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LIFESTYLES AND POSTURAL ADAPTIONS IN CLINICAL CONDITIONS, MULTIPLE SCLEROSIS AND COVID-19 PANDEMIC

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1. Miss Feka together with the Ph.D. coordinator Massimiliano Oliveri, prof. Antonino Bianco and Ph.D. colleagues – University of Palermo, Italy.

2. Miss Feka together with the prof. Roger Enoka and Ph.D. colleagues – University of Colorado, Boulder, United States of America.

Contents

Abstract

Gathering all information related to the dissertation (Posture, Multiple Sclerosis, and COVID-19) clearly shows us that several factors influence our way of living and can lead us to numerous diseases, disorders, and/or even death. Three main domains of interest have characterized miss Feka's program, and each topic was covered for approximately one year. In all her projects, an observational, experimental, and cross-sectional method has been approached. The postural assessment was performed using the FreeMed posturography system, the FreeMed baropodometric platform, and FreeStep v. 1.0.3 software. Additionally, for MS studies, these assessments took place: questionnaires, face-to-face interviews, EMG, grooved pegboard test, TENS device, etc. While for COVID-19 data collection, due to the pandemic situation, only online questionnaires were used. As a result, during these three years, Miss Feka has managed to publish 14 scientific articles in the most prestigious journals and 13 abstracts. She participated in 5 different conferences worldwide and was part of 7 European and non-European projects, and she also spent around 21 months in international mobility in the top world Universities. At the end of all the experimental approaches that Miss Feka was involved in, we can conclude that postural adaptations can be a reliable tool to detect changes in clinical conditions in children, adolescent, adults, MS suffers, as well as significant differences are were detected between genders and weight categories in plantar pressure distribution. Moving on to the electrical stimulation that showed a possibility to improve mobility in MS suffers; Temperature trigger MS patients' symptoms, but it can be improved when the temperature is normalized; The COVID-19 pandemic had a negative influence on lifestyle. Future perspectives suggest an ongoing investigation into early interventions in detecting and preventing disabilities at an early age.

Key words: Posture, Multiple Sclerosis, COVID-19, Physical activity, Temperature, Eating habits

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List of Abbreviations

PA – physical activity

A – athletes

S – sedentary

SD – standard deviation

ANOVA – Analysis of Variance

BMI – body mass index

BSA – body surface area

LF – left foot

RF – right foot

NW – normal weight

O – obese

OW – over weight

UW – under weight

NS – not significant

MS – Multiple Sclerosis

RRMS – Relapsing–Remitting Multiple Sclerosis

SPMS – Secondary-Progressive Multiple Sclerosis

PPMS – Primary-Progressive Multiple Sclerosis

PRMS – Primary-Relapsing Multiple Sclerosis

CNS – Central Nervous System

EMG – Electromyography

TENS – Transcutaneous electrical nerve stimulation

Preface

In the present dissertation will be found the main scientific research activities of the International Ph.D. student miss Kaltrina Feka. Throughout these 3 years, miss Feka has been involved in several research areas that will be described thoroughly in the following chapters.

The first chapter of the current dissertation will be divided in three main areas of investigation and each subchapter will thoroughly describe the scientific background of them all. This chapter will include areas such as Posture, Multiple Sclerosis and COVID-19.

The second chapter will contain a more comprehensive description of the main areas included in the first chapter. This chapter contains 6 different published/submitted articles from the projects that miss Feka participated during her Ph.D. course.

Whereas, in the third chapter it will be presented the entire scientific background of miss Feka. All the skills, projects and devices that miss Feka obtained, used or did during these 3 years. Finally, in the Appendix are presented the abstracts of all publications with detailed information, as well as the confirmation documents of visiting scholar from the University of Colorado, Boulder (USA) and Loughborough University, Loughborough (UK).

Chapter 1

BACKGROUND ON POSTURE, MULTIPLE SCLEROSIS AND COVID-19

1.1 Plantar pressure

General overview

The human foot, in addition to serving as a base of support it also plays an essential role in maintaining an upright posture, including balance and stabilization of the body during both states, static and dynamic [1-3]. Whereas foot plantar pressure indicates the pressure field that acts between the support surface and the foot during everyday locomotor activities. Researchers have reported that the anatomical and physiological characteristics of the foot do change with skeletal growth, gait development and motor control of the lower extremities [4, 5]. However, these changes may occur also with the alternation in foot pressure distribution during gait [4, 5]. Hence, it is essential to be able to diagnose possible foot problems at an early stage for injury prevention, risk management, and general wellbeing. In addition, both researchers and clinicians use plantar pressure distribution to diagnose any possible foot pathologies [6]. Therefore, extensive knowledge on the possible factors that influence plantar pressure distribution is more than necessary. Nevertheless, the explanation of plantar pressure distribution is confounded by several factors; such as body weight, gender, age, joint range of motion, etc., and similarly, it can also be affected by the same factors [5, 7-9]. An important point that should be highlighted is that plantar pressure values are affected by anatomical structure of the foot, sex, and joint movement separation, as well as walking speed [7, 8, 10]. Furthermore, neurological control of posture and locomotion at some levels of the central nervous system (CNS) are interdependent [11]. According to Mazzocchi et al., specific areas of the hypothalamus or brain stem when stimulated can trigger changes in posture [11]. Nevertheless, having a high plantar pressure could be a sign of numerous diseases and deformities that would affect the feet; hence, investigation and analysis of plantar pressure are critical in order to prevent pain, postural disorders, and even diseases [1, 12, 13].

Additionally, Bellizzi et al., postulated that the postural system maintains balance in two different forms, static (while standing) and dynamic (during gait) [14]. While dynamic plantar pressure distribution was mostly investigated, there is a lack of information regarding static plantar pressure distribution [15, 16]. There are a variety of plantar pressure assessment systems, however, they can be classified into two types: platform system and in-shoe system.

In the current dissertation, studies that have been included used baropodometric analysis assessment, platform system. Baropodometric analysis is used to assess dysfunctions of the feet, in principle it is used to map the actual pressure of plantar surface [14, 17]. This device

records plantar imprints and ground reaction forces while standing in a static erect position. Both legs are analysed separately and the foot is divided into the forefoot, rearfoot, and midfoot. Based on scientific literature, assessing plantar pressure distribution is not an easy matter, but very much needed as early as possible. In the light of that in the following subchapters, this topic will be thoroughly explained.

1.1.1 Plantar pressure in children and adolescents

Nowadays, obesity is considered a major public health crisis in both children and adults, however, an enormous increase in pediatric obesity has been reported worldwide, which has been associated with numerous health problems, and has become an essential topic for general public health [18-21]. Additionally, it has been reported that obesity could precipitate several musculoskeletal disorders, commonly involving knees and feet [22]. Pain and joint instability in the hip, knees, and feet are not unusual, hence having excessive weight predisposes to disorders when doing everyday activities (walking and taking stairs) [23].

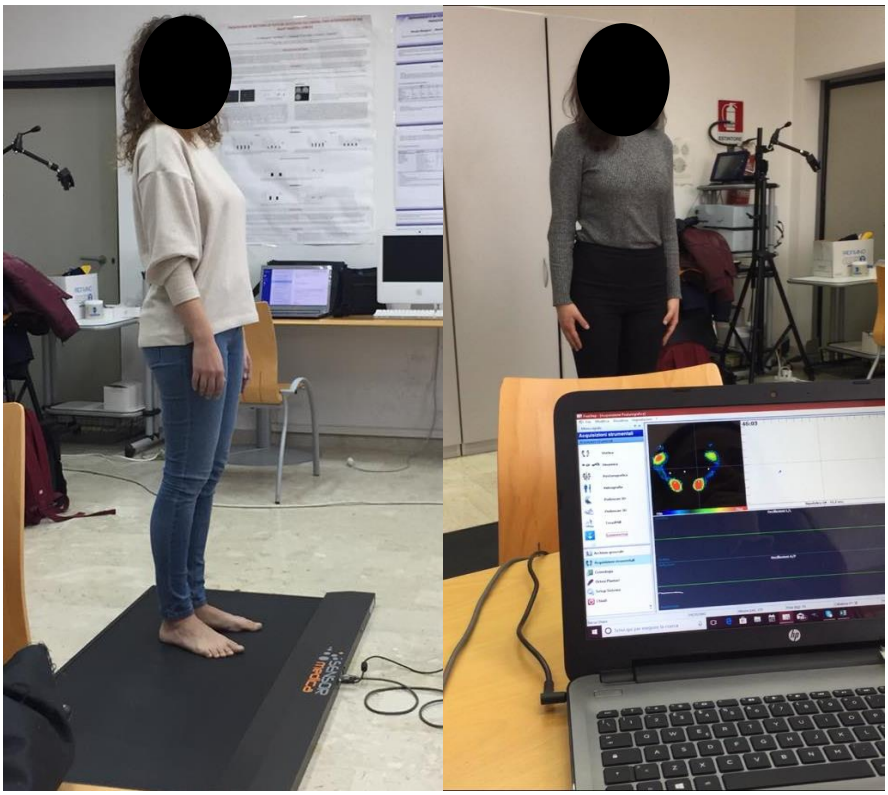
Furthermore, researchers have reported that children who belong into the categories of overweight and obesity are exposed to a higher risk of unstable posture, gait patterns deficiency, lower limbs malalignment, exposure to higher forces/impacts to the lower limbs, and diminished bone mineral density, which has been previously related to increased incidence of overuse injuries and bone fractures [24-28]. Relying on scientific literature, excessive weight does have an effect on children's musculoskeletal system development, leading to a problem that disturbs and changes their speed, step length, and stability compared to normal weight counterparts [29-32]. Considering the enormous increase of pediatric obesity worldwide, the need to assess plantar pressure in early ages is more than necessary and should be a priority to clinicians and researchers. Nevertheless, another effect of excessive weight on foot structure has brought to light that overweight among preschool kids is associated with anatomical changes and differences in plantar pressure distribution [32-35]. The increased risk of developing pathologies and getting injured is closely linked with the increase of mechanical loading in plantar pressure distribution [22, 35-38]. It has been reported that foot morphology changes during maturation and it is different between girls and boys [36, 39, 40]. Studies have reported that during gait (walking) obese children had higher foot contact area and foot loading compared to non-obese children [35, 41, 42]. Similar results with a higher foot contact area and foot loading were presented also by Dowling et al., a study conducted in 9 years old

children [35]. Although there are disagreements regarding the possible differences in plantar pressure distribution between the feet and some researchers reported that there are no significant differences, according to Feka et al., these differences exist and show that obese children bear more weight in their right foot [4, 42, 43]. In other findings regarding gender differences in children, it was detected that boys use more forefoot in contrast to girls who uses more rearfoot [42]. It can be concluded that plantar pressure distribution is affected by excessive weight and gender differences between children do exist.

1.1.2 Plantar pressure and gender differences

Anatomically and physiologically, men and women are different in a considerable number of ways. Despite a large number of investigations regarding peak pressure during walking, only a few studies aimed to explore foot characteristics and possible differences in pressure distribution beneath the foot among males and females. To further strengthen gender differences, anthropometrical studies have reported differences between bones of the foot in both genders [44]. These anthropometric differences between men and women have helped in identifying gender in forensic science [44]. Some studies found no differences between genders when compared four regions of the midfoot in the contact area and peak plantar pressure [45]. Similar results were reported also by Putti et al., however, they compared in-shoe foot pressure parameters in ten different regions of the foot in men and women [46]. They were not able to detect any significant differences in peak pressure, pressure-time integral, contact time, and instant of peak pressure in the foot [46]. Putti et al., didn't found any differences also in peak pressure between males and females in none of the 10 regions that were investigated [46]. In contrast to these results, Periyasamy et al., reported significant differences in the foot pressure distribution values in few areas and foot contact areas between genders in ten regions of the foot [7]. Furthermore, they also reported a higher foot contact area in men than women [7]. As for the differences between genders regarding the shape of the foot, researchers have reported that men have longer and wider feet than women [47]. However, these differences should be taken into consideration when sports shoes are designed. When we are talking about sports and plantar pressure distribution, there is a huge gap in the literature regarding differences between genders, there is a lack of evidence even within the same gender, especially with women as participants. One study that included both women and sports is the one conducted from Miss Feka et al., where she investigated the differences in plantar pressure distribution among athletes and sedentary women and sports specifics [48]. In this study, 173 healthy females were

enrolled and separated into 2 different groups (athletes and sedentary) [48]. Although, there were categorised based on their physical activity levels, no significant differences were found between the two groups in age, weight, height, BSA, BMI, or shoe number [48]. No significant differences were found neither in total plantar pressure surface, total left or right foot surface, fore-foot or rear-foot surface between these groups [48]. An interesting finding is that athletes tend to use forefeet rather than rear feet, making them leaning forward compared to their counterparts [48]. According to the literature, physical activity/sports specificity could affect static human balance and posture [49]. Numerous researchers have reported similar results when compared athletes of the same sport, athletes from different sports, sedentary people, and those with health issues [3, 17, 50-57]. We strongly suggest to the scientific society that gender differences should be investigated more thoroughly and widely.



3. Miss Feka while collecting data for plantar pressure distribution in prof. Massimiliano Oliveri's lab-University of Palermo.

1.2 Multiple Sclerosis

General overview

Multiple sclerosis (MS) is an inflammatory, chronic, autoimmune, and neurodegenerative disease of the central nervous system (CNS) with more than 2.3 million affected people; leading to extensive focal degradation of the myelin sheath and axonal loss, affecting young adults usually between the age of 20-40, particularly women [58-61]. For further understanding, demyelination compromises the nerve fibre activity by slowing axonal conduction velocity [62].

Although there have been numerous publications on MS, the disease is considered pretty complex in nature and unique in the course of the individuals [59, 63, 64]. So far, it has been reported that no patient responds to the therapy in the same way [65], and unfortunately, there is no cure for MS, yet [66]. Furthermore, it has been reported that MS is may be caused by the interaction of genetic susceptibility and several environmental factors such as geographical, nutritional, infectious, childhood obesity, lack of vitamin D, smoking etc. [62, 67-73]. Other symptoms that can be included are: depression, spastic paresis, ventilatory muscle weakness, poor balance and elimination dysfunction [62].

Additionally, based on the symptoms, relapses and progression, the clinical course of MS has been classified into 4 categories:

1. Relapsing–remitting MS (RRMS) - marked by frequent exacerbations; it is one the most common form of MS

2. Secondary-progressive MS (SPMS) - seen when RRMS patients enter a phase in which attacks and remissions are not easily detectable.

3. Primary-progressive MS (PPMS) - identified by symptoms and a lack of relapses; it is most generally diagnosed later in life.

4. Primary-relapsing MS (PRMS) - affects the smallest group of people suffering from MS and is characterized by progression and relapses [62, 74].

In addition to all the factors mentioned above, it can be said that geographical factor can be as a factor is also the distribution of people suffering from MS itself, MS is more prevalent in Western countries with the highest income and more distant in the equator [59].

