



# Distribution analysis of ECTS credits allocated to physical training sciences and methodology (M-EDF/01) and sport sciences and methodology (M-EDF/02) in Italian master's degree programs in exercise and sport sciences

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## Abstract

**Purpose** In Italy, the 2021 sports reform recognized the professional figure of kinesiologist, with its related specializations. Three master's degrees in Exercise and sport sciences (ESS) are offered by Italian high institutions with different purpose and distribution of the European credit transfer system (ECTS) credits. Those allocated to ESS area can be divided in two specific academic disciplines (ADs): physical training sciences and methodology (M-EDF/01) and sport sciences and methodology (M-EDF/02). The aim was twofold: first, to provide the exact measure of the ECTS credits distribution allocated to ESS area, both aggregated that disaggregated by M-EDF/01 and M-EDF/02 ADs, in the three different master's degrees in ESS; second, to investigate their differences, to check their consistency with the professional profiles of kinesiologist.

**Methods** The sample consisted of all the Italian master's degree in ESS in 2022. The total no. of ECTS credits allocated to ESS area, both aggregated that disaggregated by M-EDF/01 and M-EDF/02 ADs, were collected through University portal. Descriptive statistics and one-way ANOVA were performed to analyze data.

**Results** A great degree of heterogeneity within the same of degree course was found. The problem was not about the differences between the no. of ECTS credits allocated to ESS area among different degree courses, but within the same degree courses. From the scatter indices, the unevenness of the distribution of ECTS credits within the same degree courses and, consequently, the unrepresentativeness of the average, emerged.

**Conclusions** The heterogeneity of ECTS credits distribution allocated to ESS area (both aggregated and disaggregated by ADs), generate different undergraduate education, which varies according to the University at which one enrolls. Systemic action is needed to ensure the same education to students that choose the same master's degree course but in different sites.

**Keywords** Core curricula · Sports reform · Kinesiologist of preventive and adapted physical activities · Sports kinesiologist · Sports manager

## Abbreviations

ADs Academic disciplines  
ECTS European credit transfer system

ESS Exercise and sport sciences  
ISTAT Italian National Institute of Statistics  
LM47 Master's degree in sports management

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LM67	Master's degree in preventive and adaptive physical activity
LM68	Master's degree in sport sciences and technique
M-EDF/01	Physical training sciences and methodology
M-EDF/02	Sport sciences and methodology
MUR	Ministry of Universities and Research

## Introduction

In Italy, the recent legislative innovations in Exercise and sport sciences (ESS) are focused on the new professional figures of sports kinesiologist, preventive and adapted physical activities kinesiologist, and sports manager, as well as the compulsory teaching of physical education in primary school [1]. This significantly changes the rationale behind the construction of the curricula of individual degree courses. Specifically, the 2021 sports reform [2] recognized the new professional figure of the basis kinesiologist that can be achieved through the bachelor's degree in ESS. Then, the reform involved the introduction of three specialized figures, achievable through three master's degree courses, that differ in both purposes and education. First, the figure of sports kinesiologist, an expert in sports performance, achievable through the master's degree in Sport sciences and techniques (LM68), was introduced. According to Legislative Decree no. 36 art. 41 c.4, as well as its correction and integration [3], the exercise of the professional figure of the sports kinesiologist has as its object the *"planning, coordination and technical direction of athletic preparation activities in the competitive sphere up to the highest levels of competition for sports associations and clubs, sports promotion bodies, institutions and specialized centers, personalized physical and technical preparation aimed at individual and team competitiveness"* [2]. Second, there was the kinesiologist of preventive and adapted physical activities, an expert in prevention and exercise for individuals with different characteristics, achievable through the master's degree course in preventive and adapted physical activities (LM67). According to art. 41 c.3, the exercise of the professional figure of the kinesiologist of preventive and adapted physical activities, later also including *"of structured physical exercise individually and to groups of people"* [2] has as its object *"the conduct, management and evaluation of individual and group physical activities of a compensatory, educational, recreational and sporting nature, aimed at the maintenance and recovery of the best conditions of physical wellbeing in the various age groups, through the promotion of active lifestyles"* [2]. Finally, there was the sports manager, achievable through the master's degree course in Sports management (LM47). According to art. 41 c.5, the professional activity of sports manager has as its object *"the planning and*

