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A comparative study of university training of sports and physical activity kinesiologist

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Abstract

Background In Italy, Legislative Decree No. 36/2021 and Ministerial Decree (MD) No. 1649/2023 have redefined the professional landscape of the physical activity and health sectors, emphasizing interdisciplinary and wellness-oriented education. The current disparity in the weighting of formative elements among the biomedical, psycho-pedagogical, and Exercise and Sport Sciences (ESS) fields in the configuration of degree courses in ESS has led to a need for reform. MD No. 1649/2023 offers an opportunity to reform these courses to emphasize interdisciplinary and wellness-oriented objectives, including at least 20 ECTS credits of practical activities in ESS disciplines. However, the impact of practical and laboratory activities on future kinesiologists has never been studied. This study aims to evaluate the impact of physical activity habits on the performance and self-assessment of ESS students.

Method A sample of 56 students enrolled in the Master of Science in Sport Science and Techniques at the University of Salerno was divided into "active" and "inactive" groups based on their physical activity levels, according to WHO guidelines. Both groups underwent anthropometric and functional tests, including the Squat Jump (SJ) and Countermovement Jump (CMJ). Descriptive statistics and t-tests assessed the differences between and within groups.

Results The "active" group exhibited significantly higher performance in SJ (15.7% higher) and CMJ (18.5% higher) compared to the "inactive" group. Both groups showed significant improvements in jump height from SJ to CMJ, with the "active" group improving by 11.04% and the 'non-active' group by 7.38%.

Conclusion Continuous physical activity enhances functional efficiency, with significant gains in explosive and reactive strength. Practical, evidence-based training is crucial for future kinesiologists to provide specialized services and promote health, underscoring the importance of integrating substantial practical activities in ESS degree courses.

Keywords Degree courses, Disciplinary knowledge, Squat Jump, IPAQ

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Background

In Italy, the professional roles of sports kinesiologist and kinesiologist of preventive and adapted physical activities have recently been established, alongside those of basic kinesiologist and sports manager, through Legislative Decree No. 36 of 28 February 2021, article 41, which contains provisions on sports employment [1]. These new professional figures represent a significant innovation in the health and wellness landscape, offering a wide range of services from ensuring correct and safe physical performance to promoting well-being and healthy lifestyles [2, 3]. This purpose configures a peculiarity of the kinesiologist who must have specific skills in designing, programming, conducting, and evaluating physical activities. These skills must be able to be developed in university educational paths, currently subject to review and updating considering the redetermination of degree classes established by the Ministerial Decree (DM) No. 1649 of 19 December 2023 [4]. With the entry into force of this DM, the academic programs of the master's degree course that train these two specialized figures of kinesiologist have been renewed, namely the master's degree course in Sports Sciences and Techniques (study class LM-68) and the one in Preventive and Adapted Physical Activities (study class LM-67). This legislative reform specifically impacts degree programs in Exercise and Sport Sciences (ESS), requiring the review and updating of their curricula to align with the new professional roles of kinesiologists and the requirements of DM n. 1649/2023. The reform aims to address critical issues present in the current configuration of these degree programs, particularly the imbalance in the distribution of European Credit Transfer System (ECTS) credits between biomedical and psycho-pedagogical domains and those specific to physical activity and sport sciences. These aspects are essential for achieving the educational objectives of graduates in ESS [5, 6]. The implementation of DM No. 1649/2023 provides the opportunity to reform these study courses, also considering the current critical issues in their configuration. Previous studies have revealed a significant level of heterogeneity among the curricula of both bachelor's [7, 8] and master's [9] degree programs in ESS nationwide, contrary to the general principles of: (a) *coherence* of the specific learning objectives of the teachings pertaining to the academic disciplines (ADs) with the qualifying training objectives of the profile outgoing from the training pathway; (b) *congruence*, understood as an adequate amount of contents of the teachings pertaining to the ADs to achieve the training objectives, both specific and qualifying in the light of the heterogeneous results on significant biomedical training for the LM-67 and psycho-pedagogical training for the LM-68. The formative weight of the ESS disciplinary domain seems to be less significant compared to the other two domains: the biomedical domain for LM-67 and the psycho-pedagogical domain for LM-68. This is even though the ADs of Physical training sciences and methodology (code M-EDF/01) and Methods and Sport sciences and methodology (code M-EDF/02) are considered "characteristic". This represents a weakness, as it is highly likely that upon completing their studies, graduates may find themselves with a varied store of knowledge and skills, some of which may not be directly relevant to the specific educational objectives of the ESS domain. The need for adjustment of these study courses in accordance with the DM 1649/2023 could provide the opportunity to address some of the highlighted critical issues. A comparison between the previous decree determining the classes of master's degrees in 2007 [10] and the current one highlights the need to reconcile the professional autonomy of the kinesiologist with an interdisciplinary perspective, opening to collaboration with other professional figures, and explicitly aiming at training objectives in the field of health and psychophysical well-being. The formation of specific professional competencies for the two figures of kinesiologist is significantly enhanced by the professionalizing European Credit Transfer System (ECTS) of the master's degree courses LM-67 and LM-68. These courses include at least 20 ECTS of practical/laboratory activities, distinct from internships that, given the specific purposes of the kinesiologist professions, should pertain to the ESS disciplines. These activities are fundamental for acquiring specific skills in the design, planning, supervision, implementation, and evaluation of physical programs, in line with the specific objectives of the characterising disciplines.