Nevertheless, although MS is a complicated disease, based on scientific evidence we can detect several cognitive, motor, and sensory impairments [75]. It has been presented that cognitive impairments in MS affects executive functions. Some of these impairments in MS are as follow:

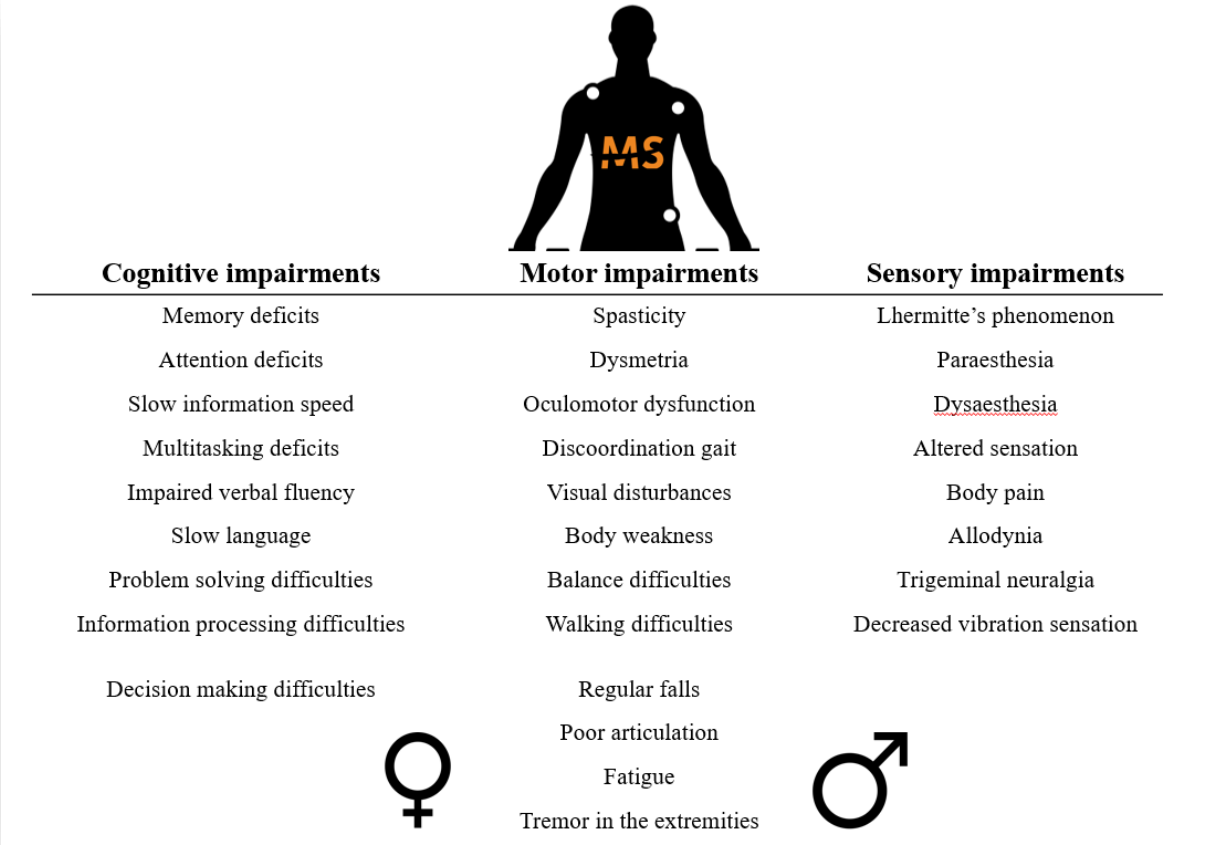


Fig. 1 – A summary of the cognitive, motor and sensory symptoms of MS suffers.

People suffering from MS, reported muscle weakness and fatigue as the most common symptoms coming with the disease [62]. Thus, atrophic changes are linked with the decrease of physical activity engagement, and further contribute to the decline in muscle strength, gait disturbance, functional capacity, vertigo and quality of life in general [62].

1.2.1 Multiple Sclerosis and Temperature

The reason why the title is not being specific to either high or low temperature is that researchers reported that people who are suffering from MS are not only heat sensitive. These two states and some other relations to MS will be thoroughly described in this subchapter. Unfortunately, cognitive and physical functions can be impaired by heat exposure, affecting the ability of MS patients to be engaged in physical activities and even daily living activities, from this situation mildly affected people cannot be excluded [76, 77].

As mentioned previously, fatigue is a symptom that most MS suffers report as an experience. Notably, researchers have reported that fatigue is a complicated problem that is related to several factors [78]. One fatigue-causing factor that will be deeply described in this subchapter is thermosensitivity. Nevertheless, the impact of temperature sensitivity on autonomic and motor symptoms are well presented, however, the same statement cannot be said for mechanisms involved in the process [64]. An increase of core temperature as little as 0.5°C known as Uhthoff's phenomenon, was reported from around 60-80% of MS patients, as well as being sensitive to environmental heat [74, 79, 80], and more than 80% of MS suffers during hyperthermia develop neurological signs [79]. MS symptoms are generally triggered when exposed to warm environments, engaging in physical activity, and even when taking hot baths [81, 82]. Interestingly, between the degree of demyelination and blocking temperature exists an excessive relationship, the greater the degree of demyelination, less heat stress is needed to conduct blocking temperature [83]. Since the main subject discussed here is thermosensitivity, it is important to highlight that when engaging in physical activities the amount of heat production can be significant, exclusively when the mechanical efficiency is poor [78]. People suffering from MS may have lower mechanical efficiencies than healthy people [78]. Meaning that for every kilocalorie spent from healthy individuals during physical activities 3 to 4 extra kilocalories are released as heat, whereas MS patients could produce more heat [78].

Nevertheless, based on scientific evidence we can say that a small increase in the temperature can trigger worsening symptoms of MS patients, but what about the decrease of the temperature? Previously, it has been reported that exposure to cold environments or even taking a cold bath can also trigger a worsening symptom in MS [84]. Although cold sensitivity in people with MS has a much smaller reported rate compared to heat sensitivity [85, 86], this issue still affects their quality of life. Furthermore, cold sensitivity in MS appears to be linked with the presence of demyelinating lesions within the hypothalamus which is the main area of

the CNS controlling body temperature [87]. This afterward leads to thermoregulatory dysfunction, a form of blunted autonomic responses [87]. With all the above-mentioned information, we can conclude that each temperature affects people with MS, with heat sensitivity being more reported.

Since, both high and low temperature affects MS patients, in the following paragraph you will find some of the impairments and symptoms caused during heat and cold sensitivity.

Symptoms during **heat** sensitivity:

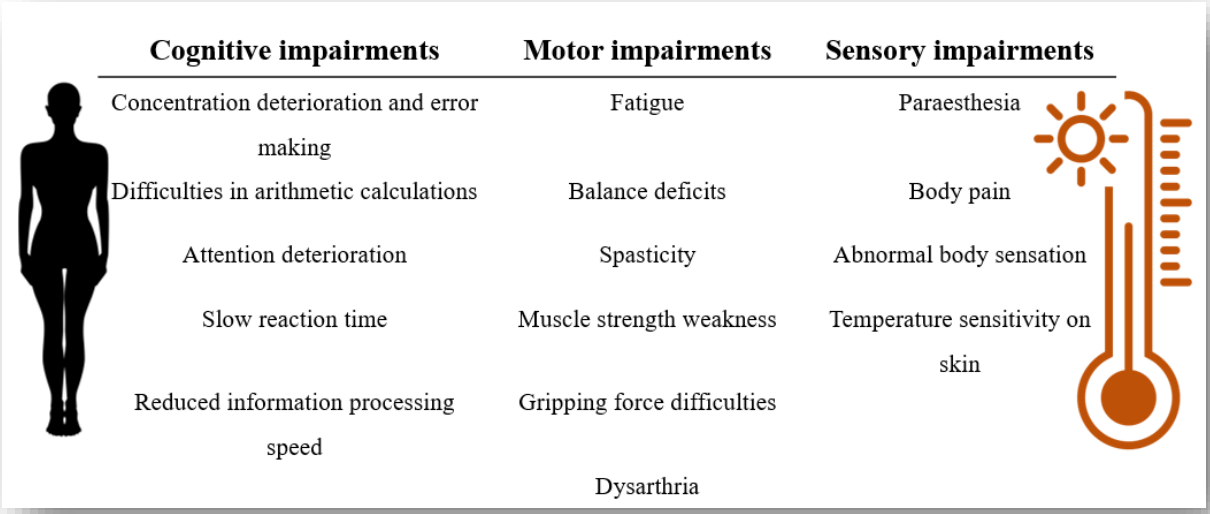


Fig. 2 – Summary of symptoms exacerbated with the increase of body temperature in MS.

Symptoms during **cold** sensitivity:

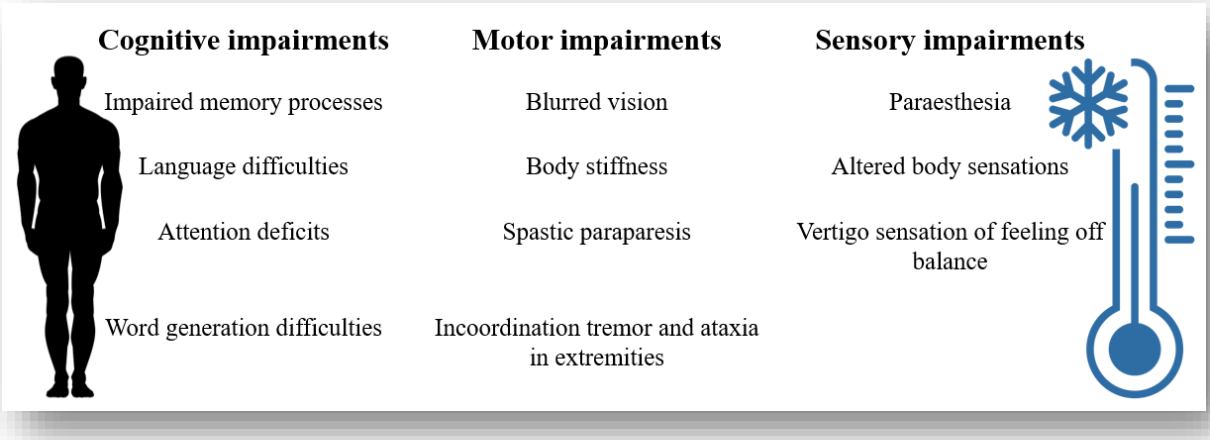


Fig. 3 – Summary of symptoms exacerbated with the decrease of body temperature in MS.

Having in mind that symptoms and signs in MS can be improved or even disappear when the temperature is normalised [79, 80].

Information in the figures 1,2 and 3 were taken from Christogianni et al. and modified by miss Feka [64].

1.2.2 Multiple Sclerosis and Physical activity

Although physical activity and exercises seemed to have a positive effect to prevent several diseases and disorders, exercise as a therapy in the actual disease remains comparatively unexplored [76, 88]. Over the years, several guidelines on physical activity have been developed based on evidence gathered from the general population (without disability) for healthy children and adults [89-91]. However, when dealing with a particular disease and its specificity, the same protocols/guidelines are unlikely to be used. General guidelines for a healthy population suggest at least 150 min of moderate to vigorous intensity of PA per week. However, for certain disabilities, improvements in well-being and fitness and can be reached with lower intensity and shorter duration in contrary to the recommendation for the general population [92-94]. Most articles reported that 30 to 60 minutes of aerobic and resistance training at moderate intensity performed from 2 to 3 times per week increase muscular strength [95]. Physical activity has been suggested by several researchers, however, despite the benefits of physical activity, a considerable number of people suffering from MS are inactive [96-102]. The reason why lots of MS patients are not physically active is not due to a lack of desire to be engaged. For example, as described in the subchapter of "temperature" in the current dissertation, most MS suffers are heat sensitive, and when they do exercise their body temperature raises, and more heat is produced which leads to worsening of symptoms. Thus, MS patients try to avoid exercising, at least this is one of the reasons. For this reason, the need for potential safety guidelines/protocols on frequency, intensity, type and duration of PA is substantial. Previously, numerous studies have shown that MS is associated with reduced levels of muscle strength, cardiorespiratory fitness, endurance and speed [103-111]. Hence, on the other hand, several articles promoted important outcomes regarding improvements in the cardiorespiratory system and muscle function while decreasing depression and fatigue while being engaged in individualised exercises [76, 102, 112-116].

Considering the benefits and the importance of physical activity, based on scientific evidence some recommendations for exercises in MS will be described below. However, before starting with any kind of exercise program, people suffering from MS are strongly advised to consult with their physician. A reminder that MS suffers react differently from one another in every treatment and the course of the diseases is unique. Prior to any given exercise program, the patient should be tested for capabilities or limitations, and based on the outcome the protocol should be adjusted. However, the progress of the patient should always monitor and track patient's outcome, with special attention to the symptoms or signs shown during the application of the program.

Some types of exercises that reported a desirable improvement in the overall affected population are as follow:

- **Cardiorespiratory Exercise Training**
- **Strength Training**
- **Flexibility Exercise**
- **Aquatic Exercise**

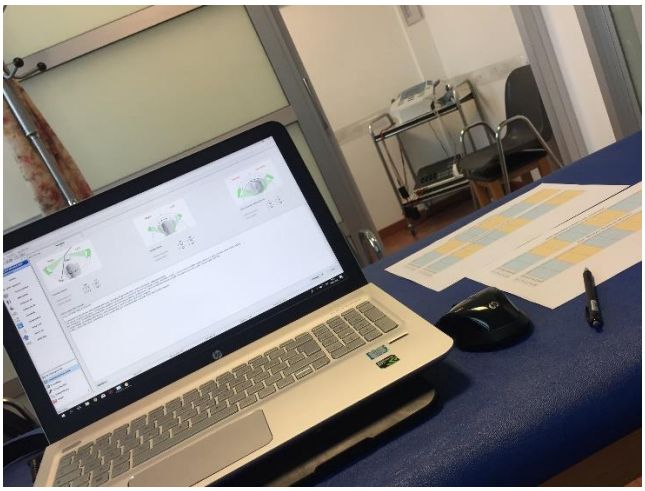
Of importance; every protocol should be individualised and include special consideration and supervision [62, 95].

1.2.3 Multiple Sclerosis and Nutrition

Although the real cause of MS has not been identified yet, nutrition is considered to be a potential environmental factor in the pathogenesis of neurological diseases such as MS [117]. However, due to unclarity and the lack of information on the subject, its role as treatment cannot be used [73]. Several studies that used nutrition intervention recommended that diet may be considered as a complementary treatment to control the progression of the disease [117]. According to Riccio and Rossano, having a high BMI prior to the age of 20 years old has been linked with an increased risk of getting MS [59]. To improve the wellbeing of people suffering from MS, scientific outcomes demonstrated that nutritional interventions with anti-inflammatory food and dietary supplements decrease the biological synthesis of pro-inflammatory compounds, whereas immunomodulatory drugs seemed to be more effective [59]. Furthermore, in order to avoid the increase of inflammatory processes in people affected with MS, the intake of saturated fatty acids with animal origin must be controlled [59].

However, a potential therapeutic low-fat diet and a polyunsaturated fatty acids supplementation attracted the researcher's attention, which may have benefits in MS [118]. Clinicians suggested that regardless of being healthy or suffering from different issues, an adopted healthy diet should be considered [119]. Although there is no cure for MS, any dietary habits that help abate MS symptoms could be considered as complementary treatment [117]. Thus, any further research on the effects of possible adverse dietary habits could help prevent chronic states of inflammation of the disease [120]. It is unknown if dietary antioxidants have further biological properties beyond simple antioxidant activity in MS [120]. Nevertheless, based on scientific outcomes, vitamin D plays an important role in MS patients [121, 122]. The profound importance of vitamin D in people suffering from MS for the first time has been proposed by the researcher Goldberg [123]. Evidence regarding vitamin D intake shows that there is a tendency of slowing down the progression of the disease [121, 122]. In addition, insufficiencies of vitamin D seems to be a risk factor for MS patients due to the reasons as follow: MS frequency increases with the increase of latitude; MS risks appear to decrease with migration from high to low latitudes; Prevalence of MS at high latitudes is lower than anticipated in people with high consumption of vitamin D [123-126]. Consumption of high doses of vitamin D by MS patients as a form of treatment for the diseases was found that plays an important role in maintaining bone health by preserving calcium and phosphorus homeostasis [127, 128]. Although extensive evidence supports the safety of large doses of vitamin D intake these findings, however, are based on studies of limited size and duration, and mostly older adults participated [122]. It is worth mentioning that a protective role for the consumption of vegetables and fruits together with healthy fats and restricted/controlled consumption of meat is an important association between healthy dietary habits and better physical and mental indicators (MS Quality of Life-54), followed by lower levels of disability [119, 129]. Regarding vitamin B12, there is still no clear picture if there is or is not a correlation with MS since different researchers found different results [130-132]. However, further investigation is required to determine whether treatment with vitamin B-12 supplements delays the progression of the disease. While, on the other hand, Bitarafan et al., found that consumption of vitamin A can improve cognitive abilities and countered disability in the upper body, however, this did not make any changes on the EDSS score [133]. Other supplements that may help MS patients are: vitamin E and C [132]. The observations presented above suggest that the nutritional status could influence the course of the disease. However, MS main therapy cannot be firmly linked with a particular diet due to the scarcity of information on the effects of nutrition on this disease. Sometimes, conclusions are limited due to the small number of subjects, generalization of the

populations, lack of controlled studies, and the use of questionnaires itself on food intake. Mediterranean diet is considered to be good, however, the intake of gluten must be limited and should be whole grains [132]. However, to our knowledge, unfortunately, there are no sufficient evidence that supports or suggests a specific diet for people suffering from MS. Hence, we encourage the scientific community to work in this direction.