*management of sports facilities; the management of public and private facilities in which physical activities, including recreational activities, take place; the organization, as an expert and consultant, of sports events, including recreational activities"* [2]. From these guidelines it is possible to summarize that the sports kinesiologist is the ideal professional figure to perform activities in sports field, the kinesiologist of preventive and adapted physical activities in prevention and wellbeing, and the sports manager in the management, organization and conduct of both physical and sports activities.

Before this reform, the ESS graduate was not considered a professional figure, and the related activities were performed by unqualified individuals [4]. For this reason, each University established and activated individual master's degree courses, exclusively based on the professions identified by the Italian National Institute of Statistics (ISTAT) [5]. For each degree course, the Ministry of Universities and Research (MUR) provided general criteria to define the curricula for all Universities [6, 7], declined in terms of qualifying educational objectives and disciplinary areas. The disciplinary area related to ESS was made up of two specific academic disciplines (ADs): physical training sciences and methodology (M-EDF/01), focused on developing and teaching theories, techniques and methods for physical education both in general and for particular age groups or classes, and sport sciences and methodology (M-EDF/02), focused on developing and teaching theories, techniques and methods for training different sports activities, assessment and sports performance [8]. To each master's degree, a variable number of the European credit transfer system (ECTS) credits [9], for a total of 120 in all thematic areas, can be allocated. As a result, since each University had its own educational autonomy [10], they had developed their own general criteria and then distributed ECTS credits in different disciplinary areas as they preferred, leading to the heterogeneity of degree courses among Universities. This could have strong repercussions on the future careers of master's degree graduates. Casolo et al. [8] noted a high heterogeneity among the curricula of master's degree courses in ESS [11, 12], because the percentage of ECTS credits allocated to ESS area was lower than that of the other two (biomedical and psycho-pedagogical), although M-EDF/01 and M-EDF/02 ADs were the main benchmarks for ESS [13, 14]. The study by D'Isanto et al. [15] compared the averages of ECTS credits allocated to ESS area, biomedical and psycho-pedagogical among two-degree courses, (LM68 and LM67), concluding that the LM68 degree course more strongly reflected the role of the kinesiologist due to the greater presence of ECTS credits allocated to ESS area than the other two. On the other hand, the LM67 had a higher prevalence of ECTS credits in the biomedical area, hardly consistent with the characteristics of the new professional

profile of the kinesiologist of preventive and adaptive physical activities. Besides investigating the differences between disciplinary areas, it would be useful to provide a detailed analysis of the differences among the three-degree courses, according to the two main ADs, M-EDF/01 and M-EDF/02.

With the 2021 sports reform, it is necessary to analyze the state of the art to assess the characteristics of the three master's degree courses, regarding the ECTS credits allocated to ESS area, both aggregated and disaggregated by ADs (M-EDF/01 and M-EDF/02) and their consistency with the new professional profiles of the kinesiologist. The aim was twofold: firstly, to provide the exact measure of the ECTS credits distribution, allocated to ESS area and divided by M-EDF/01 and M-EDF/02 ADs, in the three different master's degrees in ESS; secondly, to investigate their differences, to check their consistency with the professional profiles of kinesiologist. In this way, descriptive statistics were useful to describe the phenomenon, while the parametric test to check the significance, which, if higher than 0.05, implied that the difference was due to chance; on the contrary, if lower than 0.05, the non-random motivation of the differences was accepted and, therefore, attributed to other dynamics or specific reasons.