However, the lack of previous studies on practical and laboratory activities, including those falling within the category of internships, highlights the urgent need to investigate their possible impacts on the physical activity habits of future kinesiologists. The aim of this study is to evaluate the impact of physical activity habits on the performance and self-assessment of ESS students during the specific course on human movement analysis.

Methods

Study participants

This study involved 56 participants who were students enrolled in the master's degree course in Sport Sciences and Techniques (LM-68) from the University of Salerno. They all had a minimum of two years of training experience and were in an optimal state of health. Exclusion criteria encompassed potential medical issues or a history of ankle, knee, or back diseases within the three months preceding the commencement of the study. Participation in the study was voluntary, and informed con-sent was obtained from all participants.

Design

Analysing the physical activity habits of future kinesiologists is invaluable for understanding the processes that influence how students integrate knowledge in the field of exercise and health studies [11]. Therefore, a questionnaire based on the International Physical Activity Questionnaire (IPAQ) [12] model was administered to the students via the Google Forms platform in order to collect data regarding their daily physical activity habits. The duration of monitoring physical activity habits was set for a period of one week, allowing for a comprehensive assessment of their behaviours. The short form of IPAQ questionnaire consisted of 7 items as shown in Table 1.

Based on the responses received, the sample was divided into two groups of 28 each, in accordance with the World Health Organisation (WHO) guidelines on physical activity and sedentary behaviour [13]. The first group, defined as "active", included individuals who engaged in at least 150 min of moderate to vigorous physical activity (MVPA) each week, while the second group, referred to as "inactive", consisted of individuals who did not meet these weekly physical activity levels.

Subsequently, anthropometric and functional tests were conducted to assess physical efficiency parameters related to well-being and functional efficiency. Professional instruments, such as scales and altimeters, were used to measure height and weight for the indirect calculation of Body Mass Index (BMI). For functional parameters, jump tests representing Fundamental Movement Skills [14] were selected, including the squat jump (SJ) and countermovement jump (CMJ). Before initiating the study, participants received comprehensive briefings regarding the tests and procedures involved.

Table 1 The short form of IPAQ questionnaire

N	Items
1	Age
2	During the last 7 days, on how many days did you do vigorous physical activities (VPA) like heavy lifting, digging, aerobics, or fast bicycling?
3	How much time did you usually spend doing vigorous physical activities on one of those days?
4	During the last 7 days, on how many days did you do moderate physical activities (MPA) like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
5	How much time did you usually spend doing moderate physical activities on one of those days?
6	During the last 7 days, on how many days did you do you exercise or work out at the gym?
7	How much time did you usually spend doing exercise or work out at the gym on one of those days?

Instruments

The instrumentation selected for this study was meticulously chosen to ensure the precision, reliability, and validity of the collected data. Each instrument played a crucial role in capturing specific aspects of participants' movements during the jump tests. The participant characterization began with the use of the Pegaso digital scale (GIMA Spa, Gessate, Italy) to gather accurate anthropometric data, including height and weight, which formed the foundational dataset for subsequent analyses.

The Optojump optoelectronic device (Microgate Srl, Bolzano, Italy) was employed for real-time data acquisition during vertical jumping. This system, comprising a transmitter and receiver bar positioned one meter apart, utilized optical sensing technology to measure jump height with high resolution (1.041 cm). The Optojump system's capability to provide instantaneous data was crucial for capturing participants' nuanced movements during jumps [15, 16].

To complement the optoelectronic data, a GoPro HERO7 camera (GoPro, San Mateo, CA, USA) was set up to record at 120 frames per second (fps). Placed three meters from the acquisition area and oriented perpendicular to the plane of action, this high-speed camera provided detailed visual analysis of participants' jump techniques. The footage, recorded at 1440p resolution and 60 fps, allowed for a comprehensive evaluation of form and motion fluidity. The camera setup ensured that subtle biomechanical details were effectively captured [17].