4. Miss Feka while collecting data with MS patients in Vita, Italy.

1.3 COVID-19 and its impact in lifestyle

General overview

In December 2019, a deadly virus named COVID-19 by the World Health Organization (WHO) was firstly detected in China [134]. Due to its fast human-human transmission, this deadly virus was no longer a public health concern only in China but became a serious health issue for numerous countries at the beginning of 2020 [135], and later was spread out throughout the entire world.

Seeing the seriousness of the virus, its fast transmission, and the negative consequences in health, resulting also in deaths, the COVID-19 disease was considered an international public health emergency by the WHO, and it was declared as pandemic [134]. In order to slow down and possibly flatten the curve of a COVID-19 virus transmission, and also according to the severity of the COVID-19 virus situation, different international and national public health measures were put in place by relevant bodies.

Among the safety measures imposed were as follows: a 14-day quarantine/isolation of all individuals suspected of infection with this disease, social distancing, lockdowns of entire populations of varying severity to alleviate the spread of the virus [136]. Public health recommendations and governmental measures affected also the education system, which was changed from on-site to an online teaching process organized using different online platforms. Additionally, public and private spaces for physical activity were inaccessible, making it very hard to be involved in PA. Without any doubt, these measures have seriously restricted the mobility, daily activities [137, 138], and social interactions [139] of the individuals. In other words, in alike situations, physical and mental health are of significant concern, particularly among children and adolescents [140].

Indeed, as it will be discussed in subchapters below, the COVID-19 restrictions have had a negative impact not only in PA, sedentary lifestyle, eating behavior, but have also imposed an enormous psychological stress and have changed the social life of all individuals.

1.3.1 COVID-19 and Physical Activity/Sedentary behaviour

As mentioned previously, imposed measures have impacted the entire public health in general, and PA levels in particular among all individuals across all ages and sexes. It has been already well-documented that reduced physical activity levels and increased sedentary behaviour are associated with both negative physical and mental health consequences [141],

including loss of muscular and cardiorespiratory fitness, weight gain [142], psychosocial complications [143], and even poor academic performance.

Before starting to highlight the main findings regarding the effect of COVID-19 on PA, it is of relevance mentioning that during the lockdown there was insecurity among the population regarding doing PA, since they were thinking that it might increase the chances to get infected, or if infected it might worsen the situation. Furthermore, Halabchi et al (2020) published a good piece of work discussing if physical activity was suitable during the COVID-19 pandemic [144]. In this regard, moderate-intensity physical activity was recommended since it may be helpful for non-infected individuals. But, due to the high risk of person-person spread of the virus, it was suggested to practice PA in private spaces (e. g. home) [144].

The negative impact of COVID-19 restriction measures on PA levels has been clearly demonstrated. The decreased physical activity level among the population across the world came due to the reduced access to physical activity spaces (indoor and outdoor), particularly affecting the activities performed outdoor or/and activities performed in groups [145]. In other words, significant decreases in time spent in PA, and also the energy spent in different types of physical activities (e.g., vigorous, moderate, walking) has been reported (reference). In fact, lower PA levels during COVID-19 home confinement compared to pre-COVID-19 confinement have been extensively reported [146-150]. Furthermore, the amount of decrease in PA levels during COVID-19 home confinement was also dependent on several factors. In this regard, it was reported that age was among the factors which played a massive role in the amount of PA decrease. In this regard, a higher decrease in Pa levels during COVID-19 restrictions was reported among young and young adult participants compared to older age groups [146]. Similarly, lower PA levels during COVID-19 home confinement were also reported among Croatian adolescents [151].

Furthermore, the effect of gender, as another influencing factor in the decrease of PA levels during home confinement, was country-dependent and highly affected by cultural background. In a study conducted by Gjaka and his colleagues (2021), it was shown that no significant changes in PA levels during COVID-19 home confinement existed between males and females in Kosovan participants [146]. Moreover, a different picture regarding the gender differences in PA levels during COVID-19 restrictions was presented in a study conducted with Sicilian participants, where significant differences in PA levels during COVID-19 restrictions were reported between males and females [147].

Yet, also the living environment was claimed as an important factor that has influenced the decrease amount of PA levels during COVID-19 home confinement. Indeed, in line with this idea, according to Zenic et al. (2020) and Gjaka et al. (2021) participants living in rural environments have experienced a lower decrease in PA levels during COVID-19 restrictions compared to urban living counterparts [146, 151]. This difference is explained by the fact that rural living participants might have had more access to outdoor spaces and they usually are more involved in household and farming activities, which can be considered as a crucial factor that helped them preserve the PA levels [146].

Besides decreased PA levels, increased sedentary time (sitting time) was reported as another negative effect of COVID-19 restrictions, which has been highlighted as a very big public health concern. In a study conducted in different countries in Europe by Pišot and his collaborators (2020) was reported that participants during COVID-19 lockdown spent 50% more time by being physically inactive compared to before COVID-19 [152]. The same results were found also in another multi-national study where an increased sitting time by ~2 hours/days was reported [153]. This increased physical inactivity was reported to be closely related to increased exposure time to electronic devices such as TV, smartphone, computer, and tablets [152].

1.3.2 COVID-19 and Eating behaviour

Apart from the challenges to be engaged in PA, COVID-19 restrictions have complicated and made the food supplying process quite difficult, which undoubtedly has negatively affected the normal food-related behaviour [154]. According to WHO (2019), healthy nutrition is of outmost importance for good health and well-being, specifically when the immune system is challenged [155]. Therefore, it has been shown that lack of proper nutrition (fresh food) could have a negative impact on physical and mental health [155].

In fact, living in quarantine causes anxiety and boredom which may lead to an increased amount of food consumption and food of lower quality compared to normal living conditions [156]. The combination of lower physical activity levels during COVID-19 restrictions together with the higher amount of food consumed leads to a positive energy balance [157]. This led to increased body mass with was directly associated with the consumption of unhealthy food (e.g., fried foods) and a sedentary lifestyle [157].

According to the study conducted by Ammar et al. (2020), the percentage of individuals who reported that they were consuming unhealthy foods was higher during COVID-19 confinement compared to the before-COVDI-19 confinement [158]. Furthermore, it has been also revealed that the percentage of participants eating out of control was much higher during COVID-19 confinement compared to the before-COVDI-19 confinement [158]. Additionally, regarding the number of meals per day, it was indicated that the number of meals per day was drastically increased during COVID-19 home confinement compared to the pre-COVID-19 condition [158]. Conversely, there has been reported that home confinement due to COVID-19 has produced also some positive outcomes regarding healthy nutrition habits. In this regard, Pišot and his collaborators (2020) showed that 44% of participants included in their study reported more regular meals and healthy meals including less alcohol consumption and less smoking during COVID-19 home confinement [152]. Finally, seeing the importance of maintaining the right calorie intake, there have some suggestions that in order to better control and plan food consumption and counteract unhealthy dietary behaviours to use different nutrition apps during COVID-19 home confinement [139, 159].

1.3.3 Impact of COVID-19 in psychological health and social life

Despite the negative impact that measures against COVID-19 have had on physical activity levels and nutrition behaviour, an equally large negative effect is caused in the psychological health and emotional well-being of individuals forced to quarantine due to COVID-19. In other words, such measures have restricted mobility, normal daily activities, and social interactions [137-139]. In fact, numerous studies have shown that symptoms of psychological distress and disorder have been increased during COVID-19 home confinement [153]. Subsequently, studies have shown that symptoms of psychological distress and disorder (e.g., depression, anxiety, negative feelings, etc.) have been increased among individuals during COVID-19 quarantine [160]. Additionally, home confinement due to COVID-19 has negatively influenced also sleeping habits. Due to sleep disturbances during COVID-19 home confinement, a higher dysfunction during the day was reported, which might be related to increased negative emotions and frustrations as well [161]. In addition, Papandreou et al. (2020) revealed that the prevalence of anxiety symptoms was associated with the severity of lockdown measures, indicating higher anxiety symptoms among Spanish participants where the measures were more severe and stricter compared to Greece with more relaxed lockdown measures [162].

Consequently, to confirm sleep disturbances during COVID-19 quarantine, Pišot and his colleagues (2020) reported that participants went to bed late, woke up later compared to before COVID-19 restrictions [152]. This confirmed the claim that people slept longer during COVID-19 quarantine than before [152]. In this regard, interesting findings were reported by Trabelsi et al., (2020) showing that the global Pittsburgh Sleep Quality Index (PSQI) score during home confinement was higher than the cut-off point for poor sleep quality [153]. These results show that people during home quarantine condition, although they slept longer, they suffered from poor overall sleep quality [153].

Furthermore, COVID-19 governmental measures and restrictions have negatively influenced also the social life of people under quarantine. Studies have revealed large decreases in social activities within families, friends/neighbours or entertainment due to COVID-19 restrictions [138]. Consequently, these negative effects of COVID-19 restrictions on social life were directly related to lower life satisfaction during home confinement [138].

Additionally, a huge increase in gaming, Social media usage, and TV usage has been reported during home confinement [163, 164]. This somehow does not solve the problem, since according to previous reports frequent use of social media negatively affects mental health, circadian rhythms, and sleep outcomes [165].

Finally, as suggested by Ammar et al., (2020) the use of technology to this extent during home confinement could be used by relevant bodies to implement national strategies aiming to reduce the psychosocial of COVID-19 quarantine [138].

Chapter 2

2.1 BAROPODOMETRY – STATIC PLANTAR PRESSURE DISTRIBUTION

2.2.1 Background

Initially, when miss Feka started her Ph.D. she was involved in different tasks including lecturing, research methodology and statistics classes, data collection, and writing. However, at the very beginning, she showed excessive interest in balance and posture, its applications, and its effect, specifically in gender differences, weight and sports. For this reason, she started to prepare her very first manuscript which was published in the journal of Human Movement related to static baropodometry, sports, and sedentary in women.

The human ability to keep balance and orientation has been described as postural control [166, 167]. However, in order to maintain balance and postural control, there are several attentional requirements. Having a great postural control and its maintenance varies depending on numerous internal and external factors, such as genetics, age of the person, the state of the vestibular apparatus, the area of support, centre of mass positioning, coordination, strength, frequency of participation in motor activities and their balance abilities [168-170].

It is essential to highlight the importance of the central nervous system in order to control posture and movement [1, 171]. Although the ability to stand on the feet can be affected by several factors, however, the foot remains the first body part to get the first impact with the ground, it is also used as the base for support [1]. Thus, for this reason, it is vital to understand foot functioning and morphology during standing, moving, or any other form or function that human engages their feet.

Researchers have been highlighting the importance of balance and coordination in order to do daily tasks and other sports or exercise activities [170]. According to the literature, it has been distinguished that participating in sports can cause physiological and anthropometric changes in the practiser's body. Including the results of improving or changing other parameters of the body (physical fitness, bone mineral, lean body mass, etc.) [3]. However, there is a lack of evidence on how these specific daily activities or the practice of different sports and body weight may influence plantar pressure distribution and its evaluation.

In the light of explanation, plantar pressure refers to the pressure which is measured on the plantar surface of the foot [172]. The assessment of plantar pressure distribution varies according to the interest of the evaluation however, posture has not been an easy matter to explore anyway. Previously, expensive, ineffective and harmful tools have been used for postural assessment. Thus, the use of baropodometry as a much cheaper and portable tool has been confirmed as a reliable device for investigation by several authors [1, 173]. However,

there is a concern raised by Alves et al. that the results from the assessment of baropodomenty should be elucidated with caution when used in science and in clinical practice [174].

Relying on the literature, we can indicate that plantar pressure it's affected by several factors such as gender, body weight, body mass index, foot morphology, occupation, lifestyle, footwear, etc [4, 175]. Nevertheless, physical training and sports performance are considered as contributing factors that can cause changes in plantar pressure [176]. Therefore, the aim of the first study was two-fold: firstly, to investigate the differences in plantar pressure distribution between athletes and sedentary women; and secondly to explore the differences in plantar pressure between athletes in different sports. Whereas, the purpose of the second study was twofold: firstly, to investigate the differences in plantar pressure distribution in children within 4 weight categories, and secondly to evaluate the presence of sex-related plantar pressure distribution differences, if any.

2.2.2 **Experimental approach to the problem**

2.2.2.1 Research Methodology adopted for the first study (Feka et al 2018)

Participants

An overall number of one hundred and seventy-three (173) healthy females were enrolled in the study. Seventy-five of them practiced different sports (see table X), while ninety-eight did not engage in any sport nor had an active lifestyle. Participants in this study were divided into Active Group (A) and Sedentary Group (S). Seventy-five athletes who participated in this study, have practiced their sport for at least 3 years. The participant with any personal medical histories and/or have a previous family history of suffering from orthopedic and nervous pathologies that might influence testing or the study itself, were considered as exclusion criteria.

In the following table are presented the overall number of the subject enrolled, including the exact number of each participant belonging to the specific group and sport.

Females		
Overall participants - 173		
Athletes		**Sedentary**
Soccer	18 participants	98 participants
Judoka	18 participants	
Swimming	16 participants	
Dancing	12 participants	
Rowing	11 participants	

Table 1 – Overall number of participants in the first study (athletes and sedentary).

Study design

This is a cross-sectional study in which the shoe size, bodyweight to the nearest 100 g via scales (Seca 709, Hamburg, Germany), as well as body height to the nearest 1 mm using a wall stadiometer (Seca 220, Hamburg, Germany) were recorded. Furthermore, the mean ± standard deviation (SD) of Body Mass Index (BMI), determined as weight in kilos divided by height in meters squared, and Body Surface Area (BSA) was calculated for all participants. The BSA was attained through the Mosteller formula [177]. However, no significant differences were found between sedentary participants and athletes in age, height, body weight, BMI, BSA, and shoe size.

In addition, to assess plantar pressure distribution, we used the FreeMed posturography system together with the FreeMed baropodometric platform as well as FreeStep v. 1.0.3 software. The sampling rate was set at 25 Hz and the sensors were coated with 24K gold in order to guarantee the repeatability and reliability of the instrument which was produced by Sensor Medica, Guidonia Montecelio, in Rome, Italy. All participants were instructed to maintain the standardized standing straight with eyes closed (Romberg test) while being tested on the baropodometric platform. Each foot was divided into the fore-foot (anterior) and rear-foot (posterior) area, with an approximation to 1 mm.

Statistical analysis

Data in the current study were expressed as mean ± SD. The student's t-test for independent samples was used in order to analyse differences between the two groups. While on the other hand, one-way analysis of variance (ANOVA) with Tukey's multiple comparison post-hoc test was adopted in the case of multiple comparisons. These analyses were administered with the InStat GraphPad Prism 7.0 software (San Diego, CA, USA). All the results were considered to be statistically significant at $p < 0.05$.