## Methods

### Participants and data collection

The survey was document-based, using the University portal [16], a platform that collects all data on undergraduate and higher education courses in Italy. The sample was made up of all the Italian master's degree in ESS in 2022, both from private, public, and online Universities: no. 7 of LM47 degree courses, no. 36 of LM67 degree courses, and no. 20 of LM68 degree courses. Data on the no. of ECTS credits allocated to ESS area, both aggregated and disaggregated by M-EDF/01 and M-EDF/02 ADs, were collected. As these professional figures may change over time, and as we cannot predict the number of future degree courses, the population of degree courses was treated as a sample, since by population we do not mean all the people present in a given time period, but all the people who might exist. In future, we may have cohorts with which to compare current data.

### Statistical analysis

Descriptive statistics were used to summarize the data into mean (M), standard deviation ( $SD > \pm 2$  indicates a high value) [17], variance ( $CV > 1$  indicates a high value) [18], minimum (Min) and maximum (Max). These indices are critical to understanding the distribution of ECTS credits within degree courses. After verifying the normality of the

data with the Kolmogorov–Smirnov test and the homogeneity of variances with the Levene test, a one-way ANOVA was performed to determine the difference between the averages of the no. of ECTS credits, allocated to ESS area, among the three master's degree courses (LM47, LM67, LM68), followed by a Bonferroni post-hoc for multiple comparisons. In the case of unequal variances, Welch's ANOVA, an alternative of ANOVA, as it is not sensitive to unequal variances, was used to determine the difference in the averages of the no. of ECTS credits of M-EDF/01 and M-EDF/02 among the three master's degree courses (LM47, LM67, LM68), followed by a Games–Howell post-hoc for multiple comparisons. Partial eta squared (Partial eta squared  $\eta^2$ ) was calculated to determine the effect size ( $\eta^2 = 0.01$  is small;  $\eta^2 = 0.06$  is medium;  $\eta^2 = 0.14$  or higher is large) [19]. Data analyses were performed using the Statistical Package for Social Science software (IBM SPSS Statistics for Windows, version 25.0. Armonk, NY). Significance was set at  $p < 0.05$ .

## Results

From descriptive statistics, in all cases, both standard deviation and variance values were high. A great degree of heterogeneity was found within the same degree master's degree course, both ECTS credits allocated to ESS area and disaggregated by ADs. A detailed description is shown in Table 1.

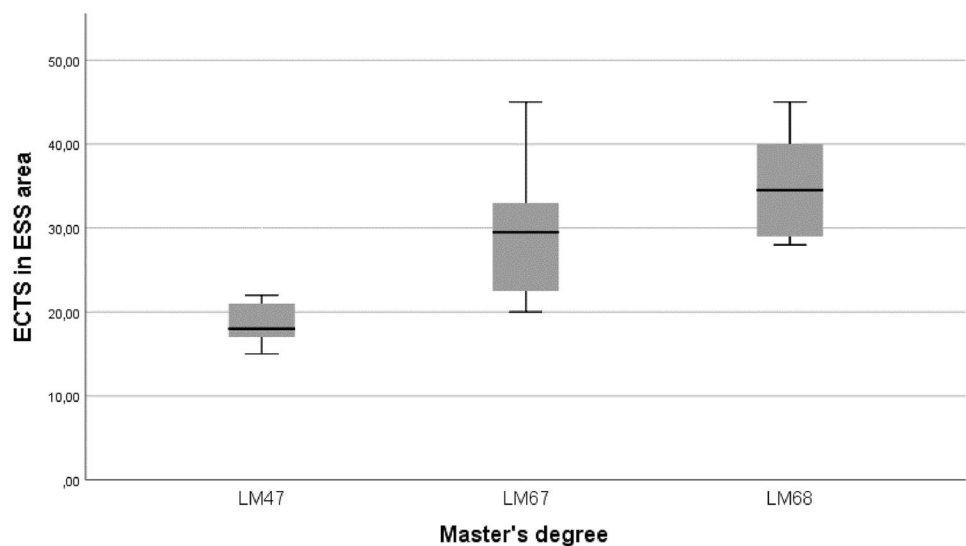
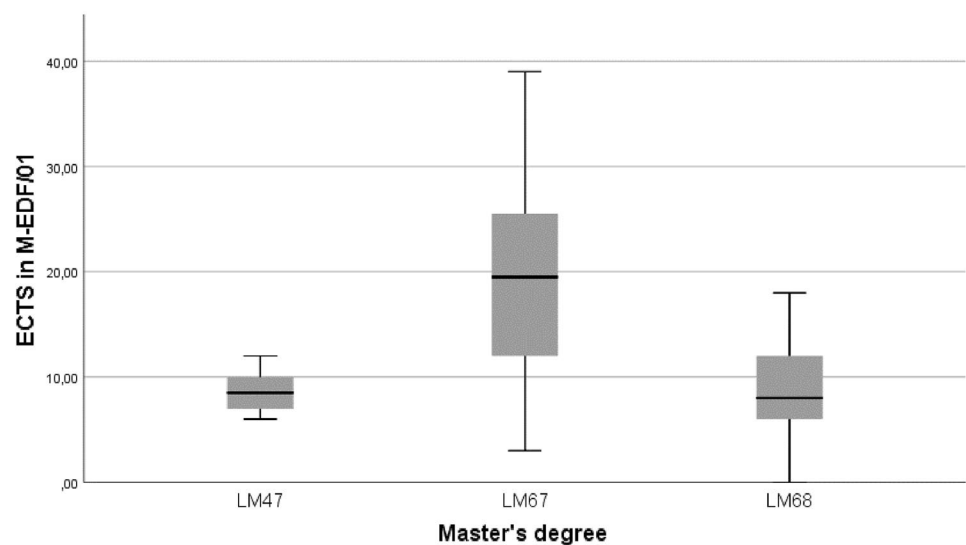
The high degree of heterogeneity of ECTS credits distribution within the same master's degree course, allocated to ESS area, both aggregated and disaggregated by ADs, was shown in Figs. 1, 2 and 3.

