specifications on harmonized epidemiological indicators (HEIs) for public health hazards to be covered by meat inspection EFSA, 2011, 2012; 2013a; 2013b; 2013c; 2013d; EFSA Panel on Biological Hazards [BIOHAZ], 2011, 2013a; 2013b, 2013c, 2013d; EFSA Panel, 2012. In addition, EFSA proposed the generic structure of a risk-based meat safety assurance system (RB-MSAS) to address the most epidemiologically relevant meat-borne public health hazards. The ultimate aim of the modern RB-MSAS is to protect human health, animal health and animal welfare through the implementation of control measures along the entire meat production chain (Antunović et al., 2021). In this context, official controls are performed in a cost-effective way and the OVs are envisaged to undertake a key role as risk managers at pre-harvest, harvest and post-harvest levels of the meat production chain. To that end, OVs are expected to be able to utilise food chain information (FCI) and HEIs (including related audit findings) for the risk categorisation of farms and abattoirs and the implementation of additional risk mitigation measures (EFSA, 2011, 2012, 2013a, 2013b, 2013d; Bonardi & Belluco, 2023; Bonardi et al., 2021; Ferri et al., 2023; Gomes-Neves et al., 2018). However, trade restrictions, cost-related factors and insufficient FCI-related data have been highlighted as the major impediments in the EU to the definitive implementation of a modern meat inspection system that currently lags behind the legislative requirements (Antunović et al., 2021; Bonardi et al., 2021; Felin et al., 2016; Gomes-Neves et al., 2018).

As recommended by EFSA scientific opinions and technical specifications, and as explicitly required by relevant EU regulations, proper training of OVs is fundamental to allow them to fulfil their advanced role as risk managers throughout the farm-to-fork continuum and within the RB-MSAS context, and this training should be provided by the EU Commission (EC), CAs or delegated bodies (EFSA, 2011, 2012, 2013a; EU, 2017, 2019a; Ferri et al., 2023). In brief, in the EU, national CAs of member states (MS) are allowed to appoint as an OV to perform official controls only veterinarians who have passed a test meeting specific minimum requirements, unless either a university degree or continuing education, resulting in a postgraduate qualification, professional experience or other qualifications, can be verified by the CAs on a case-by-case basis (Lundén et al., 2007; Smulders et al., 2012). The specific minimum requirements for OVs set by the EU legislation are numerous, ranging from knowing national and EU legislation, principles, concepts and methods of good manufacturing practice and quality management, to auditing and verification of compliance with corresponding requirements, data-handling and applied biostatistics (EU, 2019a). Before starting to work independently, each OV must undergo practical training for a probationary period of at least 200 h under the supervision of existing OVs in abattoirs, cutting plants and on holdings. This prerequisite training should particularly concern auditing good

hygiene practices and procedures based on the hazard analysis and critical control points (HACCP) principles. Nonetheless, the OVs must generally keep up-to-date and abreast of new developments through regular continuing education activities and professional literature relevant to the specific minimum requirements as set by legislation for this professional group, and, wherever possible, undertake annual education activities (EU, 2019a). Moreover, when OVs move cross-border or wish to establish themselves in another MS, mutual recognition of the tests for OVs between MSs must apply and be limited to subjects essential for human health and animal health protection in the MS of employment, but not covered by the tests in the MS of origin (EU, 2019a).

Each non-EU country has their own path for a graduated veterinarian to become OV. For instance, in Serbia, having at least three years of professional experience is a precondition for a veterinarian to sit an OV exam, while the OV's duties are regulated by the Law of Veterinary Matters (RS, 2005). Successful candidates are employed by the Veterinary Directorate and can work independently as OVs. Recently, meat inspection can also be performed by any licensed veterinarian employed at a veterinary station after having completed a specific professional training program. Nevertheless, all candidate countries for membership in the EU (like Serbia) are in the process of harmonising their legislation on food safety, including the official control of food with the EU, and on animal health and animal welfare.

The European Commission (EC) is empowered by the EU legislation to develop training for MSs and non-EU CA staff (EU, 2017). Better Training for Safer Food (BTSF) is the focal EC training initiative to improve the knowledge and implementation of EU rules covering the areas of food and feed law, animal health and welfare, as well as rules on plant health and One Health (https://better-training-for-safer-food.ec.europa.eu/training/). BTSF, therefore, constitutes a reference training frame for OVs involved in official control activities both in EU and non-EU countries, European Free Trade Association (EFTA)/European Economic Area (EEA), candidate, potential candidate, and others. The law is aimed at keeping OVs up-to-date with all aspects of EU law in the aforementioned areas and ensuring that controls are carried out uniformly, objectively and satisfactorily. Training is usually organised by external contractors who design and deliver the BTSF courses using subject matter experts in close cooperation with DG SANTE technical units and who deliver the training through face-to-face courses, virtual classrooms, eLearning or a combination of these. To that end, BTSF ACADEMY is the EC's single learning and information portal on BTSF training activities for CA staff and stakeholders in MSs and non-EU countries for which access is provided strictly to registered users and the coordination is assisted by National Contact Points (NCP).

The Federation of Veterinarians of Europe (FVE) conducted a survey amongst European veterinarians in 2018 that provided some information on demographics and training (FVE, 2019). However, the FVE survey was conducted amongst veterinarians in general, with only 14% of respondents working in the public sector and no specific information on the situation of OVs. To date, the demography, training opportunities and training needs of OVs in Europe remain largely unknown. Therefore, the objective of this study, developed in the framework of COST Action 18105 (RIBMINS), was to characterise OVs in terms of demography, academic qualification, work experience and employment and to identify continuing education and training needs via a questionnaire-based survey. The study primarily endeavoured to obtain data regarding the demographics and training characterisation of this professional group, detecting any corresponding differences between EU and non-EU countries (EU candidate countries). The data should enable practical future training initiatives, tailored to realistic educational needs.

2. Materials and methods

2.1. Questionnaire and survey design

An anonymous questionnaire, including an introductory text

elaborating on the objective and context of the study, was designed as the survey tool. It consisted of 32 questions grouped in 8 distinct parts: 1) Demographic data (country of work, nationality, gender, year of birth); 2) Qualification data (year of graduation, highest academic degree, specialisation diploma, previous experience, specific training, required examination) to be eligible to work as an OV; 3) Work experience (years of experience as an OV, the type of work); 4) Daily work [% of time dedicated to OV tasks, work in team or alone, degree of confidence in the results of the application of visual meat inspection (VMI) in comparison to traditional meat inspection and in the available resources to support risk-based meat inspection (RBMI)]; 5) Employment situation (current employer, type of contract, degree of satisfaction in the career); 6) Training activities in continuing education as an OV (frequency of training opportunities, time elapsed since last training activity, entity responsible for training, level of satisfaction for attended training activities, any experience as a trainer, preferred training methodology); 7) Training topics [relevant to both past and necessary future training activities with an available list of topics to choose including the option 'other', e.g. new legislation on official controls, VMI, FCI, RBMI, meat safety assurance systems (MSAS), etc]; 8) Final remarks and comments (open to the respondent).

Most of the questions were closed-ended (dichotomous answers or a list of available options to choose from) in order to enhance the comparability of the responses. A Likert-type response scale (Jamieson, 2004) with five response options (1 = not at all confident, 5 = extremely confident) and (1 = not at all satisfied, 5 = extremely satisfied) was applicable in questions relevant to the degree of confidence or the level of satisfaction, respectively.

The questionnaire was initially tested in a pilot study with 20 participants to evaluate the quality of the survey tool design and the clarity of the questions. The respondents' feedback was integrated into the questionnaire design and the survey was subsequently approved by the Ethics Committee of the University of Porto, Portugal. To reach as many OVs working in Europe as possible, the questionnaire was translated into 17 different languages (Albanian, Bosnian, Bulgarian, Croatian, English, French, German, Greek, Italian, North Macedonian, Polish, Portuguese, Romanian, Serbian, Slovenian, Spanish, Turkish) and was available online to recipients from 1st of December 2021 to the 31st of March 2022. The questionnaire was disseminated through the RIBMINS National Contact Points (NCP) network, the FVE, and the European College of Veterinary Public Health (ECVPH) as well as professional and personal networks in 33 countries participating in RIBMINS (European Union countries: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden; Non-EU countries (EU candidate countries): Albania, Bosnia & Herzegovina, Montenegro, North Macedonia, Serbia and Turkey; European Free Trade Association countries: Iceland, Norway; and the United Kingdom (UK).