2.2.2.2 Research Methodology adopted for the second study (Feka et al.,2019)

Participants

Four hundred and sixteen children (416) aged 7-12 years old (226 boys and 190 girls) from 6 different local elementary schools in Palermo, southern Italy, were randomly selected to be enrolled in the study. Because in this study we enrolled children, verbal assent was obtained from their parents/guardians, together with a written informed consent which was signed prior to testing. Participants with physical injuries, neurologic diseases, or intellectual disability were excluded from the study. According to Cole et al [23] cutting off points, children were separated into 4 following categories such as underweight, normal weight, overweight, and obese. The number of participants belonging to each category based on BMI calculation is presented in the table below.

Participants	UW	NW	OW	O	Over all
Male	13	129	47	37	**226**
Female	19	109	41	21	**190**

Table 2 – Overall number of participants in the second study; UW - underweight; NW - normal weight; OW - overweight; O - obese.

Study design

Similarly, to the first study, to extract participants' body mass (kg) a scale to the nearest 100 g (Seca 709, Hamburg, Germany) was used, whereas, for finding the body height (cm) a wall stadiometer with the nearest to 1mm was used (Seca 220, Hamburg, Germany). Cole et al

(23) formula was used to calculate children's BMI, by which, according to Cole's cut-off points children were divided into 4 different weight categories as presented in table 2. All children underwent a postural instrumental assessment comprising a static baropodometry in order to acquire feet characteristics in terms of plantar pressure percentage. For the baropodometric test, they were positioned in an orthostatic position on the platform (freeMed Maxi; Sensor Medica; Guidonia Montecelio, Roma, Italia) with the sampling frequency set at 50Hz, for 5 seconds. Children were instructed to be barefoot with feet placed side-by-side and arms held along the trunk while gazing forward. The current study has been implemented and adopted following the STROBE checklist.

Statistical analysis

All data presented in this study are expressed as mean and standard deviation. In order to check for normality distribution, the Shapiro-Wilk test was performed. Furthermore, for a comparison between groups, nonparametric statistical analysis was performed using Mann–Whitney U test or Kruskal-Wallis test associated with pairwise comparisons. Statistical analyses in the current study were performed by using Statistical Package for Social Sciences software version 21.0 (SPSS Inc., Chicago, IL).

2.2.3 Research findings related to the projects

In both studies were found some interesting and useful information that weight, gender, and sport have an influence in plantar pressure distribution.

In the first study (entitled: How do sports affect static baropodometry? An observational study among women living in Southern Italy) it was found that there were significant differences between sedentary and athlete group in Maximum peak pressure (g/cm^2), Pressure mean (g/cm^2), fore-foot load (%) and rear-foot load (%), however, no significant differences were found in the total left foot load (%) and total right foot load (%).

Parameters	Athlete (75)	Sedentary (98)	*p-value*
Maximum peak pressure (g/cm^2)	445.38 ± 88.47	518.06 ± 111.50	0.0001
Pressure mean (g/cm^2)	217.95 ± 38.11	232.99 ± 43.26	0.0182
Total left foot load (%)	49.93 ± 2.97	50.68 ± 4.27	NS
Total right foot load (%)	50.07 ± 2.97	49.32 ± 4.27	NS
Fore-foot load (%)	52.36 ± 3.76	50.39 ± 3.60	0.0006
Rear-foot load (%)	47.64 ± 3.73	49.61 ± 3.60	0.0006

Table 3 – Percentage loads on the plantar areas, maximum peak pressure and mean pressure values in athletes and sedentary groups.

Furthermore, significant differences were found also within the athlete group (different sports) in plantar surface values. These differences are presented below.

Parameter	Soccer	Judoka	Swimmers	Dancers	Rowers	p-value
Total surface (cm^2)	265.83 ± 30.58	245.56 ± 25.44	241.06 ± 39.00	250.58 ± 29.37	275.82 ± 23.95	0.0183
Total left surface (cm^2)	134.33 ± 17.54	120.06 ± 13.63	119.13 ± 22.18	124.25 ± 16.50	137.00 ± 13.18	0.0132
Total right surface (cm^2)	131.50 ± 14.42	125.50 ± 12.83	121.94 ± 17.86	126.33 ± 13.69	138.82 ± 11.62	0.0378
Fore-foot surface (cm^2)	155.17 ± 19.17	139.33 ± 14.26	136.88 ± 22.34	139.67 ± 15.93	152.27 ± 14.48	0.0474
Rear-foot surface (cm^2)	110.67 ± 14.08	123.55 ± 11.18	110.92 ± 15.61	104.19 ± 20.58	106.22 ± 13.71	0.0262

Table 4 – Plantar surface values (mean ± standard deviation) in athlete subgroups.

Additionally, in the second study it was found that obese children differ in plantar load distribution, as shown in figure 4.

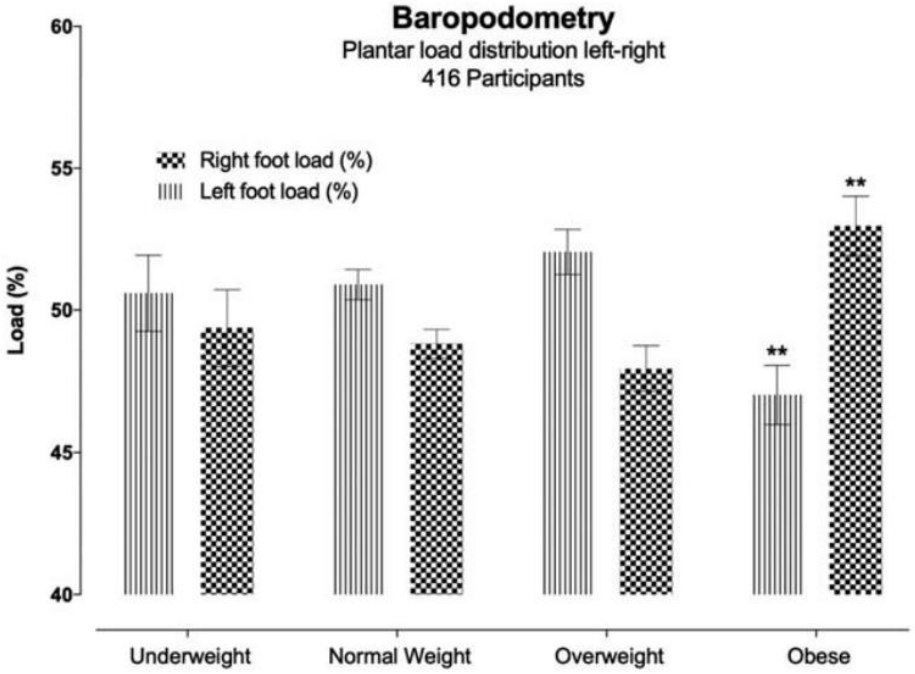


Fig. 4 – Plantar load distribution in left and right foot among UW, NW, OW, and OB in both sexes.
**Significant differences at P<.05.

Nevertheless, significant differences were found when the sample was stratified based on gender, with girls bearing more weight in rear-foot than fore-foot, which is in contrast to boys. These differences are illustrated in the figure below.

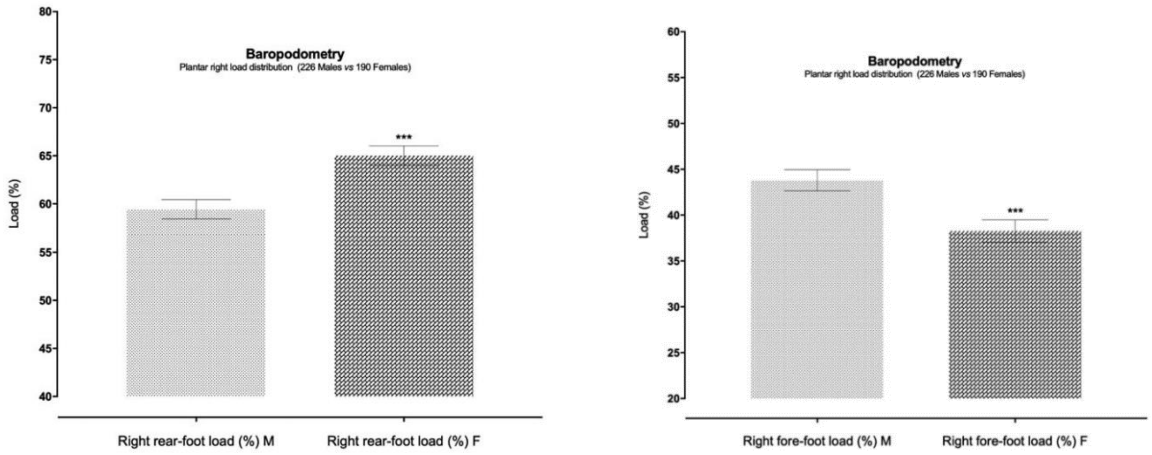


Fig. 5 and 6 - Plantar load distribution in rear-foot and forefoot between boys and girls.

2.2.4 Discussion

Considering the lack of evidence regarding the influence of gender, weight, and sports practice on plantar pressure distribution while standing, we decided to carry out these two studies in order to add some scientific data in the clinical and pediatric approaches. For this reason, the purpose of the first study was to explore the differences, if any, between sedentary women and athletes, and to investigate if there are any differences in plantar pressure distribution when practicing different sports. While, on the other hand, the purpose of the second study was to investigate if there are differences in plantar pressure distribution when stratifying the data based on weight and sex.

The main findings in both studies clearly present the existence of several factors that influence plantar pressure distribution (weight, gender, and sports practice) as hypothesised by our research team. In the first study, no significant differences were found in anthropometric data such as age, height, weight, including BMI, BSA nor shoe number between sedentary and athlete groups. No significant differences between the two groups were found also in plantar surface areas. However, an interesting finding shows that there are significant differences in the fore and rearfoot and left and right load distribution parameters between sedentary and athlete women, which was supported also by previous findings [3, 50, 178, 179]. Considering that sports and physical activity may significantly affect static human balance and posture [49], it was hypothesised that athletes would use more fore-feet rather than rear-feet (leaning forward). All these differences between athletes practicing different sports, athletes practicing the same sport, people with health issues, and sedentary people are supported and presented by several researchers [3, 17, 50-53, 55-57, 168, 180]. Regardless of the practice of diversity of the sports, all athletes enrolled in this study showed a tendency of leaning forward by using fore-feet rather than rear-feet. Similar results were presented also by several authors stating that this tendency comes due to the sport-specific adaptations [3, 50, 168, 172]. Nevertheless, it is important to mention that plantar pressure distribution does not change in normal participants since there are no adaptations to a short-term exposure to exercise [173].

Furthermore, researchers have reported that extensive weight has a negative impact on foot morphology, sensitivity, and load distribution [4, 36, 181, 182], however, it is hazy if the foot adapts to the extensive weight throughout the years. Additionally, this was found also in the second study where results show a clear effect of body weight in plantar pressure distribution with obese children being significantly different from the other categories (UW, NW, and OW). Results in the current study are in line with previous findings where was reported that obese

children experience higher plantar pressure distribution compared to the other categories [183]. Interestingly, data in the current study show that obese children bear more weight in their right foot compared to the left one. It's worth mentioning that such differences between feet were not observed in the other categories. Although the differences across categories were not statistically significant, we found that rearfoot has the highest-pressure distribution. Such findings are confirmed also by de Rocha et al [183].

In addition, within the current study statistical analysis were used in order to check if gender has an influence in plantar pressure distribution. Researchers have suggested that important sex-specific changes may be unseen by incorporating data from both sexes [4]. Thus, in the current study, when the data were stratified between sexes in plantar load distribution no significant differences were found. These results are in agreement with the data reported previously where no significant differences between legs in both sexes were observed [184]. Remarkably, results provide convincing facts that girls bear significantly more weight in rearfoot compared to boys. This information can be found illustrated in figure 7.

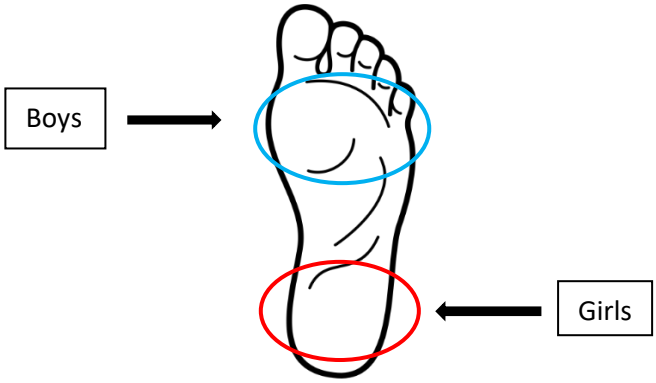


Fig. 7 – Vizualitazion of the foot and differences between boys and girls in pressure area.

Finally, it is crucial to highlight the reliability of the use of Sensor medica/baropodometric assessment as a suitable device to be applied in paediatric, clinical and sport related performance assessment.

2.2 Posture, Electrical Stimulation and Temperature in people with Multiple Sclerosis

As part of her interest in posture and biomechanics, while she was staying in Palermo, miss Feka has been introduced to a project in which Multiple Sclerosis as a disease was integrated. Following her research path, miss Feka together with another Ph.D. student started to collect data in a prestigious medical centre for physical therapy and rehabilitation using nanotechnological devices in health care applications. This study took place in a small city of Sicily called Vita. Furthermore, the aim of this study was to investigate the use of nanotechnological devices integrated with a postural exercise program on cervical range of motion, as well as assessing handgrip strength in patients suffering from Multiple Sclerosis. A part of these data was presented with an abstract at the PMD – Translational Mobility Medicine conference in 2020. This is how miss Feka was introduced to the disease that would take her attention and would make her follow the path of research to help people affected with Multiple Sclerosis.

2.2.1 Treatment with Electrical Stimulation of Sensory Nerves Improves Motor Function and Disability Status in Persons with Multiple Sclerosis (Submitted)

The second study related to MS that Miss Feka was involved in took place at the University of Colorado, Boulder in the laboratory of the neurophysiology of movement.

Since the most reported symptoms in people suffering from MS are limitations of walking and fatigue [185-187], this study aimed to assess the effectiveness of transcutaneous electrical nerve stimulation - TENS treatment applied in both, hand and leg muscles on the motor function and disability. The same device, TENS was used also by other researchers as an alternative option in which it was measured the change in clinical tests of motor function while the device has been used [188]. The application of TENS showed instantaneous improvements in several activities, such as walking speed and endurance; manual dexterity, and dynamic balance.

In this study, 15 participants with MS were enrolled, while on the other hand, other 11-age-mached controls participated. All participants had to meet the inclusion and exclusion criteria of the project and they had to provide their consent before commencing with the study. The study design included a comprised evaluation session prior to and after their treatment with TENS. On both evaluation days, several tests were used, such as tests of dynamic balance, and manual dexterity, walking ability (2 min walk test and 25 ft test) as well as muscle function (strength and force steadiness).

Treatment with TENS device improved significantly motor function (walking performance, dynamic balance, and manual dexterity) as well as self-reported disability levels in people suffering from MS. Nevertheless, some improvements reached clinically significant levels.

2.2.2 Individualized analysis of skin thermosensory thresholds and sensitivity in heat-sensitive people with multiple sclerosis – published in Journal of Temperature [189]

The third study related to MS that Miss Feka was involved in took place at Loughborough University, in ThermosenseLab under the direction of prof. Davide Filingeri.

While still there is not a clear picture regarding the link between MS suffers and heat sensitivity, more than sixty percent of patients reported that they experienced worsening neurological symptoms as a result of exercise and environment-induced increases in body temperature [64, 190]. For the sake of clarification, it is worth mentioning that MS heat sensitivity is a physiological phenomenon [190]. According to Filingeri et al., heat sensitivity can trigger a worsening of afferent thermosensory function [191]. Another finding from Filingeri et al., proved that sensory function can be worsened by 10% while exercising [191]. To further improve the existing scientific evidence, the purpose of this study was two-folded; firstly, it was investigated whether there were individual abnormalities in thresholds for perceiving increases and decreases in local skin temperature between MS patients who are prone to heat-sensitivity; and secondly, it was investigated the abnormalities in the sensitivity to gradually higher temperature stimuli applied to the skin in same participants.