Laboratory setting

As in previous studies [18, 19] the study was conducted in a controlled laboratory environment measuring 6×4×4 m (length × width × height). Specialized PVC flooring was chosen to minimize external variables affecting jump performance. An acquisition area of 90×60 cm (Length × Width), housing the Optojump system, was marked on the laboratory floor to confine participants' movements and enhance test reproducibility. Additionally, the laboratory setup included a stable tripod for the GoPro HERO7 camera, positioned to maintain a consistent focal point. Participants underwent a standardized 10-minute warm-up routine comprising joint mobility exercises and muscle stretching to standardize physiological conditions before testing, thereby ensuring data reliability.

Acquisition protocol

The acquisition protocol comprised two tests: the Countermovement Jump (CMJ) and the Squat Jump (SJ). Participants were instructed to align their sagittal plane with the video acquisition plane and faced the short sides of the laboratory room during both tests.

Table 2 Analysis of the distribution of answers per question in the IPAQ questionnaire

Active group ***N*** **= 28**	**Age (Years)**	**Weekly VPA minutes**	**Weekly MPA minutes**	**Weekly minutes of exercise in the gym**	**Total minutes**
Mean ± SD	23.7 ± 2.4	87.6 ± 122.4 (18.5%)	224.7 ± 134.7 (48.1%)	155 ± 124.6 (33.4%)	463.8 ± 253.7
Inactive group *N* = 28	**Age (Years)**	**Weekly VPA minutes**	**Weekly MPA minutes**	**Weekly minutes of exercise in the gym**	**Total minutes**
Mean ± SD	24.2 ± 2.5	13.3 ± 17.6 (11.8%)	68 ± 46.8 (60.6%)	31.4 ± 48.2 (27.6%)	112.3 ± 36.3

Table 3 Comparison of physical variables between active and inactive groups

Variables	**Active group**	**Inactive group**	**Difference (inactive-active)**	**Diff. %**	**Sign.**
BMI (kg/m^2)	23.65 ± 3.96	25.23 ± 4.83	1.58	6.69	> 0.05
SJ (cm)	23.19 ± 6.35	19.55 ± 6.73	-3.64	-15.71	0.04
CMJ (cm)	25.75 ± 6.05	20.99 ± 6.76	-4.76	-18.48	< 0.001
Diff cm (CMJ-SJ)	2.56	1.44	Diff cm (CMJ-SJ) between groups		1.12
Diff % (CMJ-SJ)	11.04	7.38	Diff % (CMJ-SJ) between groups		77.37
Sign.	< 0.001	< 0.001	Sign.		0.04

For the CMJ test, participants initiated a vertical jump after a phase of lower limb bending and a brief isometric pause. Throughout the trial, participants kept their hands resting on their iliac crests to maintain consistency.

In contrast, the SJ test required participants to start from a position where their trunk was parallel to their ankles in the sagittal plane. Participants maintained this position for 3 s before starting the test upon hearing an audible signal from the Optojump program. During the SJ, participants kept their hands fixed on their hips and had the autonomy to choose their knee angle in the starting position to emphasize natural movement. Each participant performed three trials of each jump test with a 120-second rest period between trials to ensure robust dataset collection. The average result of these trials was recorded for subsequent statistical analysis. Participants received detailed instructions on the acquisition process before initiating the test protocol.

Statistical analysis

Descriptive statistics (mean ± SD) were utilized to summarize the data for the different variables. The distribution of each variable was assessed using the Shapiro–Wilk test. To assess the differences between the two tests for both groups, a paired-samples t-test was used. Additionally, an independent samples t-test was con-ducted to examine the disparities in the effects of the two tests between the groups. All analyses were carried out using SPSS software (version 22; IBM, Armonk, NY, USA), and the significance level was set at $p \leq 0.05$.

Results

The results of the IPAQ questionnaire are presented in Table 2. The analysis reveals insightful patterns regarding participants' physical activity habits.

The active group has an average age of 23.71 years and has engaged in an average of 463 min per week of MVPA and gym activity; whereas the inactive group has an average age of 24.21 years and has engaged in an average of 112 min per week of MVPA.

Table 3 provides a comparative analysis of key variables between the active group and the inactive group. It includes data on BMI, SJ and CMJ, along with the differences observed between the two groups expressed in both absolute values and per-centages. The table also presents the statistical significance levels associated with these differences.