2.2. Statistical analysis

Descriptive statistics were used to analyse the characteristics of the participating OVs. Categorical variables were described as proportions, quantitative variables were described as mean ± standard deviation, minimum and maximum. Score results were described also as median and the interquartile range (IQR), and as the proportion of not confident or not satisfied as applicable (values 1 and 2). Participants working within the European Union (E) United Kingdom (U), or European Free Trade Association countries (EF), collectively referred to as EUEF countries, were compared with participants working in non-EUEF countries. Proportions were compared using Pearson's chi-squared test as appropriate, or by Fisher's exact test. Continuous variables and score results were compared using a two-tailed, independent sample *t*-test using SPSS version 28.0. To check for confounding effects of the variables "gender" and "age" (binned) on "work conditions", "satisfaction in

the employment", "frequency of training opportunities" and "satisfaction - training activities", both linear regression models, as well as ordinal regression models, were calculated in R Studio (version 2022.12.0 + 353) using packages MASS (Venables & Ripley, 2002), ggplot2 (Wickham, 2016) and dplyr (Wickham et al., 2023). All necessary conditions for the tests used were checked. P values lower than 0.05 were considered to be statistically significant.

3. Results & discussion

3.1. Study population, demographics and qualification data

The questionnaire was completed by 1786 OVs of 32 nationalities working in 29 European countries, although it was originally disseminated in 33 countries, since no replies were obtained from Bulgaria, Luxembourg, Latvia and Lithuania (Tables 1 and 2). The total number of OVs working in each country was provided by the CA of each country through the RIBMINS NCP network. Eight respondents did not indicate the country of their employment by choosing the option 'Prefer not to answer'. Among the remaining 1778 OVs who provided information about their country of employment, 90% reported working in EUEF countries. The level of adherence to the questionnaire and response varied from 100% (Poland) to 0.3% (Albania) (Table 1).

Considering nationality, a total of 91% of the OVs reported working in the country of their nationality, though in some countries the percentage of local OVs was less than 50%, such as the United Kingdom (6%) and Iceland (38%) (Tables 1 and 2). In the EU, 92% of the total general population in 2021 comprised local citizens, with this share ranging from 83% of the population in Austria to 99% in Romania as regards the group of EU countries that contributed with responses to our survey (EUROSTAT, 2021). These figures are fairly similar to the ones obtained by the OVs who participated in this study with respect to the country of their employment, indicating that this professional group does not differ from the general population on these societal parameters.

In terms of gender, on average, 54% of the OVs were male, 45% were female and 1% preferred not to indicate their gender (Table 2). In non-EUEF countries, only 38% of OVs were female. The share of female OVs exceeded 50% among the respondents from Germany, Denmark, Finland, France, Norway, Portugal, Serbia and the United Kingdom (Table 1). This finding is consistent with the latest FVE survey, which reported a trend towards feminisation of the veterinary profession, with exceptionally high percentages of female veterinarians in Finland (89%), Latvia (83%), Sweden (82%), Russia (79%), Estonia (73%), Norway (72%), Germany (72%) and Portugal (70%) (FVE, 2019). Since there is also a female majority in the veterinary student population and higher numbers of female than male veterinarians entering the profession, an even stronger demographic shift towards female OVs seems imminent (FVE, 2019). However, it should be noted that the FVE survey was not limited to OVs but was conducted among veterinarians in general.

Regarding age, the OVs who participated in the current survey were a mean of 49 years old (median of 50) (Table 2). Though workforces in Europe and Central Asia have been reported as the oldest in the world in 2019, and the median age of OV respondents in this survey was even higher than the median age of the general labour force, namely 41 for male and 42 for female workers (Statista Research Department, 2022). However, specific demographic data for OVs in Europe are scarce in the literature (Wojtacka et al., 2020). An available recent survey by the German Veterinary Association specified that 28% of veterinarians working on official controls of slaughter animals or meat are above the age of 60 and will retire shortly (Schünemann et al., 2021). The corresponding veterinary authorities already reported that it is difficult to fill vacant positions, with the situation likely going to become more dire in the future. The authors hypothesised that increased commuting times to fewer and larger slaughter facilities and a remuneration structure favouring payment per animal and, thus, incentivising the shortest

Table 1

Characteristics of official veterinarians working in European countries (part I).

Country of Work	OVs in the country	Sample	Same nationality	Female	Age	Years since DVM	DVM	MSc	PhD
	n	n	%	%	Mean	Mean	%	%	%
AL	654	2	100%	50.0%	36.50	13.00		50.0%	50.0%
AT	851	78	96.2%	38.5%	48.24	20.92	57.7%	1.3%	41.0%
BE	740	101	98.0%	34.7%	49.19	24.08	81.2%	14.9%	4.0%
BA	118	31	80.6%	12.9%	44.58	18.94	90.3%	6.5%	3.2%
HR	332	75	96.0%	34.7%	49.09	21.99	78.7%	21.3%	
CZ	n.a.	2	100%	0.0%	65.00	40.00	100%		
DK	376	23	78.3%	73.9%	54.48	26.43	95.7%	4.3%	
EE	58	2	100%	100%	61.50	37.50	100%		
FI	127	17	100%	76.5%	42.94	15.41	76.5%	23.5%	
FR	375	102	93.1%	56.9%	48.82	23.22	86.3%	8.8%	4.9%
DE	1934	131	96.2%	59.4%	49.86	22.70	48.1%	6.0%	45.9%
GR	320	67	100%	55.2%	51.30	24.21	46.3%	46.3%	7.5%
IS	20	8	37.5%	50.0%	45.38	19.25	75.0%	12.5%	12.5%
IT	1558	80	98.8%	37.0%	51.32	24.69	61.7%	30.9%	7.4%
IE	110	25	92.0%	36.0%	53.40	28.72	84.0%	16.0%	
ME	14	5	40.0%	40.0%	55.00	27.60	100%		
NL	332	58	66.1%	44.1%	48.07	19.88	57.6%	33.9%	8.5%
NO	70	17	94.1%	82.4%	41.76	14.29	82.4%	11.8%	5.9%
MK	108	48	87.0%	30.4%	50.65	24.18	76.1%	17.4%	6.5%
PL	336	336	99.7%	37.5%	48.03	22.14	96.7%	0.3%	3.0%
PT	206	59	98.3%	61.0%	46.61	20.56	61.0%	39.0%	
RO	328	44	97.6%	40.5%	43.98	18.31	47.6%	33.3%	19.0%
RS	300	64	93.2%	62.7%	51.27	23.68	96.6%	3.4%	
SK	840	3	100%		41.00	16.50			100%
SI	192	18	100%	55.6%	49.44	22.50	83.3%	11.1%	5.6%
ES	3083	280	99.6%	45.9%	51.35	26.50	72.4%	20.1%	7.5%
SE	136	26	88.5%	53.8%	45.77	16.85	61.5%	34.6%	3.8%
TR	3500	29	100%	24.1%	38.14	14.41	79.3%	17.2%	3.4%
UK	320	54	5.5%	61.8%	38.11	12.45	69.1%	29.1%	1.8%

Table 1: Characteristics of official veterinarians working in European countries (part II).