In this study, 11 MS suffers and 11 healthy controlled people were enrolled to participate in this study. MS suffers reported that are heat sensitive. All participants had to meet the inclusion and exclusion criteria of the project and they had to provide their consent before commencing with the study. They participated in two experimental trials, with a minimum of 48h in between the sessions. The experiments were performed in an environmental chamber with a temperature of 25Cº and fifty percent relative humidity.

The disease itself, its course, and response to treatment vary, and there is a huge variability of MS patients in heat sensitivity 23, however, there are no manners to identify which patients are more likely to be vulnerable to heat [192].

2.3 COVID-19 and its effects on Physical Activity, Sitting, Sleeping and Screen time

2.3.1 Background

In the related literature, numerous studies have highlighted the health-related benefits of being physically active, which directly explain the benefits of physical activity and its related positive effects on the prevention of cardiovascular diseases, type II diabetes, several types of cancer, immune function, and also obesity [193-196]. Additionally, other benefits of being physically active have been demonstrated in the literature, showing the positive effect of different types of exercise on bone, muscle, joint pathologies, and degenerative diseases [197-202].

On the contrary, failing to fulfil physical activity recommendations or being a sedentary person is directly related to health issues such as dyslipidaemia [203], microvascular dysfunction, and other problems related to peripheral insulin resistance [204]. In the other words, the lack of physical activity or sedentarism affects the human body at the level of the muscular, cardiovascular, metabolic, endocrine, and nervous systems [202]. In fact, when it comes to the negative effect of physical inactivity on health, related studies have categorized sedentarism (physical inactivity) as the fourth leading risk factor to death, attributing approximately 6 % of total global deaths [205].

During the last year (2020), the entire world has been battling a deadly virus (COVID-19), which initially started in China and then spread out in the entire world and became a very serious public health concern with over 141.108.623 million infected people and causing over 3.019.483 million deaths to date (15, 16, 17). Due to its fast human-to-human transmission and other health risks that the virus causes, the COVID-19 virus was declared a pandemic by the World Health Organization (WHO) on 11th March 2020 [206].

In order to abate the spreading of the COVID-19 virus, different restriction measures were implemented following the recommendations provided by WHO, governments, and relative national and international bodies. These restriction measures were adopted relative to the severity of COVID-19 infections [207], including total self-isolation, home confinement, and also restricted social interactions [137]. Consequently, the precaution measures led to the reduced access to the public and private physical activity spaces, leading to the restriction of possibilities to be engaged in physical activity in general, and for activities performed in groups in particular [207]. Recent studies have demonstrated that COVID-19 home confinement together with restricted or prohibited social interactions (schools, sports events, and sports

clubs' activities lockdown) increased the likelihood of being involved in sedentary behaviours or increased the level of inactivity [147, 208]. As reported previously, even a few days of a sedentary lifestyle are sufficient to cause numerous negative physiological consequences in the human body [202].

Indeed, home confinement and also other restriction measures have been reported to negatively affect physical activity levels in different developed countries [147-150]. In fact, in a large-scale study [137], the same trend of decreased PA levels during COVID-19 home confinement and an increased time spent in sedentary behaviour (sitting time) was reported.

Furthermore, mandatory restrictions and isolation have caused increased psychological stress which is directly linked to the increased risk of poorer food quality compared to normal living situations. Consequently, these changes in nutrition habits and energy balance might lead to weight gain [204]. Furthermore, besides the negative effect of COVID-19 restrictions in PA and eating habits, a negative effect of home confinement in sleeping habits has been reported, which directly affects peoples' lifestyles. On the contrary, normal sleeping behavior is accompanied with improved appetite and functioning of the immune system [209]. In other words, COVID-19 restrictions have induced necessary changes and adaptation of everyday life praxis to the new situation.

Furthermore, although Kosovo, like the other countries, was also affected by the COVID-19 virus, until these studies were conducted, there were no data published regarding the effect of COVID-19 restriction measures on the level of physical activity and general everyday life praxis. In fact, investigating sleeping habits, PA, eating habits and sedentary behaviour was considered of outmost relevance in order to figure out to what extent were the population of Kosovo affected by the COVID-19 restriction measures, based on which to advise people how to react in order to successfully face the new and unexpected situation. Nevertheless, providing some data of this nature from a country like Kosovo is considered of high importance, knowing the fact that demographics of Kosovo population are completely different from the other countries, with a high number of young and young adults and a relatively low number of old inhabitants [210].

Therefore, to better understand the effect of COVID-19 restrictions in Kosovo population, the following two separate studies were conducted:

1. The purpose of the first study was to evaluate the effect of COVID-19 lockdown in PA levels expressed as energy expenditure (MET-minutes/week) and sedentary behavior among the Kosovo population. Additionally, cofactors such as age, gender, and living area, might be related to the amount of decrease in PA level were analyzed.
2. The second study, which was part of a multinational study, aimed to understand if there were any changes in everyday life praxis of sleeping, PA and inactivity behaviours, and eating habits due to COVID–19 restrictions.

2.3.2 Experimental approach to the problem

For the purpose of both studies, a cross-sectional study design was adopted. Two different questionnaires were managed during the COVID-19 pandemic restriction measures in Kosovo (21,22). For the first study an adapted International Physical Activity Questionnaire-Short Form (IPAQ-SF) [147] translated into the Albanian language was administered using an online survey created on the Google Forms platform (Google LLC, Mountain View, CA, USA). Whereas, for the second study the translated "Everyday life in the time of COVID–19 pandemic restriction" questionnaire created by a consortium of six partners coming from different countries was managed online using 1KA online platform, developed by the Centre for Social Informatics, at the Faculty of Social Sciences, University of Ljubljana.

Both questionnaires were administered online during the COVID-19 restriction measures, using social media such as Instagram, Facebook, WhatsApp and Viber as well as emailing contacts [137, 147, 149, 150, 211]. For both studies a cleaning process of data was implemented, consisting of exclusion of participants who did not complete the entire questionnaire, multiple respondents, meaningless data, etc. The data collection timeline and participants' characteristics for both studies are presented in figure 8 and 9.

In the first study, energy expenditure expressed in (MET-min/week) was estimated based on the formula (*total weekly energy expenditure (MET-min/week) = MET x duration of PA type (minutes) x frequency)* using the specific metabolic equivalent (MET) values for each PA category (3.3 MET for walking; 4 MET for moderate-intensity PA; and 8 MET for vigorousintensity PA) [212-214].

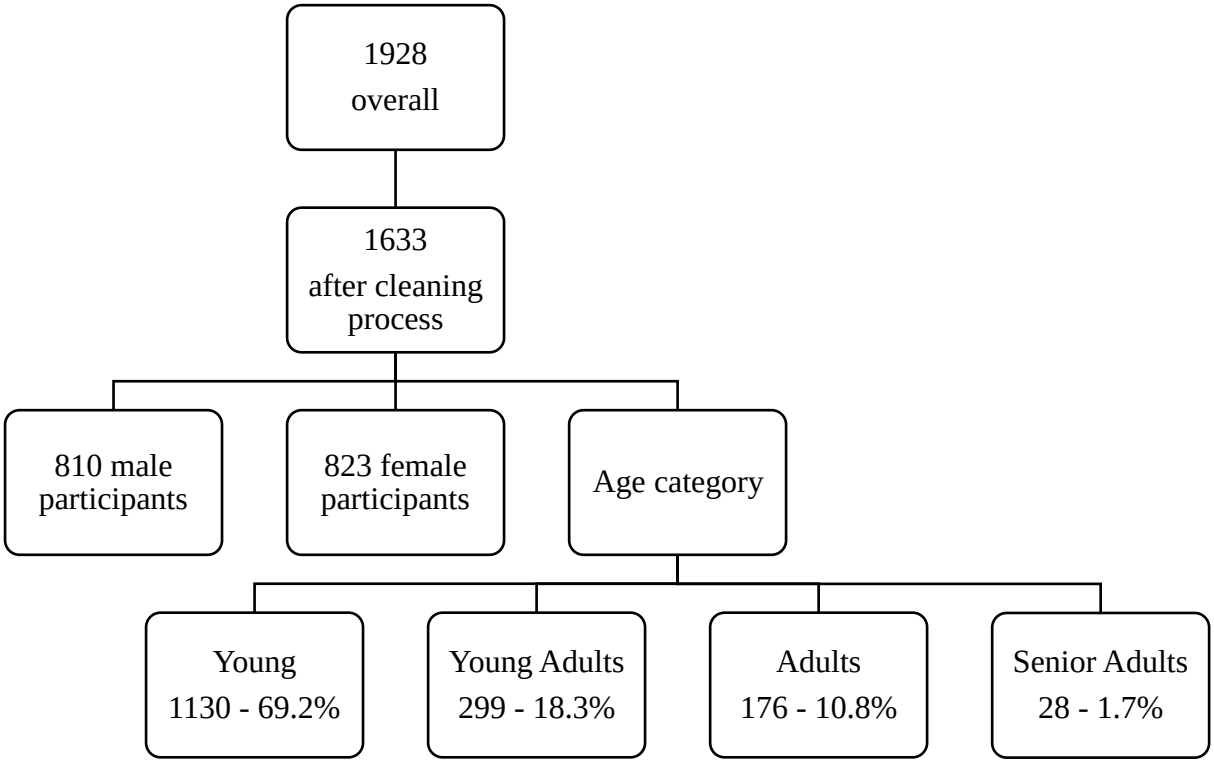


Fig. 8 – Participants information from the first study.

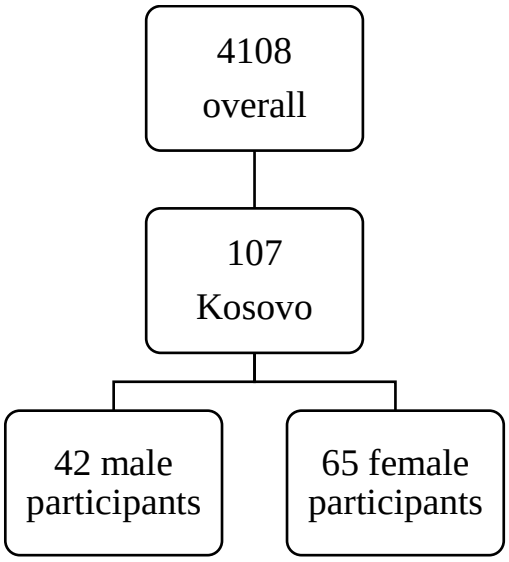


Fig. 9 – Participants information from the second study.

Statistical analysis

Initially, the data distribution for both studies was checked using Shapiro-Wilk test. Since the data of the first study were not normally distributed, statistical methods such as Wilcoxon signed-rank test, Mann-Whitney U test, and Kruskal-Wallis rank-sum tests were employed, with Mann-Whitney U test chosen for pairwise comparisons.

For the second study, differences in each variable were tested using the 2-way ANOVA (time, country) with Bonferroni correction. Additionally, to identify significant determinants of body mass changes, a Multiple Linear Regression was used.

For the purpose of data analysis SPSS (version 21.0) and Graph Pad Prism (version 8. 4. 3) were used for the first study, while STATISTICA (version 13.0) and SPSS (version 24.0) were used for the second study. In both studies, the significance level was set at $p<0.05$.

2.3.3 Research findings related to the projects

2.3.3.1 Study 1

As depicted in the (Figure 10), significant differences were reported in the energy expenditure expressed as (MET-min/week) between pre, and during home confinement condition ($p<0.001$).

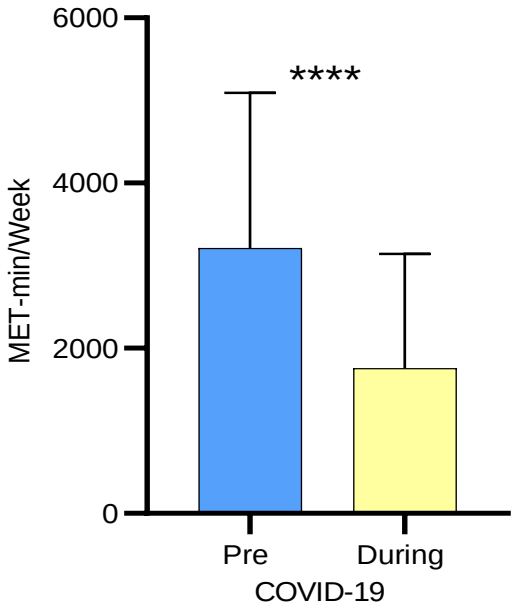


Fig. 10 - Total weekly energy expenditure (MET-min/week) pre home confinement, during home confinement and the difference between pre and during home confinement. Legend: ****- ($p<0.001$).

Age categories analysis showed a significant difference in MET-min/week between pre and during home confinement conditions ($p<0.001$), except for senior adults the difference was ($p=0.006$). Pairwise comparison analysis revealed a significant difference between young and adults ($p<0.001$), young and senior adults ($p<0.001$), young adults with adults ($p<0.001$), and young adults with senor adults ($p=0.002$) in MET-min/week pre confinement conditions (Figure 11a). Likewise, during confinement conditions, the pairwise analysis showed the same significant differences between young and adults ($p<0.001$), young and senior adults ($p=0.005$), young adults with adults ($p=0.001$), and young adults with senior adults ($p=0.02$) in MET-min/week during confinement condition (Figure 11b). As depicted in Figure 11c, the highest MET-min/week difference between pre and during confinement was found among young and young adult categories.

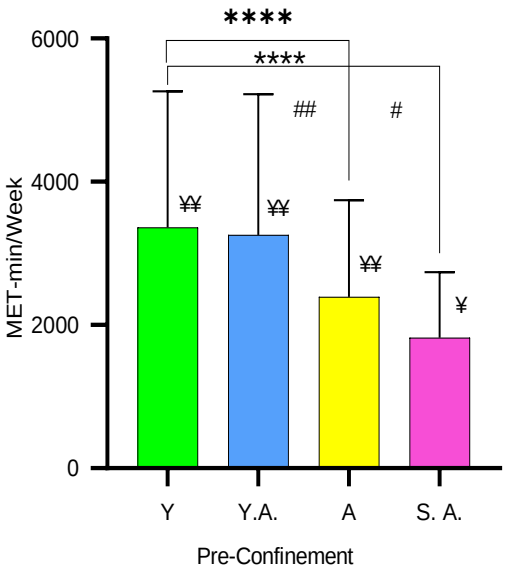


Fig. 11 (a)

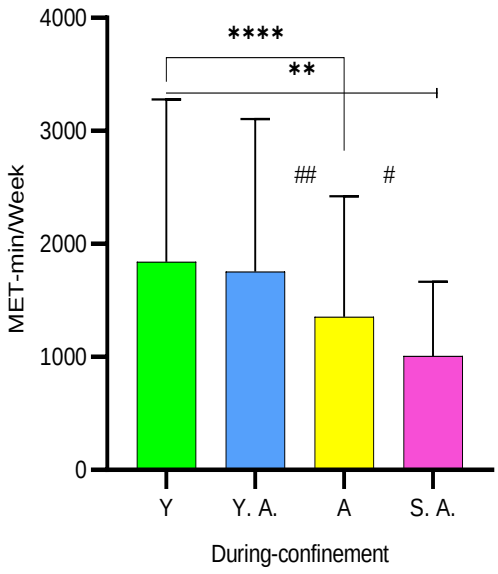


Fig. 11 (b)

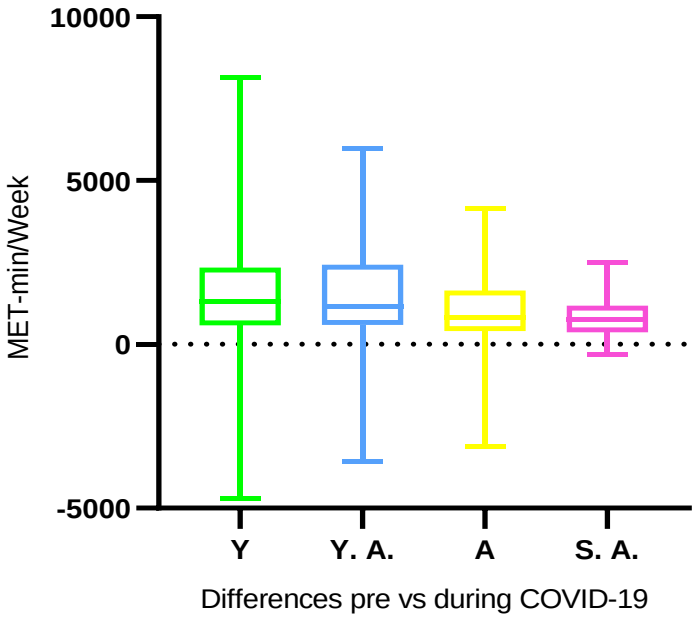


Fig. 11 (c)

Fig. 11 (a,b and c) – Age category differences in MET-min/week (pre and during COVID-19).