From the comparison between the two groups, the inactive group showed an average BMI higher by 6.69% compared to the active group, but this difference was not statistically significant ($p > 0.05$). However, statistically significant differences emerged in explosive and reactive strength between the two groups ($p < 0.05$): the active group exhibited superior performances by 15.7% (+3.64 cm) in the SJ and 18.5% (+4.76 cm) in the CMJ compared to the non-active group, confirming the positive effects of continuous physical activity on functional efficiency.

Both groups showed an increase in jump height from the SJ to the CMJ ($p < 0.05$): an average increase of 2.56 cm (11.04%) was observed in the active group and 1.44 cm (7.38%) in the non-active group. Furthermore, the active group showed an improvement of 77% (1.12 cm) greater than the non-active group. This difference be-tween the two groups was found to be statistically significant ($p < 0.05$).

Discussion

The aim of this study is to evaluate the impact of physical activity habits on the body composition, physical efficiency, and self-assessment of ESS students. By investigating differences in physical activity levels, body mass index (BMI), and measures of explosive and reactive strength between active and inactive groups, the study seeks to pro-vide insights into the potential health and well-being benefits associated with adherence to physical activity recommendations. This examination aims to justify the im-portance of integrating practical and/or laboratory activities into degree programs, aligning with the interdisciplinary and wellness-oriented objectives outlined in legislative changes affecting the ESS field.

The data from the questionnaire analysis (Table 2) reveals substantial disparities in physical activity levels between the “active” and “inactive” groups among ESS students. The “active” group, comprising 28 individuals, demonstrates markedly higher engagement in physical activity compared to their “inactive” counterparts. Specifically, the “active” group, with a mean age of 23.7 years, averages 463.8 weekly minutes of physical activity, including 87.6 min of vigorous physical activity (VPA), 224.7 min of moderate physical activity (MPA), and 155 min of gym exercise. In contrast, the “inactive” group, with a mean age of 24.2 years, exhibits significantly lower levels of physical activity, with an average of 112.3 weekly minutes. This includes 13.3 min of VPA, 68 min of MPA, and 31.4 min of gym exercise.

The higher levels of physical activity observed in the “active” group, according to the WHO guidelines on physical activity and sedentary [13] should suggest improved cardio-vascular fitness [20], muscular strength [21], and endurance [22], potentially reducing the risk of chronic diseases such as obesity, cardiovascular disease [23], and type 2 diabetes [24]. Moreover, regular physical activity is associated with enhanced mental well-being [25], including reduced stress, anxiety, and depression [26], which may contribute to overall quality of life.

In the comparison between the two groups (Table 3), the “inactive” group exhibited a BMI on average higher by 6.69% compared to the “active” group, yet this difference did not reach statistical significance ($p>0.05$). This aligns with previous studies that suggest BMI alone may not be a comprehensive indicator of health or fitness level [27–29]. Although BMI doesn’t show significant differences between active and inactive groups, jump tests clearly indicate greater physical efficiency in active subjects. Statistically significant disparities surfaced in explosive and reactive strength between the two groups ($p<0.05$): the active group displayed superior performances by 15.7% (+3.64 cm) in the SJ and 18.5% (+4.76 cm) in the CMJ compared to the inactive group, affirming the positive effects of sustained physical activity on functional efficiency. These findings are consistent with research indicating that regular physical activity enhances muscular strength [21, 30] and neuromuscular coordination [31, 32]. Both groups demonstrated an increase in jump height from the SJ to the CMJ ($p<0.05$): an average increase of 2.56 cm (11.04%) was observed in the active group and 1.44 cm (7.38%) in the inactive group. Additionally, the active group exhibited an improvement of 77% (1.12 cm) greater than the inactive group. This difference between the two groups was found to be statistically significant ($p<0.05$). The significant improvement in the active group’s jump performance underscores the im-portance of consistent physical activity in enhancing plyometric capabilities, which are crucial for various athletic and daily functional activities [33, 34]. The results are consistent with the findings of Hollerbach et al. [35], who reported that university students participating in fitness classes experienced significant adaptations in muscular strength, power, and endurance. This suggests that structured physical activity programs can lead to improvements in physical performance, supporting the idea of integrating such programs into university curricula. Additionally, Redondo-Flórez et al. [36] found a positive relationship between physical fitness and academic performance among university students, highlighting the cognitive and health benefits of physical activity. This underscores the importance of promoting physical activity not only for health but also for enhancing academic success.