Country of Work	Specialisation diploma: National	Specialisation diploma: European	Previous experience required	Specific Training: University	Specific Training: Nat. Veterinary Auth.	Specific exam to become an OV	Years Experience as OV
	%	%	%	%	%	%	Mean
AL	50.0%		50.0%		100%	100%	3.50
AT	12.8%	1.3%	12.8%	20.5%	75.6%	79.5%	15.37
BE	18.8%	1.0%	6.9%	24.8%	29.7%	38.6%	16.17
BA	6.5%		96.8%	3.2%	29.0%	61.3%	10.06
HR	32.0%		93.3%	16.0%	30.7%	82.7%	14.89
CZ						100%	20.00
DK	4.3%		13.0%	8.7%	21.7%	30.4%	14.87
EE			100%		100%		17.50
FI	35.3%	5.9%	23.5%	47.1%	11.8%	52.9%	10.12
FR	27.5%	6.9%	10.8%	1.0%	37.3%	7.8%	9.83
DE	29.3%	0.8%	28.6%	10.5%	30.1%	27.1%	15.40
GR	10.4%	1.5%	35.8%	4.5%	29.9%	4.5%	16.79
IS	12.5%		12.5%	25.0%	25.0%	25.0%	10.63
IT	87.7%	2.5%	18.5%	61.7%	16.0%	77.8%	16.57
IE	24.0%		52.0%	8.0%	40.0%	8.0%	15.76
ME			100%		80.0%	100%	22.00
NL	22.0%	1.7%	13.6%	5.1%	94.9%	86.4%	11.25
NO			11.8%	29.4%	82.4%	94.1%	8.12
MK	15.2%	4.3%	67.4%	19.6%	41.3%	84.8%	16.76
PL	72.3%		46.7%	18.2%	50.3%	34.8%	16.69
PT	6.8%		23.7%	3.4%	52.5%	10.2%	15.61
RO	57.1%	7.1%	45.2%	23.8%	16.7%	92.9%	14.57
RS	22.0%		84.7%	6.8%	40.7%	83.1%	16.92
SK	100%					100%	14.50
SI			94.4%	33.3%	66.7%	100%	17.28
ES	33.3%	0.7%	7.5%	9.0%	7.5%	56.6%	17.62
SE	15.4%	3.8%	7.7%	11.5%	3.8%	11.5%	10.19
TR	17.2%	6.9%	48.3%	48.3%	10.3%	79.3%	11.10
UK	25.5%	7.3%	10.9%	70.9%	18.2%	89.1%	9.15

n.a.: not available (the number of OVs in the country was not provided).

Austria (AT), Belgium (BE), Croatia (HR), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (GR), Italy (IT), Ireland (IE), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES), Sweden (SE); Non-EU countries: Albania (AL), Bosnia and Herzegovina (BA), Montenegro (ME), North Macedonia (MK), Serbia (RS), and Turkey (TK); European Free Trade Association countries: Iceland (IS), Norway (NO), and the United Kingdom (UK).

Empty cells correspond to 0%.

Table 2

Socio-demographic characteristics of official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No		Yes		Total N = 1786[a]		
	N = 172		N = 1606				
	n	%	n	%	n	%	
Nationality							<0.001
EUEF	8	4.8%	1592	99.5%	1602	90.6%	
Sex							0.045
Male	107	62.2%	850	52.9%	961	53.9%	
Female	65	37.8%	745	46.4%	8124	45.5%	
Prefer not to say	0	0.0%	11	0.7%	11	0.6%	
Age							0.061
Mean ± SD	47.6	±9.3	48.8	±11.1	48.7	±10.9	
Min. – Max.	27–64		23–77		23–77		

Total for each variable may not sum to the sample size due to missing data.

[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.

[b] P-value for the comparison between non-EUEF and EUEF countries.

possible stay at the slaughter facilities play important roles (Schüne-mann et al., 2021).

The data on qualifications obtained by the OVs who participated in the survey are presented in Table 3. The vast majority (>74%) of the study population indicated DVM (doctor of veterinary medicine) as the highest academic degree, which was acquired, on average, 23 years ago. Only a minority of 16% held an MSc (master of science) and 10% a PhD (doctor of philosophy) degree. A statistically significantly higher proportion of OVs with a PhD degree was registered in the EUEF countries. In the overall dataset, 36% of the respondents held a national specialisation diploma and merely 4% a European one (European Board of Veterinary Specialisation – EBVS), while the majority (>58%) held no such diploma at all. The questionnaire used in this study, however, did not require any further clarifications or the exact title of any kind of specialisation diploma to be provided by the respondents. Therefore, national specialisation diplomas could likely stand for any degree certificate awarded by Veterinary Schools or Faculties to licensed OVs after the completion of post-graduate specialist studies in fields relevant to hygiene and technology of food of animal origin. In terms of European specialisation diplomas and according to the figures available on the

Table 3

Qualification data of official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No		Yes		Total		
	N = 172		N = 1606		N = 1786[a]		
	n	%	n	%	n	%	
Years since DVM							0.043
Mean ± SD	21.4	±8.9	22.6	±11.3	22.5	±11.1	
Min. – Max.	2–39		0–53		0–53		
Highest academic degree							0.001
DVM	148	86.0%	1184	73.7%	1335	74.8%	
MSc	18	10.5%	258	16.1%	278	15.6%	
PhD	6	3.5%	164	10.2%	171	9.6%	
Specialisation diploma[c]							
National	28	16.3%	609	37.9%	640	35.9%	<0.001
European	4	2.3%	25	1.6%	29	1.6%	0.659
Other	2	1.2%	53	3.3%	55	3.1%	0.192
No	140	81.4%	953	59.3%	1093	61.4%	<0.001
Previous experience required to be OV							<0.001
	131	76.2%	443	27.6%	578	32.4%	
Entity responsible for specific training to become OV [c]							
University	28	16.3%	289	18.0%	317	17.8%	0.652
National Vet. Authority	61	35.5%	565	35.2%	626	35.2%	1.000
Other	15	8.7%	110	6.8%	125	7.0%	0.449
Duration of the training (Median IQR)							n.a.
Hours	6 (N = 10)	5–6	20 (N = 112)	10–72	16 (N = 122	8–50	
Weeks	3 (N = 11)	1.5–3	3 (N = 283)	2–4	3 (N = 295)	2–4	
Months	6 (N = 21)	5–12	6 (N = 1992)	3–7	6 (N = 221)	3–8	
Years	5 (N = 14)	3–7	3 (N = 177)	2–5	3 (N = 191)	2–5	
Specific exam to become an OV							
	137	79.7%	754	46.9%	895	50.2%	<0.001

Total for each variable may not sum to the sample size due to missing data.

IQR: interquartile range = Percentile 25 – Percentile 75; n.a.: not applicable.

[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.

[b] P-value for the comparison between non-EUEF and EUEF countries.

[c] The sum may exceeds 100% due to multiple choices.

official EBVS website (https://ebvs.eu/colleges/ECVPH), among the 4000 veterinarians active as European Veterinary Specialist™, merely 168 veterinarians (4%) originating from 25 European countries are currently active Diplomates of the European College of Veterinary Public Health (ECVPH) in both its subspecialties, Food Science and Population Medicine. The ECVPH curriculum by definition includes dedicated clusters covering all the pre-harvest, harvest and post-harvest levels of the food of animal origin production chains (https://ecvph. org/residency-and-training), and is extremely relevant to the professional tasks undertaken by OVs. Therefore, it can be anticipated that the OVs aiming to become acknowledged European specialists are more likely to enrol in the ECVPH residency instead of choosing another veterinary specialisation. In this case, the EBVS figures regarding the total number of ECVPH specialists are in accordance with the equally low percentage of European specialisation diplomas reported by the OVs participating in this survey. However, OVs holding specialisation diplomas from colleges other than ECVPH could also be present in the study sample.

Previous professional experience as a veterinarian was reported as a requirement to enter the OV career by 32% of the overall study population and, particularly, by a statistically significantly higher proportion of OVs from non-EUEF (76%) compared to EUEF (28%) countries (Table 3). This professional experience was specifically reported as a prerequisite by the vast majority of respondents (>80%) from Bosnia & Herzegovina, Croatia, Estonia, Montenegro, Serbia and Slovenia (Table 1). Moreover, a mandatory examination to enter the OV career was reported as a requirement by overall 80% of the OVs from non-EUEF compared to 47% from EUEF countries, and this difference was statistically significant (Tables 1 and 3). All the respondents (100%) from only five countries (Albania, Czech Republic, Montenegro, Slovakia and Slovenia) uniformly reported a specific exam to become an OV as obligatory (Table 1). These findings collectively indicate the prospect of entering the OV career sooner in EUEF than in non-EUEF countries.