(a) Total weekly energy expenditure (MET-min/week) pre home confinement condition in relation to age categories. Legend: Y- young; Y. A.- young adult; A- adult; S. A.- senior adult; ****- ($p<0.001$); ##- ($p<0.001$); #- ($p=0.002$); ¥¥- differences between pre and during confinement ($p<0.001$); ¥- differences between pre and during ($p=0.006$). **(b)** Total weekly energy expenditure (MET-min/week) during home confinement condition in relation to age categories. Legend: Y- young; Y. A.- young adult; A- adult; S. A.- senior adult; ****- ($p<0.001$); **- ($p=0.005$); ##-($p=0.001$); #-($p=0.02$). **(c)** Total weekly energy expenditure (MET-min/week) difference between pre and during home confinement condition in relation to age categories. Legend: Y- young; Y. A.- young adult; A- adult; S. A.- senior adult.

Furthermore, significant gender differences were found in MET-min/week ($p<0.001$), with male participants revealing higher values of energy expenditure in the pre confinement condition compared to the female participants (Fig. 12a). Whereas, no significant gender differences were deteced during the confinement condition in MET-min/week ($p= 0.53$) (Fig. 12b). The difference between pre and during confinement conditions showed a higher decrease in MET-min/week among male participants (Fig. 12c).

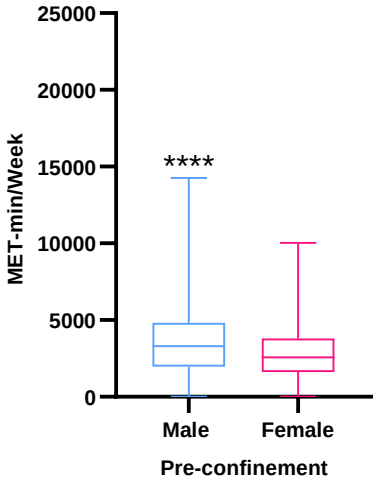


Fig.12a

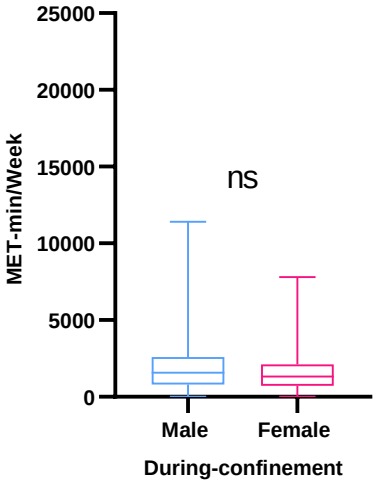


Fig.12b

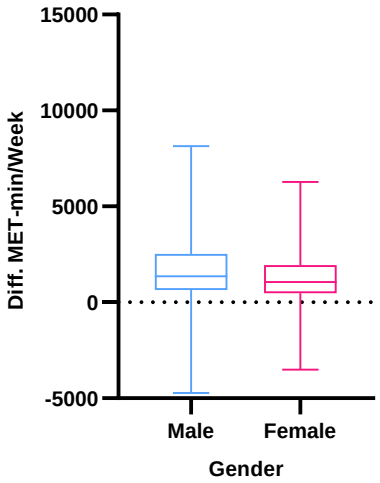


Fig.12c

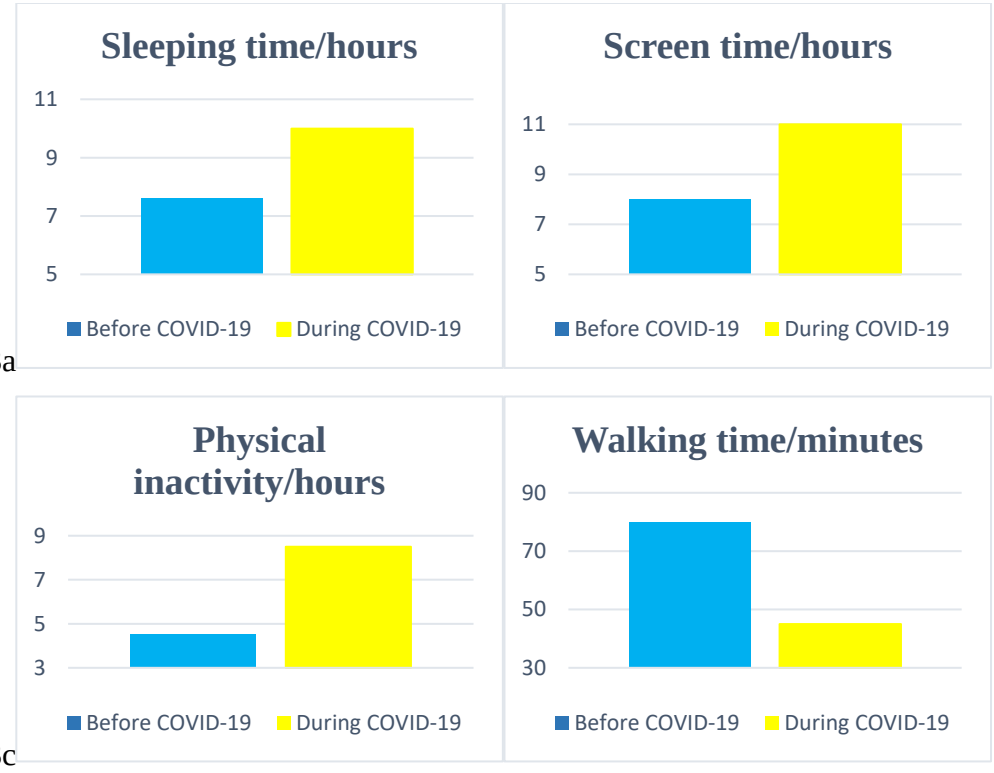
Fig. 12 – Gender differences in MET-min/week (pre and during COVID-19)

(a) Total weekly energy expenditure (MET-min/week) pre home confinement condition in relation to gender category. **(b)** Total weekly energy expenditure (MET-min/week) during home confinement condition in relation to gender category. **(c)** Total weekly energy expenditure (MET-min/week) difference between pre and during home confinement in relation to gender category. Legend: ****- ($p<0.001$); ns- non significant difference.

2.3.3.2 Second study

The overall number of participants in the second study was 4108 as illustrated in figure 9, with a total number of 107 from Kosovo. However, in this study, only the male group was included in the statistical analysis. Lifestyle changed drastically with the Covid-19 pandemic, daily activities and habits that were affected the most are as follows: sleeping and eating habits, sitting time and physical activity, and inactivity in general. However, the main focus will be on the data coming from Kosovo.

In this study, it has been reported that home restrictions due to the COVID-19 pandemic had a negative impact on the Kosovo population by changing all parameters assessed in the questionnaire. In figure 13 (a, b, c, and d) are illustrated all information regarding sleep exposure, screen time, physical inactivity, and walking time by comparing data before and during Covid-19 in the Kosovan population. It is presented a clear picture of how COVID-19 restrictions affected our daily life activities, by increasing the time of sleep, the time that was spent in front of a screen (phone, tv, tablet, etc), increasing the time of inactivity for several hours, and decreasing the time of walking.



13a 13b

13c 13d

Figure 13 – **(a)** sleeping time exposure (hours); **(b)** Screen time exposure (hours); **(c)** Physical inactivity (hours); **(d)** Walking time in minutes.

2.3.4 Discussion

Kosovo is a country with a fairly young population and data regarding physical activity in general, sleep, or inactivity are scarce. Hence, using the given situation of the pandemic COVID-19, it was decided to start collecting online data through two different questionnaires in collaboration with different universities in their respective countries.

The main findings of both studies demonstrated a significant decrease in PA levels due to COVID-19 home confinement compared to pre-COVID-19 confinement conditions. A similar negative effect of COVID-19 home restrictions was reported also in the other studies [137, 147, 202, 208, 215, 216]. Besides reductions reported due to COVID-19 home confinement in PA levels, the negative effect of such condition was also found in sitting behaviour (hours/day), screen time, and sleeping which was significantly increased during home confinement when compared data before the pandemic. Comparable trends of increased sitting behaviour during home confinement were reported in a large study conducted by Achraf and his collaborators (2020) [137] presenting data from different countries and different continents as well.

Additionally, the results of the first study have depicted an effect of gender in the PA level pre and during COVID-19 home confinement. In this regard, significant gender differences in PA level were found before COVID-19, with males being more active, but such differences disappeared during COVID-19 home confinement. In fact, a higher decrease in PA levels among males during COVID-19 home restrictions made these differences fade away. These findings are different compared to the results reported from another similar study, where significant gender differences were reported during both pre and during COVID-19 home confinement conditions [147]. However, these findings can be justified by a cultural context, in which Kosovan people live. Females living in Kosovo are way much more involved in household daily activities compared to males. Thus, this can be considered as a help for female participants to prevent as much decrease in PA level as males. This fact is also supported in other scientific evidence where household chores were reported to be the most prevalent PA type during home confinement [149]. Regarding age category variables, results in the first study reveal significant differences between pre and during COVID-19 home restrictions in PA levels. The highest PA level for both pre and during home confinement conditions was reported from the young and young adult categories, while on the other hand, senior adults reported the lowermost PA level. These findings are in complete agreement with the results reported from other studies showing a comparable trend of PA levels in both conditions (pre and during home confinement) [147, 217]. Indeed, previously it has been stated that younger

people are more physically active than the older ones [218] and the PA level progressively declines with aging [219]. However, results from the first study might have been possibly affected by such a high number of young and young adult participants enrolled in the study. Nevertheless, the high number of young and young adult participants may perhaps be considered as representative of Kosovo, since the majority of the people belong to these two categories [210]. Witnessing the increased number of deaths due to COVID-19 among older adults, it might be speculated that this reason has prevented the elderly to move outside of their living environments resulting in higher levels of physical inactivity.

Chapter 3

OVERVIEW OF PH.D. ACTIVITIES

3.1 International mobility

Throughout these 3 years of the international Ph.D., miss Feka spent more than 20 months in most preeminent laboratories outside Italy. Universities that she has been part of including her involvement within projects and other activities will be thoroughly described below.

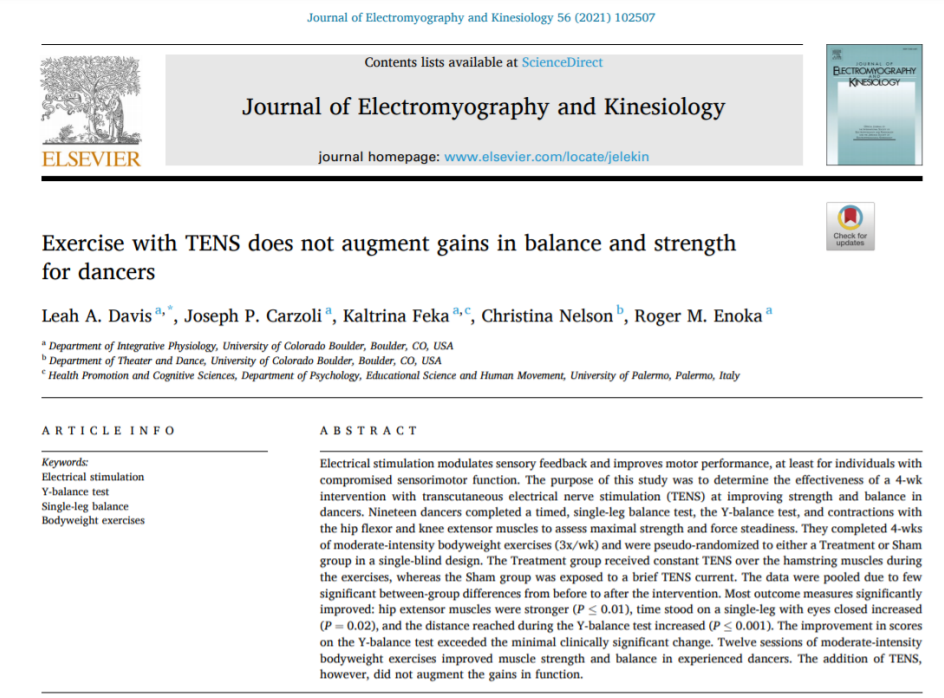
3.1.1 United States of America

At first, thanks to a close collaboration between prof. Antonino Bianco (University of Palermo) and prof. Roger Enoka (University of Colorado, Boulder), she spent 6 months as a visiting scholar at the University of Colorado, Boulder, United States of America; in the department of Integrative Physiology, precisely in the **Neurophysiology of Movement Laboratory** with prof. Enoka as the head of the lab. Miss Feka started her international journey at the University of Colorado Boulder 27th of August 2018 and finished it on 28th of February 2019.

5. Miss Feka in Neurophysiology of Movement Laboratory at the University of Colorado, Boulder for her birthday with prof. Roger Enoka and her colleagues.

During these months she was involved in two different research projects, she participated in prof. Enoka's lectures, she visited another laboratory at the Colorado State University (Fort Collins, Colorado, USA), she took part also in several practical lecturing in learning to use different devices at **Neurophysiology of Movement Laboratory.** The first project that miss Feka was involved in upon her arrival in the United States was related to her field of interest of Multiple Sclerosis and electrical stimulation. The manuscript entitled: "Treatment with Electrical Stimulation of Sensory Nerves Improves Motor Function and Disability Status in Persons with Multiple Sclerosis" has been submitted to the Journal of Neurologic Physical Therapy and it is still under revision.

The second project that she was involved in again it was related to electrical stimulation but this time in dancers. The manuscript of this project has been published in the Journal of Electromyography and Kinesiology under the DOI number: 10.1016/j.jelekin.2020.102507.



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Exercise with TENS does not augment gains in balance and strength for dancers

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[b] Department of Theater and Dance, University of Colorado Boulder, Boulder, CO, USA
[c] Health Promotion and Cognitive Sciences, Department of Psychology, Educational Science and Human Movement, University of Palermo, Palermo, Italy

ARTICLE INFO

Keywords:
Electrical stimulation
Y-balance test
Single-leg balance
Bodyweight exercises

ABSTRACT

Electrical stimulation modulates sensory feedback and improves motor performance, at least for individuals with compromised sensorimotor function. The purpose of this study was to determine the effectiveness of a 4-wk intervention with transcutaneous electrical nerve stimulation (TENS) at improving strength and balance in dancers. Nineteen dancers completed a timed, single-leg balance test, the Y-balance test, and contractions with the hip flexor and knee extensor muscles to assess maximal strength and force steadiness. They completed 4-wks of moderate-intensity bodyweight exercises (3x/wk) and were pseudo-randomized to either a Treatment or Sham group in a single-blind design. The Treatment group received constant TENS over the hamstring muscles during the exercises, whereas the Sham group was exposed to a brief TENS current. The data were pooled due to few significant between-group differences from before to after the intervention. Most outcome measures significantly improved: hip extensor muscles were stronger ($P \leq 0.01$), time stood on a single-leg with eyes closed increased ($P = 0.02$), and the distance reached during the Y-balance test increased ($P \leq 0.001$). The improvement in scores on the Y-balance test exceeded the minimal clinically significant change. Twelve sessions of moderate-intensity bodyweight exercises improved muscle strength and balance in experienced dancers. The addition of TENS, however, did not augment the gains in function.