All data were normally distributed, according to Kolmogorov–Smirnov normality test ( $p > 0.05$ ). However, only variables allocated to the ECTS credits in ESS area had homogeneous variances ( $p > 0.05$ ), an assumption that allowed the application of one-way ANOVA. The variables allocated to the ECTS credits in M-EDF/01 and M-EDF/02 did not have homogeneous variance ( $p < 0.05$ ); consequently, Welch's ANOVA, insensitive to unequal variances, was performed. Starting from the difference analysis among the three master's degree courses, regarding the distribution of ECTS credits allocated to ESS area, a statistically significant result emerged [ $F(2,60) = 15.01$ ,  $p = 0.000$ ,  $\eta^2 = 0.3$ ]. Since ANOVA was an omnibus test, Bonferroni's post-hoc was performed, which revealed a statistically significant difference between the ECTS credits distribution allocated to ESS area among the LM47 and LM67 degree courses ( $p = 0.003$ ), LM47 and LM68 ( $p = 0.000$ ), and LM67 and LM68 ( $p = 0.005$ ). A detailed description is shown in Table 2.

A statistically significant difference emerged in ECTS credits distribution, allocated to M-EDF/01, within the

**Table 1** Descriptive statistics of ECTS credits allocated to ESS area (both aggregated and disaggregated by ADs)

	Descriptive statistics				Min	Max
		<i>M</i>	SD	CV		
LM47	No. ECTS credits in ESS	19.85	5.04	25.47	15	30
	No. ECTS credits M-EDF/01	10.00	4.04	16.33	6	18
	No. ECTS credits in M-EDF/02	9.85	3.28	10.81	6	16
LM67	No. ECTS credits in ESS	28.97	6.82	46.54	20	45
	No. ECTS credits in M-EDF/01	18.63	8.89	79.21	3	39
	No. ECTS credits in M-EDF/02	10.13	6.86	47.15	0	28
LM68	No. ECTS credits in ESS	34.95	6.11	37.13	28	45
	No. ECTS credits in M-EDF/01	9.20	5.81	33.74	0	24
	No. ECTS credits in M-EDF/02	24.95	8.15	66.47	14	38