Specific training to become an OV in the country of employment was not a prerequisite for all the respondents. Only 35% of the respondents referred to a national Veterinary Authority as the entity responsible for OV-specific training, followed by a university (18%) (Table 3). However, the responses suggest that such training is rather country-dependent since a high level of heterogeneity was observed between the countries (Table 1). The duration of the OV-specific training, when reported, varied from a few hours to years among respondents, also indicating a high heterogeneity among responses (Table 3). The results of this study, thus, indicate a non-homogeneous approach across Europe on the terms and conditions of specific training to become an OV. This could be related to the period that the respondents entered their careers, since the average length of experience of the OVs who participated in this study was 15 years, while the EU legal requirements on OV training are relatively recent (Table 4). Therefore, a DVM degree obtained on average more than 22 years ago, could suffice for many respondents in the past to enter the OV career due to the absence of any mandatory training (Lundén et al., 2007). However, the observed diversity in specific training requirements could also be justified even nowadays, at least partly, by the variety of approaches that the CAs in the EU can follow in order to verify that the minimum legislative requirements are met by candidate OVs on a case-by-case basis (European Commission, 2019a). For example, a few hours of training could be sufficient when the previous experience of an OV candidate provides objective evidence of it already having acquired at least the minimum competencies set by the EU legislation in the university training to obtain the DVM degree (Lundén et al., 2007; Smulders et al., 2012). In any case, amendments in the respective legislation in any country over the years and the various degrees of compliance with the given legislative requirements could, overall, explain the observed non-homogeneous approach in Europe and beyond on the terms and conditions to become an OV.

Table 4
Work experience of official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No N = 172		Yes N = 1606		Total N = 1786 [a]		
	n	%	n	%	n	%	
Years as an OV							0.224
Mean ± SD	14.6	±9.8	15.3	±10.7	15.2	±10.6	
Min. – Max.	0–39		0–48		0–48		
Type of establishment they work for [c]							
Cattle abattoir	81	47.1%	703	43.8%	785	44.0%	0.456
Pig abattoir	46	26.7%	796	49.6%	845	47.4%	<0.001
Small ruminant abattoir	39	22.7%	464	28.9%	505	28.3%	0.102
Poultry abattoir	25	14.5%	383	23.9%	408	22.9%	0.008
Farmed game abattoir	1	0.6%	128	8.0%	130	7.3%	<0.001
Soliped abattoir	0	0.0%	84	5.2%	84	4.7%	0.004
Lagomorph abattoir	0	0.0%	50	3.1%	50	2.8%	0.012[d]
Red meat plant	41	23.8%	345	21.5%	389	21.8%	0.541
Poultry meat plant	21	12.2%	199	12.4%	222	12.5%	1.000
Game meat plant	0	0.0%	113	7.0%	113	6.3%	<0.001
Fish plant	5	2.9%	91	5.7%	96	5.4%	0.178
Other	85	49.4%	395	24.6%	483	27.1%	<0.001

Total for each variable may not sum to the sample size due to missing data.
[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.
[b] P-value for the comparison between non-EUEF and EUEF countries.
[c] The sum exceeds 100% due to multiple choices.
[d] Fisher exact test.

3.2. Work experience and daily work

The respondents reported an average experience of 15 years as OVs without significant differences between individuals working in non-EUEF and EUEF countries (P = 0.224) (Table 4). Most frequently, OVs reported they work in pig (47%) and cattle abattoirs (44%). In the question relevant to the type of work establishment, the option "Other" was also available and was chosen by almost one-third of the respondents, who were asked to further specify the type. The responses for those "Other" types included positions in the food industry (i.e., cold store, meat, dairy or egg processing, prepared meals, food supplements, baby food), animal control (i.e., farm and disease monitoring, domestic slaughter, transport, semen and embryo collection centres, wildlife management), post-harvest control (i.e., restaurants and commercial catering, institutional collective canteens, supermarkets, consumer complaint management), border and airport control, export certification, office/central services and diagnostic laboratories.

The significantly lower number of OVs working in the pig sector in non-EUEF than in EUEF countries could be grounded in religious food practices. Muslim populations avoid the consumption of pork meat and based on numbers from the US State Department 2021 Report on International Religious Freedom, the Muslim population outnumbered the non-Muslim population in the non-EUEF countries included in this study by a factor of over 5 (Office of International Religious Freedom, 2022). The majority of OVs (around 65%) reported working full-time under different work conditions, that is either alone or in different team configurations (Table 5).

A larger proportion of OVs in the non-EUEF than in the EUEF countries reported working alone (P < 0.001). Age over 40 years was a significant predictor for OVs to be working alone (P < 0.003); however,

Table 5

Daily work of official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No N = 172		Yes N = 1606		Total N = 1786 [a]		
	n	%	n	%	n	%	
Time dedicated to OV tasks							<0.001
Full time	149	86.6%	1011	63.0%	1165	65.3%	
50%	14	8.1%	255	15.9%	270	15.1%	
Other	9	5.2%	340	21.1%	349	19.6%	
Work conditions[c]							
Alone	101	58.7%	456	28.4%	559	31.3%	<0.001
OVs	59	34.3%	623	38.8%	686	38.5%	0.285
OVs + OAs	10	5.8%	376	23.4%	386	21.6%	<0.001
OAs	1	0.6%	140	8.7%	141	7.9%	<0.001
Other	1	0.6%	43	2.7%	44	2.5%	0.118 [d]
Confidence – visual meat inspection[e]							0.426
Mean ± SD	3.46	±0.91	3.40	±1.11	3.41	±1.09	
Median IQR	4	3–4	4	3–4	4	3–4	
Confidence – having the resources to support risk-based meat inspection[e]							
Mean ± SD	3.40	±1.09	3.13	±1.21	3.15	±1.20	
Median IQR	3	3–4	3	2–4	3	2–4	0.001

Total for each variable may not sum to the sample size due to missing data.

IQR: interquartile range = Percentile 25 – Percentile 75.

[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.

[b] P-value for the comparison between non-EUEF and EUEF countries.

[c] The sum exceeds 100% due to multiple choices; Work conditions categories: Alone; OVs: Team with OVs; OVs + OAs: Team with OVs and Official Auxiliaries (OAs); OAs: Team with OAs; Other.

[d] Fisher exact test.

[e] Scale with five response options: 1 = not at all confident, 5 = extremely confident.

there was no difference in the age structure between the two groups of countries. Modernised meat inspection within the framework of Regulation (EU) 2019/627 allows the inclusion of official auxiliaries (OAs) in meat inspection (European Commission, 2019b), which may be a reason for the significantly greater number of OVs working in a team structure in the EUEF countries than in the non-EUEF countries (Table 5).

The median level of confidence in the application of VMI, when compared to traditional meat inspection, was 4 out of 5, with 5 being the highest in both groups of countries. A total of 18% of the participants reported not being confident with the results of VMI in comparison to traditional meat inspection (19% in EUEF versus 11% in non-EUEF, P = 0.008). This could be explained by the fact that VMI has been in force since 2014 for swine and 2019 for other species, following Regulations (EU) 219/2014 (repealed by 2017/625) and 2019/627 (EU, 2017; 2019b) respectively (Table 5). However, similar concerns and limitations on the practical application of VMI have been already reported (Laukkanen-Ninios et al., 2020).

Regarding the level of confidence in the resources to support RBMI (e.g., FCI) the median value was 3, and 29% of OVs reported not being confident (30% in EUEF versus 19% in non-EUEF countries, P = 0.004) (Table 5). This lack of confidence may be related to the fact that FCI frequently does not include valuable information to support risk-based decisions in AMI and PMI, such as HEIs regarding the most relevant hazards to meat inspection (Bonardi et al., 2021; Felin et al., 2016; Gomes-Neves et al., 2018; Laukkanen-Ninios et al., 2020).

3.3. Employment situation

The national veterinary authority was reported most frequently as the employer (77%) in the non-EUEF countries versus 31% in the EUEF

countries. Nearly 40% of the OVs employed in EUEF countries reported they work for the regional/municipal authorities, whereas this type of employer was indicated by only 11% of the respondents in non-EUEF countries (Table 6). This predominance of regional/municipal authorities is particularly relevant in countries where there is a strong regional administration, as in Germany, Poland or Spain. This is probably due to more pronounced regional competencies in EUEF countries when compared to a more centralised aggregation of competencies in the central national authorities of non-EUEF countries.