Given the crucial importance of physical activity and well-being there is a need to deepen understanding of the benefits of exercise not only on individual health but also on performance and productivity in the workplace [37]. Simultaneously, it is crucial to invest in the education of professionals in the field, such as kinesiologists. Integrating practical and laboratory training into undergraduate courses can prepare aspiring kinesiologists to offer more specialized and targeted services. Through this training, they can acquire best practices for designing customized exercise programs for employees of companies with diverse needs, or they could acquire specific skills to work with professional or amateur athletes to maximize their performance on the field [6]. This advanced training, based on scientific evidence, would empower them to deliver services grounded in evidence-based and highly effective methodologies [7]. In this study, we also included BMI values in order to see if, in addition to the change in performance levels, there was also a change in parameters related to the subjects’ well-being and health. However, the analysis of the BMI values did not un-cover any significant changes either within the groups or in the comparison between them. This observation could potentially be attributed to the characteristics of the entire sample. Notably, the baseline BMI values fell within the normal range, specifically within the range of 20 to 25.99 [27]. Variables such as the environmental conditions during task execution and the inherent traits of the participants might have contributed to maintaining this equilibrium. It would be interesting to expand the study to subjects with different BMIs.

Moreover, this study faces several limitations. Firstly, the relatively small sample size restricts the generalizability of the findings, making it difficult to extrapolate results to a broader population. Additionally, the study did not explore other influential variables, such as diet and sleep, which are known to significantly affect physical performance and overall health. Dietary habits and sleep quality play a crucial role in determining outcomes like strength, endurance, and recovery [38, 39]. Without accounting for these factors, the findings may not fully capture the true impact of physical activity habits alone. Furthermore, the duration of monitoring physical activity habits was not specified, which raises questions about the reliability of the self-reported data. Participants' self-assessment may introduce bias, as individuals might overestimate their physical activity levels or selectively report their behaviors. Given these limitations, future research should adopt a more comprehensive approach by incorporating larger sample sizes and considering additional variables such as dietary intake and sleep patterns. Additionally, employing objective measures of physical activity and integrating qualitative assessments could enhance the reliability of the data collected. Furthermore, it would be beneficial to include a wider range of physical tests, such as endurance and flexibility assessments, alongside the SJ and CMJ. These additional tests can provide a more holistic evaluation of the physical abilities of exercise and sports science students, contributing valuable insights into their overall health and performance.

Conclusion

Weekly physical activity frequencies, although below the WHO recommendations, do not appear to significantly influence body composition. However, they have demonstrated a significant impact on physical efficiency. Therefore, it is important to develop strategies aimed at promoting and encouraging daily physical activity to achieve levels that enhance well-being and long-term health. In particular, the future training of kinesiologists should prioritize practical, evidence-based approaches to structured exercise and sport. This includes incorporating hands-on experience in designing and implementing exercise programs, understanding individual client needs, and utilizing the latest research to inform practice. Kinesiologists should also be trained to employ motivational techniques that encourage clients to engage in regular physical activity, as well as to evaluate and adapt exercise interventions based on client feedback and progress. Investing in this practical training is important for equipping kinesiologists with the skills necessary to provide specialized services and contribute effectively to health promotion in both work and sport contexts. This investment will enhance the overall impact of the profession on community health and well-being.

Abbreviations

ESS	Exercise and Sport Sciences
MD	Ministerial Decree
ADs	Academic Disciplines
WHO	World Health Organisation
MPA	Moderate physical activity
VPA	Vigorous physical activity
BMI	Body max index
SJ	Squat Jump
CMJ	Countermovement Jump
IPAQ	International Physical Activity Questionnaire

Author contributions

Conceptualization: F.D. and G.E.; methodology: G.E.; software: S.A.; validation: T.D. and G.E., R.C.; formal analysis: R.C.; investigation: S.A.; resources: R.C.; data curation: R.C.and T.D.; writing—original draft preparation: G.E.; writing—review and editing: T.D.; visualization: R.C.; supervision: F.D. All authors have read and agreed to the published version of the manuscript.

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Data availability

All data generated or analysed during this study have been included within the manuscript.

Declarations

Institutional review board statement

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki. Ethical review and approval were waived for this study because it was an educational research study. According to the Ethical Principles and Guidelines for the Protection of Human Subjects of Research from the U.S. Department of Health & Human Services, innovative methods that are non-invasive and solely designed to enhance the quality of learning might be exempt from Institutional Review Board (IRB) or Ethics Committee review and approval.https://www.hhs.gov/ohrp/regulations-and-policy/regulations/45-cfr-46/common-rule-subpart-a-46104/index.html.

Informed consent

Informed consent was obtained from all subjects involved in the study. All individuals involved in the study were guaranteed anonymity and were provided with complete and honest information about the content, purpose, and process of the research in an understandable way. No individual was forced to participate.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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