**Fig. 1** ECTS credits allocated to ESS area among the three master's degrees**Fig. 2** ECTS credits allocated to M-EDF/01 among the three master's degrees

three master's degree courses [ $F(2,60) = 11.26, p = 0.000, \eta^2 = 0.3$ ]. Games–Howell's post-hoc test revealed a statistically significant difference between the ECTS credits

distribution allocated to M-EDF/01 among LM47 and LM67 ( $p = 0.002$ ), LM67 and LM68 ( $p = 0.000$ ). No statistically significant difference in ECTS credits distribution in

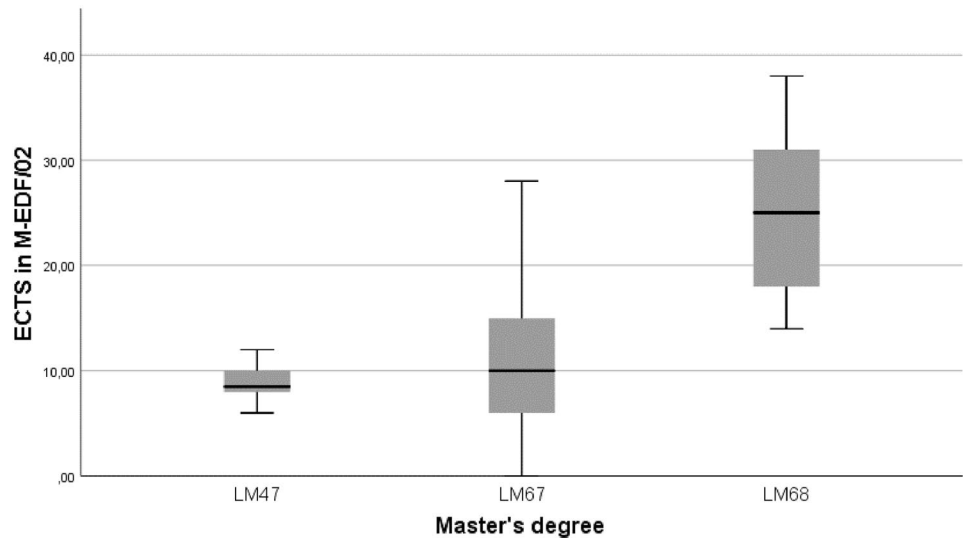
M-EDF/01, among LM47 and LM68 ( $p=0.916$ ), emerged. A detailed description is shown in Table 3.

A statistically significant difference in ECTS credits distribution, allocated to M-EDF/02, among the three master's degree, emerged [ $F(2,60) = 30.35, p = 0.000, \eta^2 = 0.5$ ]. Games–Howell post-hoc revealed a statistically significant difference in the ECTS distribution, allocated to M-EDF/02, among LM47 and LM68 ( $p = 0.000$ ), LM67 and LM68 ( $p = 0.000$ ). No statistically significant difference in ECTS credits distribution, allocated to M-EDF/02, among LM47 and LM67 ( $p = 0.985$ ) was found. A detailed description is shown in Table 4.

## Discussion

The main purpose of the study was to verify the homogeneity of ECTS credits distribution, allocated to ESS area, both aggregated and disaggregated by ADs (M-EDF/01 and M-EDF/02), within the three master's degree courses. Descriptive statistics were helpful to hit the target. For the LM47, LM68 and LM67 degree courses, the standard deviation and variance of ECTS credits distribution were high. This meant that undergraduate education varied, as the University in which the student decides to enroll varied. In other words, the University education was different,

**Fig. 3** ECTS credits allocated to M-EDF/02 among the three master's degrees



**Table 2** Multiple comparisons between ECTS credits allocated to ESS area among the three master's degree courses

Multiple comparisons		Bonferroni					
Dependent variable		Difference in mean	SE	Sig	CI 95%		
					Lower	Upper	
ECTS credits allocated to ESS area	LM47 LM67	-9.11508	2.6615	0.003	-15.6702	-2.5599	
	LM47 LM68	-15.0929	2.8295	0.000	-22.0618	-8.1239	
	LM67 LM68	-5.97778	1.79688	0.005	-10.4034	-1.5521	