A private company/agency was more frequently reported as the current employer in the EUEF group of countries (25% vs. 11%). In the UK and some EU countries, such as Croatia and Poland, the responsibility for official controls is delegated to private companies or agencies. According to Article 28 of Regulation (EU) 2017/625, "Competent authorities may delegate certain official control tasks to one or more delegated bodies or natural persons in accordance with the conditions provided for in Articles 29 and 30 respectively. The competent authority shall ensure that the delegated body or natural person, to which such tasks have been delegated, have the powers needed to effectively perform these tasks." (EU, 2017). In this case, delegated bodies are usually veterinary stations or veterinary practices on private property. For example, in Croatia, most OVs are so-called 'authorised veterinarians' because they work for veterinary stations - delegated bodies - to which the CA (State Inspectorate) has transferred the authority to carry out official controls. In this case, a contract is concluded between the state inspectorate and the delegated body for seven years with the conditions specified in Regulation (EU) 2017/625, as well as in the regulations adopted at the national level. A delegated body must function and be accredited in accordance with standards relevant to the delegated tasks. Accreditation is granted for a period of five years. The list of delegated bodies is public and available on the website of the Croatian Accreditation Agency. The transferred authority can be revoked before the expiration of 7 years in cases explicitly described in EU legislation, in the national legislation and in the contract (EU, 2017). CAs are also allowed to delegate certain official control tasks to one or more persons, but in line with the results of this study, none of the respondents mentioned this possibility, probably because it has not been materialised as yet in EUEF countries (EU, 2017).

This form of cooperation is described as a public-private partnership (PPP) (Rojas, 2018). These PPPs cover part of the animal health management performed by private actors and are normally carried out by official veterinary services. Delegated actions are expected to achieve equivalent results (or even better) than the ones achieved by the official veterinary authority PPP is a form of activity in line with a state policy decision to reduce staff capacities, cancel a certain group of activities, or improve activities in such a way as to involve the private sector. In non-EUEF countries, OVs predominantly work for the national veterinary authority and have a permanent contract. In contrast, a less homogeneous situation was observed in EUEF countries.

Approximately, 90% of the OVs in the non-EUEF countries reported having long-term/permanent contracts, while in EUEF countries such contracts were held by 67% of the respondents. Only OVs from EUEF countries selected the option "other" (14%), and this includes veterinarians hired as OVs for specific tasks, e.g., for animal health control or meat inspection in hunting seasons. With a median level of satisfaction of 4 out of 5, employment satisfaction was high among respondents in both groups of countries (Table 6), in line a previous study (Wojtacka et al., 2020). This level of satisfaction amongst OVs is considerably higher than the medium satisfaction (5 out of 10) reported by FVE in their survey amongst European veterinarians in general (FVE, 2019). Nonetheless, dissatisfaction with employment was reported by 15% of the OVs, without significant differences between OVs working in EUEF or non-EUEF countries (15.1% in EUEF versus 11.7% in non-EUEF, P = 0.276).

Generally, very few data are available on the pay structure of OVs. In a 2021 survey, the German Veterinary Association concluded that there

Table 6
Employment situation of official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No N = 172		Yes N = 1606		Total N = 1786 [a]		
	n	%	n	%	n	%	
Current employer							<0.001
National veterinary authority	131	76.6%	487	30.5%	621	35.0%	
Regional/municipal authority	19	11.1%	646	40.4%	666	37.5%	
Private company/agency	18	10.5%	406	25.4%	425	23.9%	
Other	3	1.8%	60	3.8%	64	3.6%	
Type of contract							<0.001
Long term/permanent	156	90.7%	1050	66.9%	1209	68.9%	
Short term/temporary	16	9.3%	301	19.1%	318	18.1%	
Other	0	0.0%	226	14.3%	227	12.9%	
Satisfaction in the employment[c]							0.002
Mean ± SD	3.83	±1.09	3.56	±1.02	3.59	±1.03	
Median IQR	4	3–5	4	3–4	4	3–4	

Total for each variable may not sum to the sample size due to missing data.
IQR: interquartile range = Percentile 25 – Percentile 75.
[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.
[b] P-value for the comparison between non-EUEF and EUEF countries.
[c] Scale with five response options: 1 = not at all satisfied, 5 = extremely satisfied.

Table 7
Continuing education of official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No N = 172		Yes N = 1606		Total N = 1786 [a]		
	n	%	n	%	n	%	
Frequency of training opportunities							<0.001
Regular	105	61.4%	1121	70.3%	1230	69.5%	
Sporadic	34	19.9%	325	20.4%	361	20.4%	
Rare	20	11.7%	119	7.5%	139	7.8%	
Never	12	7.0%	29	1.8%	41	2.3%	
Last training activity							0.044
Less than 1 year	109	64.5%	1098	69.3%	1212	68.9%	
Between 1 and 5 years	44	26.0%	414	26.1%	458	26.0%	
More than 5 years	11	6.5%	45	2.8%	57	3.2%	
Other	5	3.0%	28	1.8%	33	1.9%	
Entity responsible for training[c]							
University	35	20.7%	251	16.2%	288	16.7%	0.162
National Veterinary Authority	133	78.7%	1157	74.5%	1294	74.9%	0.271
European Union	47	27.8%	296	19.1%	345	20.0%	0.009
Other	20	11.8%	333	21.4%	355	20.5%	0.005
Satisfaction – training activities[d]							<0.001
Mean ± SD	4.08	±0.84	3.56	±0.96	3.61	±0.96	
Median IQR	4	3–4	4	3–4	4	3–4	
Experience as a trainer							<0.001
Regular	15	8.9%	303	19.2%	318	18.2%	
Sporadic	20	11.8%	461	29.3%	485	27.7%	
Rare	9	5.3%	118	7.5%	127	7.3%	
Never	125	74.0%	694	44.0%	821	46.9%	
Preferred training methodology[c]							
Face to face lectures	93	55.7%	956	60.5%	1052	60.0%	0.267
Online lectures	18	10.8%	510	32.3%	530	30.2%	<0.001
On-site practical sessions	113	67.7%	949	60.1%	1065	60.8%	0.067
Books/manuals	22	13.2%	210	13.3%	233	13.3%	1.000
Other	1	0.6%	26	1.6%	27	1.5%	0.507[e]

Total for each variable may not sum to the sample size due to missing data.
IQR: interquartile range = Percentile 25 – Percentile 75.
[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.
[b] P-value for the comparison between non-EUEF and EUEF countries.
[c] The sum exceeds 100% due to multiple choices.
[d] Scale with five response options: 1 = not at all satisfied, 5 = extremely satisfied.
[e] Fisher exact test.

are considerable gaps in the pay structure. OVs who are employed on a per-hour basis in the control of small abattoirs with less than 1000 animals/year could not charge for tasks controlling animal welfare or the supervision of slaughter hygiene during the slaughter process. Therefore in smaller abattoirs, OVs were not present during slaughter, making supervision of animal welfare and slaughter hygiene a function of the throughput of the abattoir (Schünemann et al., 2021). Whether these effects are mirrored in other EU MS could not be determined from the data presented here.

3.4. Continuing education and training topics

The responses regarding continuing education were very similar between the two groups of countries (Table 7). For 70% of the respondents, the frequency of training opportunities was regular, and 69% reported that the last training activity was less than one year ago (Table 7). This could be explained by the need for adequate knowledge of the new legislation on official controls in the food sector, primarily based on Regulation (EU) 2017/625 and its delegated and implementing acts (EU, 2017; 2019a; 2019b). Indeed, the new legislation on official controls was reported as one of the topics already included in the OV's training and, in cases not included, it was the most training frequently required by the respondents (Table 8). While a total of 60% of respondents reported preferring lectures face-to-face and on-site practical sessions to online lectures (Table 7), the value of online courses and virtual platforms was also recognised (Table 7). National veterinary authorities were the entities most frequently responsible for OV training, with universities and the EU (e.g., BTSF) exhibiting a minor input. Notably, this EU initiative on training was more relevant in non-EUEF countries (Table 7).