6. Miss Feka first publication with the Neurophysiology of Movement Laboratory team.

3.1.2 United Kingdom

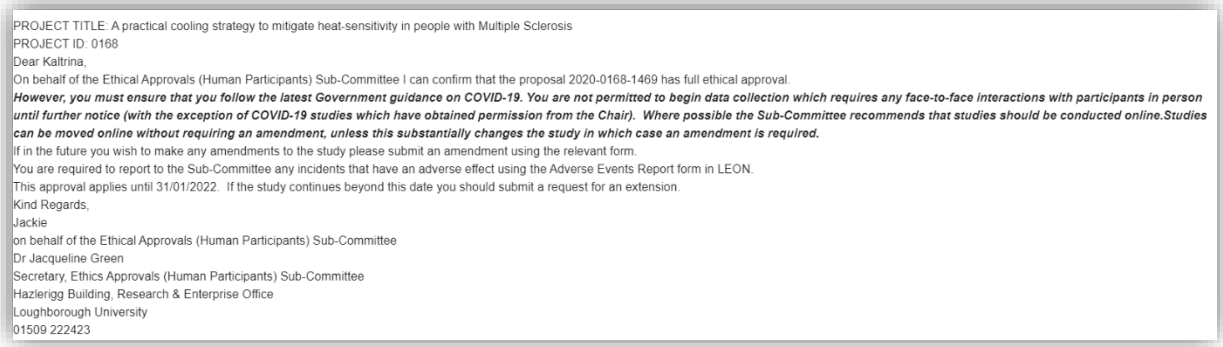
As for the second University, thanks again to a close collaboration between prof. Antonino Bianco (University of Palermo) and prof. Davide Filingeri (Loughborough University) miss Feka spent 14 months as a visiting Ph.D. student at Loughborough University, England; in the department of Environmental Ergonomics Research Centre, in the Thermosense Laboratory with prof. Filingeri as head of the lab.

7. Miss Feka in THERMOSENSE Laboratory at Loughborough University, England with prof. Davide Filingeri and her colleagues.

Prior to going there, miss Feka started her collaboration with another Ph.D. student Aikaterina Christogianni. She translated an online questionnaire for people suffering from Multiple Sclerosis in two different languages (Albanian and Italian). Miss Feka started her international journey at Loughborough University, Loughborough, England starting on the 12th of November 2019 and finishing it on the 31st of December 2020. Upon her arrival at Loughborough University, miss Feka started to work on her projects in two new ideas related to her field of interest. During this time, she was involved in writing, creating, piloting, and implementing these projects. She was also in charge in writing both projects and applying with a full research proposal to the ethical committee of Loughborough University for each project.

First project that she was working in was entitled "A practical cooling strategy to mitigate heat-sensitivity in people with multiple sclerosis" which had a full ethical approval.

Loughborough University



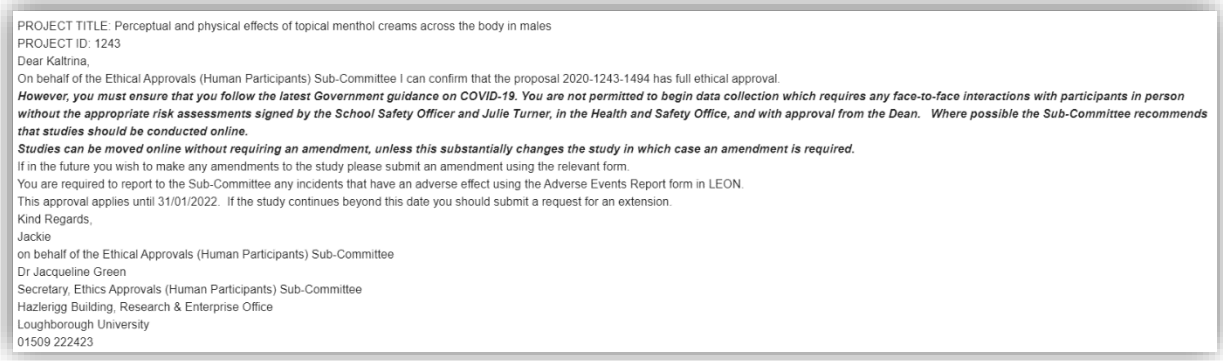
PROJECT TITLE: A practical cooling strategy to mitigate heat-sensitivity in people with Multiple Sclerosis
PROJECT ID: 0168
Dear Kaltrina,
On behalf of the Ethical Approvals (Human Participants) Sub-Committee I can confirm that the proposal 2020-0168-1469 has full ethical approval.
However, you must ensure that you follow the latest Government guidance on COVID-19. You are not permitted to begin data collection which requires any face-to-face interactions with participants in person until further notice (with the exception of COVID-19 studies which have obtained permission from the Chair). Where possible the Sub-Committee recommends that studies should be conducted online.Studies can be moved online without requiring an amendment, unless this substantially changes the study in which case an amendment is required.
If in the future you wish to make any amendments to the study please submit an amendment using the relevant form.
You are required to report to the Sub-Committee any incidents that have an adverse effect using the Adverse Events Report form in LEON.
This approval applies until 31/01/2022. If the study continues beyond this date you should submit a request for an extension.
Kind Regards,
Jackie
on behalf of the Ethical Approvals (Human Participants) Sub-Committee
Dr Jacqueline Green
Secretary, Ethics Approvals (Human Participants) Sub-Committee
Hazlerigg Building, Research & Enterprise Office
Loughborough University
01509 222423

8. Picture of Ethical approval email from Loughborough University for the first project.

However, although the project had the green light to be implemented, unfortunately, miss Feka was not able to run the project due to governmental restrictions as a result of the COVID-19 pandemic.

She was facing the same problems also with the second project entitled: "Perceptual and physical effects of topical menthol creams across the body in males" which had ethical approval but due to the distance required by the government in the United Kingdom, she was not able to implement it either.

Loughborough University



PROJECT TITLE: Perceptual and physical effects of topical menthol creams across the body in males
PROJECT ID: 1243
Dear Kaltrina,
On behalf of the Ethical Approvals (Human Participants) Sub-Committee I can confirm that the proposal 2020-1243-1494 has full ethical approval.
However, you must ensure that you follow the latest Government guidance on COVID-19. You are not permitted to begin data collection which requires any face-to-face interactions with participants in person without the appropriate risk assessments signed by the School Safety Officer and Julie Turner, in the Health and Safety Office, and with approval from the Dean. Where possible the Sub-Committee recommends that studies should be conducted online.
Studies can be moved online without requiring an amendment, unless this substantially changes the study in which case an amendment is required.
If in the future you wish to make any amendments to the study please submit an amendment using the relevant form.
You are required to report to the Sub-Committee any incidents that have an adverse effect using the Adverse Events Report form in LEON.
This approval applies until 31/01/2022. If the study continues beyond this date you should submit a request for an extension.
Kind Regards,
Jackie
on behalf of the Ethical Approvals (Human Participants) Sub-Committee
Dr Jacqueline Green
Secretary, Ethics Approvals (Human Participants) Sub-Committee
Hazlerigg Building, Research & Enterprise Office
Loughborough University
01509 222423

9. Picture of Ethical approval email from Loughborough University for the second project.

Nevertheless, meanwhile she was staying there she was involved also in another project used for bachelor thesis. This project was entitled “The effect of aging on skin wetness sensitivity across the body and the implication on hand dexterity”.

10. Miss Feka while collecting data at Loughborough University, England.

A part of this project has been presented with an abstract at the virtual 8th International Conference on the Physiology and Pharmacology of Temperature Regulation (vPPTR2020) hosted from North Vancouver, BC, Canada from 26-29th of October.

11. Miss Feka’s poster at the conference of PPTR 2020

Since the COVID-19 pandemic paralysed the whole world and physical testing within research centre’s/ universities was not possible, miss Feka was obligated to find other ways to do research and complete her Ph.D. now changed goals. Thus, miss Feka started collaborating with other researchers of the field with the new trend, and the only option left to doing research in those difficult times was data collection through an Online questionnaire. She was of two

different teams when it came to this. Firstly, she was involved with researchers from different countries such as Slovenia, Italy, Croatia, Greece, Serbia, Slovakia, and Kosovo. Since she comes from Kosovo, she was in charge to translate and adapt the questionnaire into the Albanian language as well as collecting the data from her own country. These data collected from several countries were published in the European Journal of Public Health which can be found under the DOI number: 10.1093/eurpub/ckaa157.

As for the second project, she was in collaboration with professors from the University of Palermo (Italy), University for Business and Technology UBT – Pristina (Kosovo), and from the University of Pristina "Hasan Prishtina" (Kosovo). In the second project she collected data only from Kosovan people related to Physical Activity and the effect of the COVID-19 pandemic. These results were published in the Journal of Clinical Medicine which can be found under the DOI number: 10.3390/jcm10040763.

Furthermore, she was involved also in another project led by prof. Filingeri related to heat sensitivity in people suffering from Multiple Sclerosis. Afterward, these data have been published in the journal of Temperature and the article can be found under the DOI number: 10.1080/23328940.2020.1769007.

3.2. Research area of interest

During the three years of the International Ph.D. in "Health Promotion and Cognitive Sciences" miss Feka was faced with different research areas, helping her to find the field that she was most interested in. She started her Ph.D. journey with a clear focus in Posture and biomechanics, however, throughout these years her interests changed to be more concerned and involved in improving the mobility/lifestyle of people suffering from Multiple Sclerosis.

3.3 Other activities

3.3.1 European and non- European projects

Miss Feka was active also in different European and non-European projects. The list of the projects together with her duties are presented below.

1. "HERAS" – Pristina, Kosovo & Vienna, Austria 2017

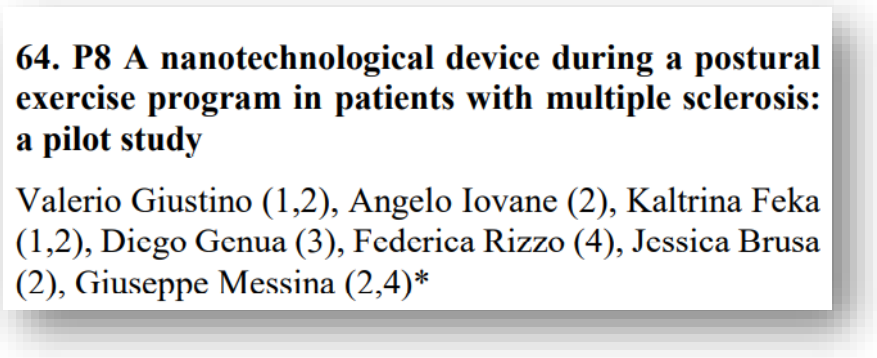
In this project, which was a collaboration between University of Gjakova (Kosovo) and University of Vienna (Austria), miss Feka was involved in data collection as well as contributing in writing and editing the manuscript. A part of these data where recently published in the journal Data in Brief and can be found under the DOI number: 10.17632/ntsrj6hf87.1.

2. "Seneca" – University of Murcia, Spain 2017-2018

In this project, miss Feka participated in data collection together with other Ph.D. students from University of Palermo. Data collection took place in some elementary schools in the city of Trapani, Sicily, Italy.

3. "Posture in Multiple Sclerosis" – University of Palermo, Italy 2017-2018

In this project, Miss Feka was involved in data collection together with another Ph.D. student from University of Palermo. Data collection for this project took place in medical centre of physical therapy and rehabilitation "Vitality" in the city of Vita, Sicily, Italy. These data were presented in PMD conference (2020) – Translational Mobility Medicine.



64. P8 A nanotechnological device during a postural exercise program in patients with multiple sclerosis: a pilot study

Valerio Giustino (1,2), Angelo Iovane (2), Kaltrina Feka (1,2), Diego Genua (3), Federica Rizzo (4), Jessica Brusa (2), Giuseppe Messina (2,4)*

4. "Enriched Sports and Activity – ESA" – European Project 2017-2020

Whereas in this European Project, miss Feka was officially in charge for Social Media for all countries involved (Italy, Spain, Portugal, Turkey, Lithuania, Germany). She was also involved in data collection in different elementary schools from the city of Palermo in collaboration with master students from University of Palermo. Within this project, miss Feka was also involved in manuscript preparation which later was published in the Sustainability (MDPI). More details can be found in the Annex of the thesis.

5. Temperature sensitivity in Multiple Sclerosis – Online Questionnaire

As mentioned above, miss Feka started collaborating with another Ph.D. student miss Aikaterina Christogianni from Loughborough University prior to her departure. She translated the online questionnaire in two different languages Albanian and Italian and started to collect data in Italy and Kosovo.

6. Executive Functions and Physical Exercise – University of Palermo

In this project, miss Feka participated in data collection as well as a participant. She helped in completing the manuscript which later on was submitted and published in the Journal of Biomedical Human Kinetics and the article can be found under the DOI number: 10.2478/bhk-2020-0029.

7. Physical activity, nutritional habits and health status in young adults - University of Pristina "Hasan Prishtina"

This project has been financed by the United States of America embassy and has been implemented by Faculty of Physical Education and Sport in Prisina. In this project, miss Feka help in data collection and was working as a young investigator.

3.3.2 Conferences

Starting from the first year of enrolment at the University of Palermo for the international Ph.D., miss Feka participated in different conferences where she presented some of her work through posters. Her first conference as a Ph.D. student was at the conference of "Societa Italiana delle Scienze Motorie e Sportive- SISMES" in Messina, Italy (2018). Her second conference was in 2019, again in the conference of "Societa Italiana delle Scienze Motorie e Sportive - SISMES" but this time, the conference was held in Bologna, Italy. When miss Feka was doing her international experience at Loughborough University, she participated in "Talk Sport 2020" conference which was held in Loughborough, England. While her staying at Loughborough University, she presented her work also in the virtual conference of Physiology and Pharmacology of Temperature Regulation 2020 which was hosted from North Vancouver, Canada. Her last participation as a Ph.D. student was at the UBT 9th Annual International Conference which was held in Pristina, Kosovo.

Miss Feka was also as invited speaker at the UBT- summer school 2020, where she presented scientific facts related to Physical Activity and Multiple Sclerosis as a new possibility for people in Kosovo.

3.3.3. Skills and devices

Since miss Feka was involved in different projects within different Universities, she was lucky enough to obtain enormous knowledge from all her professors. She followed lectures on Methodology and Statistical Analysis from both prof. Antonino Bianco (University of Palermo) and prof. Davide Filingeri (Loughborough University). She also followed lectures from prof. Roger Enoka while she was visiting the University of Colorado, Boulder. Nevertheless, since miss Feka was part in three different laboratories, she has learned to use different devices that were used for the projects that she was involved. A short list of the devices/platforms and skills that were learned from her are presented below:

1. Bioelectrical impedance – BIA
2. InBody
3. Polar system
4. VO2

5. TENS device

6. OTBio program

7. Spike 2 program

8. Pegboard test

9. SubQ- recording motor units

10. Thermocaps

11. Lactate

12. GraphPad prism program

13. SPSS - statistical program

14. EMG

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APPENDIX

1. **Abstracts of published manuscripts.**
2. **International mobility at University of Colorado, Boulder, Colorado, United States of America**
3. **International mobility at Loughborough University, Loughborough, England, United Kingdom**
4. **CITI Program – Human research certification**

THE EFFECT OF COMPREHENSIVE WARM UP (FIFA 11+ PROGRAM) ON MOTOR ABILITIES IN YOUNG BASKETBALL PLAYERS: A PILOT STUDY

NEŞE SAHIN, VELI VOLKAN GÜRSES, BILGEHAN BAYDIL, MUSTAFA ŞAKIR AKGÜL, **KALTRINA FEKA**, ANGELO IOVANE, GIUSEPPE MESSINA

ABSTRACT

Aim: Recent findings indicated that dedicated warm up activities may significantly affect performance and prevent injuries. Furthermore, since it is known that comprehensive warm up program helps in prevention injuries, the purpose of this study was to investigate the effects of a comprehensive warm-up program (F-MARC The 11+) on performance and injuries in young basketball players. While knowing the specifics and possible injuries of basketball game, the prevention of injuries must be considered as an important issue.