**Table 3** Multiple comparisons between ECTS credits allocated to M-EDF/01 among the three master's degree courses

Multiple comparisons		Games–Howell				
Dependent variable		Difference in mean	Error std	Sig	CI 95%	
					Lower	Upper
ECTS credits in M-EDF/01	LM47 LM67	-8.82857	2.15056	0.002	-14.2664	-3.3907
	LM47 LM68	0.66667	1.96921	0.939	-4.4614	5.7948
	LM67 LM68	9.49524	1.95858	0.000	4.7745	14.216

**Table 4** Multiple comparisons between ECTS credits allocated to M-EDF/02 among the three master's degree courses

Multiple comparisons		Games–Howell					
Dependent variable				Difference in mean	SE	Sig	CI 95%
							Lower      Upper
ECTS credits in M – EDF/02	LM47	LM67	–0.05714	1.69635	0.999	–4.378	4.2637
		LM68	–14.7619	2.15888	0.000	–20.1448	–9.379
	LM67	LM68	–14.7048	2.10949	0.000	–19.8561	–9.5534

even though all students decided to attend the same master's degree course. In-depth studies are needed to try to calibrate the *core curricula* in different Italian locations of the same degree course. The supplementary purpose was to compare the ECTS credits distribution, allocated to ESS area and disaggregated by M-EDF/01 and M-EDF/02, among the three master's degree courses, to verify the statistical significance. The intention was to discard the  $H_0$  (randomness, superficiality, ignorance of the connection of the learning objectives of the education/teaching with the educational objectives of the degree courses) to accept  $H_1$  (the ECTS credits distribution was due to specific reasons). To do this, we began by testing the assumptions necessary to perform parametric statistics, such as normality of the data and homogeneity of variances. The results confirmed that all the data had a normal distribution, while only data related to ECTS credits distribution allocated to ESS area, were homogeneous. In this case, one-way ANOVA was performed, to compare the ECTS credits distribution, allocated to ESS area, among the three master's degree courses. The result was statistically significant, with a large effect. Bonferroni's post-hoc, for between-group comparisons, showed that the number of ECTS credits, allocated to ESS area, was significantly different among all master's degree courses, placing LM68 on the top, followed by LM67 and LM47.

As for the inhomogeneous data, the ECTS credits disaggregated by ADs, Welch's ANOVA was performed. Again, the result was statistically significant, with a large effect. From Games–Howell's post-hoc, for multiple comparisons, it was found that the number of ECTS credits, allocated to M-EDF/01, was significantly different among all master's degree courses, except between LM47 and LM68. Quantitatively, the highest number of ECTS credits in M-EDF/01 among the LM67 degree courses was found, followed by LM47 and LM68, between which there was a non-significant difference. This result makes LM67 consistent with the professional profile of the kinesiologist of preventive and adapted physical activities. This professional figure is responsible for conducting, managing, and assessing physical activities, both individual and group, of a compensatory, educational, recreational and sports nature, designed to maintain and recover the best conditions of physical

wellbeing in different age groups, through the promotion of active lifestyles. The comparison of ECTS credits distribution, allocated to M-EDF/02, among the three-degree courses, showed a statistically significant result in all cases, except for LM47 and LM67. Quantitatively, the highest number of ECTS credits in M-EDF/02 in the LM68 degree courses was found, followed by LM47 and LM67, between which no significant difference was found. This result makes the LM68 consistent with the professional profile of the sports kinesiologist, whose purpose is the planning, coordination, and technical direction of athletic preparation activities in the competitive field, up to the highest levels of competition, for sports associations and clubs, sports promotion bodies, institutions, and specialized centers, of physical and technical preparation, aimed at individual and team competitions [2]. The LM47 achieved the minimum required by the MUR in ECTS credits distribution in ESS area; therefore, was not dominant in any ADs. It is because the sports manager is involved in both areas, but regarding the design and management of sports facilities, the management of public and private facilities where physical activities, including recreational ones, take place, and the organization, as an expert and consultant, of sports events, including recreational ones [2]. Moreover, it is worth mentioning that, unlike the other two master's degree courses, LM47 is still not very widespread in Italy, as it is currently present in only seven Italian Universities.