The most requested topics for future training were the new legislation on official controls, zoonotic and emerging diseases and risk-based meat inspection, which were indicated, respectively, by 64% for the first two and 62% of the respondents (Table 8). As most of the respondents expressed the need for an update on zoonotic and emerging diseases, a

stronger involvement of academic institutions that are leading the research in this field could be useful. Animal welfare was reported as a topic of interest in future training, albeit already addressed in continuing education (Table 8). Many respondent OVs also requested more training on MSAS and chemical hazards, which requires researchers from academia or other scientific entities to act as their trainers (Bonardi & Belluco, 2023; Swedish National Food Agency, 2018). Concerning the need for future training, particular interest was given to some topics in the meat inspection sector, i.e., HEIs for the most important foodborne zoonotic diseases, animal welfare assurance and, above all, VMI and the concepts of RBMI (Table 8). The need for training on the role and implementation of FCI was highlighted by almost half of the respondents, thus emphasising that FCI is perceived as a key tool in the whole inspection process that requires updating and attention (Bonardi et al., 2021; Gomes-Neves et al., 2018). Other topics pointed out as important in future training activities were microbiological criteria, antimicrobial resistance, biosecurity, by-products, new technologies in the food industry, and administrative or certification procedures. This reflects the wideness of the fields where the OVs develop their activity and the awareness of this professional class of the upcoming challenges. Indeed, OVs' training should be based on integrating expertise between universities, national veterinary authorities, food industry associations and the EU authorities to fully cover all aspects of their profession (Lundén et al., 2007; Ortega et al., 2007; Seguino et al., 2021; Smulders et al., 2012). Regarding the training attended, 12% were unsatisfied, with a significantly greater proportion among those working in EUEF (13% versus 4% in non-EUEF countries, $P = 0.001$) (Table 7). Insufficient training in AMI and PMI, in work with legal acts and risk analysis has been previously reported and should be adequately addressed (Wojtacka et al., 2020).

Despite their experience as health officers working for the national veterinary authorities for an average period of 15 years, most of the respondents were never or only rarely involved as trainers for other colleagues (Table 7). This situation seems to be at odds with the regular training opportunities that were reported. Organisational rules that do

Table 8
Training topics indicated by official veterinarians working in European countries and comparison between countries belonging to and outside the European Union (E), United Kingdom (U) or European free trade countries (EF).

	EUEF						P-value[b]
	No N = 172		Yes N = 1606		Total N = 1786 [a]		
	n	%	n	%	n	%	
Topics already included[b]							
New Legislation on Official Controls	90	53.6%	1160	75.4%	1255	73.3%	<0.001
Visual Inspection	52	31.0%	606	39.4%	659	38.5%	0.040
Food Chain Information	63	37.5%	535	34.8%	598	34.9%	0.539
Risk-based Meat Inspection	50	29.8%	513	33.4%	564	32.9%	0.393
Animal Welfare	123	73.2%	1179	76.7%	1306	76.3%	0.367
Harmonized Epidemiological Indicators	11	6.5%	97	6.3%	110	6.4%	1.000
Meat Safety Assurance System	28	16.7%	244	15.9%	273	15.9%	0.874
Zoonotic and emerging diseases	83	49.4%	687	44.7%	773	45.2%	0.276
Chemical Hazards	19	11.3%	196	12.7%	215	12.6%	0.682
Other	9	5.4%	76	4.9%	12	5.0%	0.961
Topics to be included[c]							
New Legislation on Official Controls	90	52.3%	1018	65.7%	1113	64.4%	<0.001
Visual Inspection	85	49.4%	827	53.4%	915	53.0%	0.368
Food Chain Information	78	45.3%	686	44.3%	766	44.3%	0.848
Risk-based Meat Inspection	93	54.1%	969	62.5%	1065	61.6%	0.038
Animal Welfare	64	37.2%	762	49.2%	829	48.0%	0.004
Harmonized Epidemiological Indicators	64	37.2%	645	41.6%	712	41.2%	0.302
Meat Safety Assurance System	105	61.0%	850	54.8%	958	55.4%	0.141
Zoonotic and emerging diseases	98	57.0%	973	65.7%	1072	62.0%	0.160
Chemical Hazards	69	40.1%	477	30.8%	548	31.7%	0.016
Other	4	2.3%	68	4.4%	73	4.2%	0.280

Total for each variable may not sum to the sample size due to missing data.
[a] Eight (8) respondents chose the option "Prefer not to answer" regarding the country of employment.
[b] P-value for the comparison between non-EUEF and EUEF countries.
[c] The sum exceeds 100% due to multiple choices.

not offer many OVs the possibility to act as a trainer for colleagues could also explain this situation, in spite of the clear advantages of using this resource (Lundén et al., 2007; Rahkio et al., 1995). Nevertheless, the situation will probably change rapidly because probationer OVs must be trained under the supervision of existing OVs in abattoirs, cutting plants and on holdings (European Commission, 2019a). In addition, when legislation is amended and rapid updating is needed, the training contribution of the OVs in a work team could be crucial (Lundén et al., 2007; Rahkio et al., 1995). In general, OVs could be involved in on-site practical training sessions, which were the preferred mode of training for more than two-thirds of the respondents, whereas face-to-face lectures, which were preferred by more than half of the OVs, could be more appropriate to be delivered by scientists or university teachers. Overall, 30% of OVs were in favour of online training, but in non-EUEF countries, this training opportunity was appreciated by only 11% of the respondents, who were much more oriented towards on-site practical lessons (68%) and face-to-face lectures (56%). The statistically significant difference between EUEF countries and the other countries (i.e., EU candidates) could probably indicate that in the latter, online training was perceived rather as a negative consequence of COVID-19 restrictions than as an opportunity to save time (Maatuk et al., 2022; OECD, 2020). The OVs working in both groups of countries considered the use of books and manuals of marginal importance, probably due to the online availability of scientific articles and legislative documents.

3.5. Final remarks and comments from respondents

The last open question asked to the respondents was relevant for any final remarks and comments, and it was completed by 8% (n = 146) of the OVs. Comments were obtained from OVs working in Spain (21%), Germany (9%), Poland and Croatia (8%), Greece (7%), Belgium, Italy, Portugal and Serbia (5%), Austria and France (4%), UK (2%), Netherlands, Norway and Turkey (1%), Finland, Czech Republic, Iceland, Ireland, North Macedonia and Romania (0.7%). Based on their content, comments were categorised into four groups. The first was related to the acknowledgement of the survey's initiative or the request for the results after publication. Indeed, some respondents voluntarily provided their contact information, despite the questionnaire being anonymous. The second and the third groups of comments were related, respectively, to ethical and professional concerns with procedures during work, and to work conditions or job satisfaction. The final group of comments was related to training needs.

Animal welfare in general and animal transport are at the top of the ethical concerns mentioned in the comments. The need to preserve small abattoirs and consider mobile slaughter are regarded as a means to protect animals. Regarding procedures and methods in the work development, OVs expressed their difficulties dealing with the simplification of AMI, VMI and the scarcity of resources to support RBMI, as already previously reported (Felin et al., 2016; Gomes-Neves et al., 2018; Laukkanen-Ninios et al., 2020). Particularly, FCI was mentioned as a valuable tool to be more explored and to have correspondent measures applied to those who do not follow the law concerning the administration of medication to the animals sent to slaughter. The comments point to the need for regular meetings between OVs to discuss current technical issues.

Considering work conditions and career satisfaction, the most frequent comment was the need to reinforce OVs by hiring more professionals and paying them better. Several respondents indicated their salary has not been increased for many years, in spite of the fact that OVs frequently work in shifts during night hours and on holidays and at weekends. The opportunity to get a permanent position is often not available, and OVs are hired on short-term contracts with no compensation for vacation or sickness, despite the fact that they frequently deal with public health hazards. This concern with public health and occupational hazards has already been reported previously (Wojtacka et al., 2020). OVs feel that there is a need to improve communication with the

CAs, the farmers and the food business operators due to the constant new demands in food law. Also, they suggest that for the improvement of veterinary inspection, there should be not only people with knowledge but also organisational skills in management positions. Respondents think the activity in meat hygiene appears to be socially and professionally very underestimated, especially given the importance of their role in public health, animal health and animal welfare protection.

Regarding training needs, respondents reported the need for life-long learning to fulfil the duties related to their OV positions. They were highly motivated to participate in continuing education courses. As reported previously, OVs have problems related to insufficient training in several topics and also declared a lack of preparation in coping with crisis situations (Wojtacka et al., 2020). However, in this study, while most respondents reported preferring face-to-face and on-site practical sessions to online lectures, many commented that they found it difficult or impossible to attend training during work hours due to a lack of substitute staff. The respondents stressed that many skills needed to perform their duties cannot be acquired online, but that continuing practical training is crucial. Still, the value of online courses and virtual platforms was recognised, in particular regarding flexible training hours and the opportunity to share experiences and training materials (e.g., videos, reading materials and links to relevant legislation). With regard to training opportunities provided by the EU (BTSF), many respondents emphasised that they found it problematic that these were offered mostly in English and that the few online courses offered in local languages were riddled with translation errors.

The limitations of this study have been acknowledged. First of all, data was obtained through voluntary participation, and this varied from 100% to 0.3% of the total number of OVs in each country. However, as this study included many European countries, the studied sample is likely to approximate the profile of the European OVs. Secondly, the questionnaire was filled in by relaying self-declared facts, but nevertheless, there is nothing to indicate that the respondents did not provide accurate data and personal perspectives.

Some reporting bias should also be considered, mainly in questions related to work experience, employment satisfaction, training needs and comments. It is possible that the most professionally engaged and experienced OVs might have been more prone to respond. Nevertheless, this study obtained the views of European OVs on their own situations and careers.

4. Conclusions

The data obtained from this survey enabled the first characterisation of OVs throughout Europe. OVs are a highly qualified professional group, and country-related and probably age-related differences were detected in previous training and experience requirements to enter the OV career. The average age of this professional group is rather high and should be a matter of concern for the CAs or the delegated bodies. Legal requirements on official controls, emphasising the role of OVs as risk managers, point to the need to maintain and reinforce this professional group with new training elements. OVs undertake a wide diversity of tasks in several types of establishments, from animal health to meat inspection, from food industry control to certification, from canteens to restaurants and supermarkets, dealing with animal producers, food business operators and consumers. This breadth of tasks must be carefully considered when planning specific training and continuing education. Our study identified on-site practical sessions as the most preferred methodology for training. Currently, OVs normally do not function as regular trainers, but their experience and knowledge could be utilised more in future on-site practical training.

In the context of RB-MSAS, and regarding specific questions on the modernisation of meat inspection, OVs do not feel totally confident they can support RBMI based on the currently available resources, a matter that should be addressed by the CAs. Accordingly, the topics considered of interest in future training were RBMI, MSAS and relevant components

(e.g., FCI and HEIs), as well as chemical hazards. Training in these fields could benefit from enhanced collaboration between universities/academia and the entities responsible for continuing education, such as the CAs and the EC. The development of an online platform was requested by the respondents and could make an essential contribution to the sharing of experiences and training materials. Regular future surveys targeting OVs in order to update their training needs would also be beneficial.

Ethics declaration

The questionnaire used in the survey was approved by the Ethics Committee of the CHP-ICBAS, University of Porto, Portugal ref. 2021/CE/P027 (P367/CETI/ICBAS).

CRediT authorship contribution statement

Eduarda Gomes-Neves: Conceptualization, Methodology, Supervision, Project administration, Data curation, Writing – original draft, Writing – review & editing. **Margarida F. Cardoso:** Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Thomai Lazou:** Questionnaire design, translation and dissemination, Writing – review & editing. **Brigita Hengl:** Questionnaire design, translation and dissemination, Writing – review & editing. **Silvia Bonardi:** Questionnaire design, translation and dissemination, Writing – review & editing. **Bojan Blagojevic:** Questionnaire design, translation and dissemination, Writing – review & editing, Funding acquisition. **Claudia Guldiman:** Questionnaire design, translation and dissemination, Writing – review & editing, Methodology, Funding acquisition. **Sophia Johler:** Questionnaire design, translation and dissemination, Writing – review & editing.

Declaration of competing interest

The authors have read and approved the revised version submitted. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The questionnaire used in the survey was approved by the Ethics Committee of the CHP-ICBAS, University of Porto, Portugal ref. 2021/CE/P027 (P367/CETI/ICBAS).

Data availability

The data that has been used is confidential.

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References

Antunović, B., Blagojević, B., Johler, S., Guldimann, C., Vieira-Pinto, M., Vågsholm, I., Meemken, D., Alveseike, O., Georgiev, M., & Alban, L. (2021). Challenges and opportunities in the implementation of new meat inspection systems in Europe. In *Trends in food science and technology* (Vol. 116, pp. 460–467). Elsevier Ltd. https://doi.org/10.1016/j.tifs.2021.08.002.

Bonardi, S., & Belluco, S. (2023). Working Group 1-Scope and targets of meat safety assurance DELIVERABLE REPORT ON SCOPE OF MEAT SAFETY ASSURANCE SYSTEM AND COMPETENCIES AND ROLES OF RISK MANAGER. https://ribmins.com/wp-content/uploads/2023/02/RIBMINS-WG1-Deliverable.pdf.

Bonardi, S., Blagojevic, B., Belluco, S., Roasto, M., Gomes-Neves, E., & Vågsholm, I. (2021). Food chain information in the European pork industry: Where are we?. In *Trends in food science and technology* (Vol. 118, pp. 833–839) Elsevier Ltd. https://doi.org/10.1016/j.tifs.2021.10.030.

EFSA. (2011). Technical specifications on harmonised epidemiological indicators for public health hazards to be covered by meat inspection of swine. *EFSA Journal, 9*(10), 2371. https://doi.org/10.2903/J.EFSA.2011.2371

EFSA. (2012). Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of poultry. *EFSA Journal, 10*(6), 2764. https://doi.org/10.2903/J.EFSA.2012.2764

EFSA. (2013a). Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of bovine animals. *EFSA Journal, 11*(6), 3276. https://doi.org/10.2903/J.EFSA.2013.3276

EFSA. (2013b). Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of domestic sheep and goats. *EFSA Journal, 11*(6), 3277. https://doi.org/10.2903/j.efsa.2013.3277

EFSA. (2013c). Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of domestic solipeds. *EFSA Journal, 11*(6), 3268. https://www.efsa.europa.eu/en/efsajournal/pub/3268.

EFSA. (2013d). Technical specifications on harmonised epidemiological indicators for biological hazards to be covered by meat inspection of farmed game. *EFSA Journal, 11*(6), 3267. https://doi.org/10.2903/J.EFSA.2013.3267

EFSA Panel on Biological Hazards [BIOHAZ]. (2011). Scientific Opinion on the public health hazards to be covered by inspection of meat (swine). *EFSA Journal, 9*(10), 2351. https://doi.org/10.2903/j.efsa.2011.2351

EFSA Panel on Biological Hazards [BIOHAZ]. (2013a). Scientific Opinion on the public health hazards to be covered by inspection of meat from sheep and goats. *EFSA Journal, 11*(6), 3265. https://doi.org/10.2903/J.EFSA.2013.3265

EFSA Panel on Biological Hazards [BIOHAZ]. (2013b). Scientific Opinion on the public health hazards to be covered by inspection of meat (bovine animals). *EFSA Journal, 11*(6), 3266. https://doi.org/10.2903/j.efsa.2013.3266

EFSA Panel on Biological Hazards (BIOHAZ). (2013c). Scientific Opinion on the public health hazards to be covered by inspection of meat from farmed game. *EFSA Journal, 11*(6), 3264. https://doi.org/10.2903/J.EFSA.2013.3264

EFSA Panel on Biological Hazards [BIOHAZ]. (2013d). Scientific Opinion on the public health hazards to be covered by inspection of meat (solipeds). *EFSA Journal, 11*(6), 3263. https://doi.org/10.2903/J.EFSA.2013.3263

EFSA Panel on Biological Hazards [BIOHAZ], EFSA Panel on Contaminants in the Food Contaminants [CONTAM], EFSA Panel Animal Health and Welfare [AHAW]. (2012). Scientific Opinion on the public health hazards to be covered by inspection of meat (poultry). *EFSA Journal, 10*(6), 2741. https://doi.org/10.2903/J.EFSA.2012.2741

EU. (2017). Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products amending Regulations (EC) No 999/2001, (EC) No 396/2005, (EC) No 1069/2009, (EC) No 1107/2009, (EU) No 1151/2012, (EU) No 652/2014, (EU) 2016/429 and (EU) 2016/2031 of the European Parliament and of the Council, Council Regulations (EC) No 1/2005 and (EC) No 1099/2009 and Council Directives 98/58/EC, 1999/74/EC, 2007/43/EC, 2008/119/EC and 2008/120/EC, and repealing Regulations (EC) No 854/2004 and (EC) No 882/2004 of the European Parliament and of the Council, Council Directives 89/608/EEC, 89/662/EEC, 90/425/EEC, 91/496/EEC, 96/23/EC, 96/93/EC and 97/78/EC and Council Decision 92/438/EEC (Official Controls Regulation). *Official Journal L, 95*, 1–142.