The problem emerged from this analysis was not related to the differences in the ECTS credits distribution, allocated to ESS area (aggregated and disaggregated by ADs), among different master's degree courses, but within the same degree courses. From the scatter indices, the unevenness of the distribution of ECTS credits within the same degree courses and, consequently, the unrepresentativeness of the average, emerged. The heterogeneity of ECTS credits distribution, allocated to ESS area (both aggregated that disaggregated by ADs), generate different undergraduate education, which varies depending on the University to which the student enrolls. If the situation persists, we will have future graduates with different knowledge and skills whose common goal is to get the same job. All three master's degree, in addition to the 24 ECTS credits, are requisite for teaching physical



education in primary school [20] and ESS in secondary school [21].

Similar studies are addresses in other countries. An American study [22] surveyed several University institutions, to understand the guidelines they take as a benchmark, when preparing ESS *core curricula*. The results showed that most of Universities took as primary benchmark the biomedical area, including exams in physiology, anatomy, biochemistry, underestimating the topics related to health promotion, including the prescription of physical exercise and its adaptations for individuals with different age and conditions, but also performance assessment, and test administration [22]. This problem is very common in Italy too, where some Universities, which offer degree courses in ESS, present more ECTS credits in the biomedical area, compared to the ESS one [15]. Moreover, the scientific production of Italian University professors, who teach in bachelor's and master's degree in ESS, goes in the same direction [23].

To summarize, the heterogeneity in the distribution of ECTS credits in the different University locations, which offer the same degree course, may be due the fact that, several institutions give more emphasis to topics related to the biomedical area, disfavoring the ESS one. This has a strong impact on students' education, who very often perceive they have not acquired, by the end of their University career, the necessary skills [24] to practice the profession of kinesiologist. Even regarding the bachelor's degree courses in ESS, dos Santos' study [25] highlighted the heterogeneity of the areas covered, emphasizing the need to redesign the curricula to establish the specific profile of the graduate and choose the most appropriate content and methods to achieve the expected results. So, it is necessary to create interrelationships between Universities and redesign the *core curricula* together, with greater emphasis on ESS area. Systemic action is needed to ensure the same education to students that choose the same master's degree course but in different sites. The strengths of the study are its originality, because, to our knowledge, no Italian research addressed this topic, and the representative sample, as it included all master's degree courses in ESS present in the year 2022.

## Conclusions

The study revealed a great degree of heterogeneity in the ECTS credits distribution allocated to ESS area, both aggregated disaggregated by ADs (M-EDF/01 and M-EDF/02), within the same master's degree course in ESS. A reorganization of the system is needed, to ensure the same education for students who choose to attend the same master's degree course. Although the data averages were unrepresentative, due to the high values of dispersion indices, significant differences between ECTS credits distribution among different

degree courses emerged. Specifically, the LM68, compared with LM47 and LM67, had a higher prevalence of ECTS credits allocated to M-EDF/02, consistent with the professional figure of sports kinesiologist. The LM67 degree course had a higher prevalence of ECTS credits allocated to M-EDF/01, than LM68 and LM47, consistent with the professional figure of kinesiologist of preventive and adaptive physical activities. The LM47 did not prevail in either ADs, as it must possess knowledge of both two, to perform the job of sports manager. Institutions should work to homogenize the ECTS credits allocated to ESS area, both aggregated and disaggregated by ADs, among the same master's degree courses, to reduce their dispersion, making the identified averages more representative. The intention is to generate future graduates, in ESS, who come from the same master's degree course, with the same knowledge and skills, independently of which Italian University they enroll.

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**Data availability** Data sharing not applicable.

## Declarations

**Conflict of interest** The authors declare no conflict of interests.

**Human and animal rights** Not applicable.

**Informed consent** Not applicable.

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