EU. (2019a). Commission Delegated Regulation (EU) 2019/624 of 8 February 2019 concerning specific rules for the performance of official controls on the production of meat and for production and relaying areas of live bivalve molluscs in accordance with Regulation (EU) 2017/625 of the European Parliament and of the Council. *Official Journal L, 131*, 1–17.

EU. (2019b). Commission Implementing Regulation (EU) 2019/627 of 15March 2019 laying down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption in accordance with Regulation (EU) 2017/625 of the European Parliament and of the Council and amending Commission Regulation (EC) No 2074/2005 as regards official controls. *Official Journal L, 131*, 51–100.

EUROSTAT. (2021). In *Key figures on Europe 2021 edition*. https://ec.europa.eu/eurostat/documents/3217494/13394938/KS-EI-21-001-EN-N.pdf/ad9053c2-debd-68c0-2167-f2646efeaec1?t=1632300620367.

Felin, E., Jukola, E., Raulo, S., Heinonen, J., & Fredriksson-Ahomaa, M. (2016). Current food chain information provides insufficient information for modern meat inspection of pigs. *Preventive Veterinary Medicine, 127*, 113–120. https://doi.org/10.1016/j.prevetmed.2016.03.007

Ferri, M., Blagojevic, B., Maurer, P., Hengl, B., Guldimann, C., Mojsova, S., Sakaridis, I., Antunovic, B., Gomes-Neves, E., Zdolec, N., Vieira-Pinto, M., & Johler, S. (2023). Risk based meat safety assurance system – an introduction to key concepts for future training of official veterinarians. *Food Control, 146*. https://doi.org/10.1016/j.foodcont.2022.109552

FVE. (2019). Survey of the veterinary profession in Europe. https://fve.org/cms/wp-content/uploads/FVE_Survey_2018_WEB.pdf.

Gomes-Neves, E., Müller, A., Correia, A., Capas-Peneda, S., Carvalho, M., Vieira, S., & Cardoso, M. F. (2018). Food chain information: Data quality and usefulness in meat inspection in Portugal. *Journal of Food Protection, 81*(11), 1890–1896. https://doi.org/10.4315/0362-028X.JFP-18-266

Jamieson, S. (2004). Likert scales: How to (ab)use them. *Medical Education, 38*(12), 1217–1218. https://doi.org/10.1111/J.1365-2929.2004.02012.X

Swedish National Food Agency (NFA), U. S, Langerholc, T., Lindqvist, R., & Sand, S. (2018). Risk ranking of chemical and microbiological hazards in food. *EFSA Journal, 16*(S1). https://doi.org/10.2903/J.EFSA.2018.E160813

Laukkanen-Ninios, R., Rahkila, R., Oivanen, L., Wirta, E.-R., & Fredriksson-Ahomaa, M. (2020). Views of veterinarians and meat inspectors concerning the practical application of visual meat inspection on domestic pigs in Finland. *Journal of Consumer Protection and Food Safety, 15*, 5–14. https://doi.org/10.1007/s00003-019-01265-x

Lundén, J., Björkroth, J., & Korkeala, H. (2007). Meat inspection education in Finnish veterinary curriculum. *Journal of Veterinary Medical Education, 34*(2), 205–211. https://doi.org/10.3138/jvme.34.2.205

Maatuk, A. M., Elberkawi, E. K., Aljawarneh, S., Rashaideh, H., & Alharbi, H. (2022). The COVID-19 pandemic and E-learning: Challenges and opportunities from the perspective of students and instructors. *Journal of Computing in Higher Education, 34*(1), 21–38. https://doi.org/10.1007/s12528-021-09274-2

OECD. (2020). The potential of online learning for adults: Early lessons from the COVID-19 crisis (OECD). *OECD.* http://www.oecd.org/coronavirus/policy-responses/the-potential-of-online-learning-for-adults-early-lessons-from-the-covid-19-crisis-ee040002.

Office of International Religious Freedom. (2022). 2021 Report on international religious freedom - United States department of state. https://www.state.gov/reports/2021-report-on-international-religious-freedom/.

Ortega, C., Parilla, G., De Balogh, K., De Rosa, M., Gimeno, O., Estol, L., Dobosh, D., Leguia, G., Falcon, N., Fonseca, A., Torres, M., Caballero, M., Quiros, J., Vilhena, M. C., Villamil, L. C., Cediel, N., & De Meneghi, D. (2007). New approaches for education and training in veterinary public health: The SAPUVET projects. *Journal of Veterinary Medical Education, 34*(4), 492–496. https://doi.org/10.3138/JVME.34.4.492

Rahkio, M., Uutela, A., & Korkeala, H. (1995). Motivation and characterization of Finnish meat inspection veterinarians. *Acta Veterinaria Scandinavica, 36*.

Rojas, H. (2018). The role of private veterinarians in official veterinary service programmes: Mechanisms for interaction, accreditation and quality control in a globalised world. https://doi.org/10.20506/TT.2932.

RS. (2005). Law on veterinary matters passed by national parliament of the Republic of Serbia, official gazette of Republic of Serbia, No.91/05. https://fsvps.gov.ru/fsvps-docs/ru/importExport/serbia/files/1-Law-on-Veterinary-Matters.pdf.

Schünemann, R., Wullinger, E., Failing, K., Langen, M., Mersmann, C., & Feldhusen, F. (2021). Quo vadis amtliche Schlachttier- und Fleischuntersuchung? *Auswertung einer BTK Umfrage. Deutsches Tierärzteblatt.* https://www.bundestieraerztekammer.de/btk/dtbl/archiv/artikel/1/2021/quo-vadis-amtliche-schlachttier-und-fleischuntersuchung.

Seguino, A., Braun, P. G., Del-Pozo, J., Soare, C., Houf, K., & Baillie, S. (2021). Evaluation of a harmonized undergraduate catalog for veterinary public health and food hygiene pedagogy in Europe. *Journal of Veterinary Medical Education.* https://doi.org/10.3138/jvme-2021-0061

Smulders, F. J. M., Buncic, S., Fehlhaber, K., Huey, R. J., Korkeala, H., Prieto, M., & Steinhauserova, I. (2012). Toward harmonization of the european food hygiene/veterinary public health curriculum. *Journal of Veterinary Medical Education, 39*(2), 169–179. https://doi.org/10.3138/jvme.0711.078R

Statista Research Department. (2022). Median age of the global labor force by region and gender 2019. *Stat.* https://www.statista.com/statistics/996588/median-age-global-labor-force-region-gender/.

Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics with S* (Fourth). Springer. https://www.stats.ox.ac.uk/pub/MASS4/.

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis* (2nd ed.). Springer International Publishing. https://doi.org/10.1007/978-0-387-98141-3. Springer New York.

Wickham, H., François, R., Henry, L., Müller, K., & Vaughan, D. (2023). *Dplyr: A grammar of data manipulation*.

Wojtacka, J., Wysok, B., & Szteyn, J. (2020). Analysis of the factors influencing veterinary food inspectors in Poland. Animals: An open access. *Journal from MDPI, 10*(5). https://doi.org/10.3390/ANI10050884