Methods: Twenty children (mean ± SD: age 10,7 ± 0,3 yr; height 149,20 ± 7.51, weight 47,61 ± 12,30 kg, percentage of body fat: 14,44 ± 7,68 %) were recruited from two local basketball clubs to participate in this study. Players were randomly selected and assigned to either group: experimental (Exp. n = 10) or a control (Con. n = 10), respectively. They were trained 3 days per week (2,1 ± 0,6 years of experience), for 10 weeks in a row. The experimental group followed the F-MARC 11+ program for 20 minutes during warm up phase in each training season for ten weeks while control group performed their regular warm up routine. Both groups performed vertical jumps and pro agility tests at the beginning and at the end of the tenth-week training sessions. Moreover, nonparametric Wilcoxon signed rank tests were performed to compare the pre and post test scores.

Results: The agility pre-test result was found 6,358 ± 0, 27 seconds and post-test was found 6,121 ± 0, 34 seconds. A significant difference was found between agility test values ($p<0.05$).

Discussion: Comprehensive warm-up program leads to a significant change in agility in the present study. Therefore, this is a desirable result since basketball is characterized by many quick movements such as sudden speed-ups, stops and turns. Eventually, previous studies indicated that the FIFA 11+ program resulted to be an important way to warm up properly before training sessions.

Conclusion: Based on the results of this study we may conclude that "The F-MARC 11+" comprehensive warm-up is an appropriate and effective tool for improving basketball-specific performance such as agility in young basketball players.

Journal: Acta Medica Mediterranean

Doi: https://10.19193/0393-6384_2018_3_108

Cite: Sahin, N. E. Ş. E., Gurses, V. V., Baydil, B., Akgul, M. S., Feka, K., Iovane, A., & Messina, G. (2018). The effect of comprehensive warm up (FIFA 11+ program) on motor abilities in young basketball players: A pilot study. *Acta medica*, *34*, 703.

HOW DO SPORTS AFFECT STATIC BAROPODOMETRY? AN OBSERVATIONAL STUDY AMONG WOMEN LIVING IN SOUTHERN ITALY

KALTRINA FEKA, FRANCESCO POMARA, GIUSEPPE RUSSO, MARIA CUSMA PICCIONE, MARCO PETRUCCI, VALERIO GIUSTINO, GIUSEPPE MESSINA, ANGELO IOVANE, ANTONIO PALMA, ANTONINO BIANCO

ABSTRACT

Purpose: The aim of the study was (a) to investigate the differences in plantar pressure distribution between athletes (A) and sedentary (S) women; (b) to examine the differences, if any, in plantar pressure between sports within the A group.

Methods: The study involved 173 females; 98 were S (age: 24.23 ± 6.11 years; height: 161.11 ± 6.44 cm; weight: 56.70 ± 8.19 kg; BMI: 21.81 ± 2.52 kg/m2; body surface area [BSA]: 1.59 ± 0.13; shoe size: 37.83 ± 1.53), 75 were A (age: 22.47 ± 4.89 years; height: 159.98 ± 5.95 cm; weight: 55.49 ± 7.61 kg; BMI: 21.62 ± 2.18 kg/m2; BSA: 1.57 ± 0.12; shoe size: 38.05 ± 1.55). For plantar support analysis, the FreeMed posturography system was used, including the FreeMed baropodometric platform and FreeStep v. 1.0.3 software.

Results: No significant differences were found between groups regarding anthropometric data, in the total surface, fore-foot, rear-foot, total left or total right foot surface. Significant differences between S and A were observed in fore-foot (S: 50.39 ± 3.60%; A: 52.36 ± 3.76%) and rear-foot load distribution (p = 0.0006; p = 0.0006). Also, the maximal peak pressure (S: 518.06 ± 111.50 g/cm2; A: 445.38 ± 88.47 g/cm2) and the mean pressure showed significant differences between groups. There were significant differences between sports in total surface and fore-/rear-foot and total left/right surfaces ratios.

Conclusions: Women practising sport differ from sedentary ones in the fore-/rear-foot pressure ratio. In addition, we detected plantar surface and fore-/rear-foot pressure ratio differences within the athletes group.

Journal: Human Movement

Doi: https://doi.org/10.5114/hm.2019.78091

Cite: Feka, K., Pomara, F., Russo, G., Piccione, M. C., Petrucci, M., Giustino, V., ... & Bianco, A. (2019). How do sports affect static baropodometry? An observational study among women living in southern Italy. *Human Movement*, *20*(1), 9-16.

Field-Based Tests for the Assessment of Physical Fitness in Children and Adolescents Practicing Sport: A Systematic Review within the ESA Program

Garden Tabacchi, Guillermo F. Lopez Sanchez, Fatma Nese Sahin, Meltem Kizilyalli, Rosario Genchi, Michele Basile, Musa Kirkar, Carlos Silva, Nuno Loureiro, Eduardo Teixeira, Yolanda Demetriou, David Joseph Sturm, Simona Pajaujene, Ilona J. Zuoziene, Manuel Gómez-López, Ante Rada, Jelena Pausic, Nemanja Lakicevic, Luca Petrigna**, Kaltrina Feka**, Ana Ribeiro, Marianna Alesi and Antonino Bianco

ABSTRACT

High levels of physical fitness (PF) can positively affect both health and cognitive function, thus monitoring its levels in youth can help increase health and quality of life in adult populations later on. This systematic review aims to identify PF field-based tests used in young European populations practicing sport to find tools that are adequate for the considered target involving a new battery within the Enriched Sport Activities (ESA) project. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was followed. In the 83 identified articles, the main tests used were: vertical/horizontal jumps (for muscular strength/power); pushups, running at maximum effort, sit-ups (for muscular strength/endurance); multistage nonintermittent and intermittent tests (for aerobic endurance); sit and reach (for flexibility); sprinting and agility T-tests (for speed and agility, respectively); 10 × 5 m shuttle run (SR) (for both speed and agility). Few studies assessed coordination, reaction time, power, and balance. Although the selected tests are widely used and validated, they do not determine all PF aspects and do not reflect sport-specific features. A final decision was made for the inclusion of the following tests: standing broad jump, seated medicine ball throw, 20 m SR test, 30 m sprint, Illinois test, and a new test, i.e., the crunning test, to assess different skill-related components at once. The use of this combination of tests allows for the assessment of all PF components and can help planning effective training programs and cultivate sporting talent.

Journal: Sustainability - MDPI

Doi: https://doi.org/10.3390/su11247187

Cite: Tabacchi, G., Lopez Sanchez, G. F., Nese Sahin, F., Kizilyalli, M., Genchi, R., Basile, M., ... & Bianco, A. (2019). Field-based tests for the assessment of physical fitness in children and adolescents practicing sport: a systematic review within the ESA Program. *Sustainability, 11*(24), 7187

Sport Intervention Programs (SIPs) to Improve Health and Social Inclusion in People with Intellectual Disabilities: A Systematic Review

Lidia Scifo, Carla Chicau Borrego, Diogo Monteiro, Doris Matosic, **Kaltrina Feka**, Antonino Bianco and Marianna Alesi.

Abstract:

Inactivity is a major issue that causes physical and psychological health problems, especially in people with intellectual disability (ID). This review discusses the beneficial effects of sport intervention programs (SIPs) in people with ID, and aims to provide an overview of the scientific literature in order to identify the main factors influencing the participation of people with ID in SIPs. Twelve papers were analyzed and compared. The results show a large variety in examined SIPs, concerning participants' age and disability, intervention characteristics and context, as well as measures and findings. The main factors essential for people with ID partaking in SIPs appeared to be suitable places for the SIP development, adequate implementation of physical activity (PA) programs in school and extra-school contexts, education, and the training of teachers and instructors. The literature review highlights the relevance of using SIPs in order to improve physical and psychological health, as well as increase social inclusion in populations with ID. SIPs should be included in multifactor intervention programs. Nevertheless, the need is recognized for stakeholders to adopt specific practice and policy in promoting social inclusion in order to organize intervention strategies which are able to provide quality experiences in sport and physical activity for people with ID.

Journal: Functional Morphology and Kinesiology

Doi: https://doi.org/10.3390/jfmk4030057

Cite: Scifo, L., Chicau Borrego, C., Monteiro, D., Matosic, D., Feka, K., Bianco, A., & Alesi, M. (2019). Sport intervention programs (SIPs) to improve health and social inclusion in people with intellectual disabilities: A systematic review. *Journal of Functional Morphology and Kinesiology*, *4*(3), 57.

The "*Journal of Functional Morphology and Kinesiology*" Journal Club Series: Highlights on Recent Papers in Overtraining and Exercise Addiction

Antonino Bianco, Silvia Ravalli, Grazia Maugeri, Velia D'Agata, Michele Vecchio, Agata Grazia D'Amico, Vito Pavone, Ludovico Lucenti, Alessandra Amato, Ambra Gentile, Valerio Giustino, **Kaltrina Feka**, Ewan Thomas and Giuseppe Musumeci

ABSTRACT

We are glad to introduce the seventeenth Journal Club. This edition is focused on several relevant studies published in the last years in the field of Overtraining and Exercise Addiction, chosen by our Editorial Board members and their colleagues. We hope to stimulate your curiosity in this field and to share with you the passion for the sport seen also from the scientific point of view. The Editorial Board members wish you an inspiring lecture.

Journal: Functional Morphology and Kinesiology

Doi: https://doi.org/10.3390/jfmk4040068

Cite: Bianco, A., Ravalli, S., Maugeri, G., D'Agata, V., Vecchio, M., D'Amico, A. G., ... & Musumeci, G. (2019). The "Journal of Functional Morphology and Kinesiology" Journal Club Series: Highlights on Recent Papers in Overtraining and Exercise Addiction.

A single bout of physical exercise does not affect young adults' executive functions

Ambra Gentile, Ewan Thomas, **Kaltrina Feka**, Anita Di Vincenzo, Marco Restifo, Valentina Amata, Marianna Alesi, Patrik Drid, Nebojsa Maksimovic, Antonino Bianco, Stefano Boca

Summary

Study aim. The purpose of the current study is to determine the impact of single bouts of physical exercise of different duration and intensity on young adults' executive functions. Material and methods. The study employed 81 participants (37 females, 44 males) ranging between 19 and 39 years (mean age: 24.6 ± 4.08 years; mean height: 168 ± 9.67 cm; mean weight: 67.2 ± 13.0 kg). The executive functions were assessed through the Stroop task, the Tower of London test, and the Corsi block test. Participants were randomly assigned to one of the three experimental conditions (30-second Wingate test condition, an incremental intensity exercise test, and a submaximal constant-intensity test) or the control group. Results. For all the conditions, repeated measures ANOVA revealed a significant effect of time on executive function performances, meaning that participants improved their performance between pre-test and post-test, while the interaction time x activity was in the expected direction but nonsignificant. Conclusions. Apparently, a single, brief, high-intensity bout of exercise has no effects on young adults' cognitive functions, but the same experiment should be replicated with a bigger sample.

Journal: Biomedical Human Kinetics

Doi: https://doi.org/10.2478/bhk-2020-0029

Cite: Gentile, A., Thomas, E., Feka, K., Di Vincenzo, A., Restifo, M., Amata, V., ... & Boca, S. (2020). A single bout of physical exercise does not affect young adults' executive functions. *Biomedical Human Kinetics*, *12*(1), 226-235.

Maintaining everyday life praxis in the time of COVID-19 pandemic measures (ELP-COVID-19 survey).

Sasa Pisot, Ivana Milovanovic, Bostjan Simunic, Ambra Gentile, Ksenija Bosnar, Franjo Prot, Antonino Bianco, Gianluca Lo Coco, Suncica Bartoluci, Darko Katovic, Peter Bakalar, Terezia Kovalik Slancova, Lenka Tlucakova, Cristina Casals, **Kaltrina Feka**
, Aikaterini Christogianni, Patrik Drid

ABSTRACT:

Background: The extreme social circumstances caused by declared COVID-19 pandemic deeply intervene people's everyday life and should not be neglected but seen through the view of social reality pinpointing the 'ordinary' people. In this article, authors explored basic segments of everyday and their subjective perception to what extent sleeping habits, physical inactivity, physical activity, nutritional habits and smoking have changed. Methods: The online survey was conducted in nine European countries (Bosnia and Herzegovina, Croatia, Greece, Kosovo*, Italy, Serbia, Slovakia, Slovenia and Spain) in 4108 participants, aged 15–82 years. The survey took place 30–40 days after World Health Organization declared COVID-19 pandemic state, from 15 April to 3 May 2020. Results: The results have shown 30 min longer sleeping time, 50% longer physical inactivity time, 65% longer screen time, 43% shorter walking time, 24% shorter sport time and 37% longer physical work time. Additionally, body mass gains (0.3 kg) could be explained in 20.6% with meals sizes, unhealthy food consumption, screen time and sport time. Further, respondents reported more regular meals (44%) and healthier meals with less alcohol consumption and less smoking, which have been positive outcomes of home confinement. Conclusion: The findings draw attention to negative changes in everyday praxis (inactivity, body mass gain) after such a short period. Because of possible risk to population's health (especially of countries such as Italy and Spain with serious threat and more stringent measures), findings enable development of recommendations for maintaining healthy lifestyle habits with minimal negative health consequences in similar pandemic circumstances.

Journal: European Journal of Public Health

Doi: https://doi.org/10.1093/eurpub/ckaa157

Cite: Pišot, S., Milovanović, I., Šimunič, B., Gentile, A., Bosnar, K., Prot, F., ... & Drid, P. (2020). Maintaining everyday life praxis in the time of COVID-19 pandemic measures (ELP-COVID-19 survey). *European journal of public health*, *30*(6), 1181-1186.

Exercise with TENS does not augment gains in balance and strength for dancers

Leah A. Davis, Joseph P. Carzoli, **Kaltrina Feka**, Christina Nelson, Roger M. Enoka

ABSTRACT

Electrical stimulation modulates sensory feedback and improves motor performance, at least for individuals with compromised sensorimotor function. The purpose of this study was to determine the effectiveness of a 4-wk intervention with transcutaneous electrical nerve stimulation (TENS) at improving strength and balance in dancers. Nineteen dancers completed a timed, single-leg balance test, the Y-balance test, and contractions with the hip flexor and knee extensor muscles to assess maximal strength and force steadiness. They completed 4-wks of moderate-intensity bodyweight exercises (3x/wk) and were pseudo-randomized to either a Treatment or Sham group in a single-blind design. The Treatment group received constant TENS over the hamstring muscles during the exercises, whereas the Sham group was exposed to a brief TENS current. The data were pooled due to few significant between-group differences from before to after the intervention. Most outcome measures significantly improved: hip extensor muscles were stronger ($P \leq 0.01$), time stood on a single-leg with eyes closed increased ($P = 0.02$), and the distance reached during the Y-balance test increased ($P \leq 0.001$). The improvement in scores on the Y-balance test exceeded the minimal clinically significant change. Twelve sessions of moderate-intensity bodyweight exercises improved muscle strength and balance in experienced dancers. The addition of TENS, however, did not augment the gains in function.

Journal: Journal of Electromyography and Kinesiology

Doi: https://doi.org/10.1016/j.jelekin.2020.102507

Cite: Davis, L. A., Carzoli, J. P., Feka, K., Nelson, C., & Enoka, R. M. (2021). Exercise with TENS does not augment gains in balance and strength for dancers. *Journal of Electromyography and Kinesiology*, *56*, 102507.

Individualized analysis of skin thermosensory thresholds and sensitivity in heat-sensitive people with multiple sclerosis

Davide Filingeri, Georgia Chaseling, Aikaterini Christogianni, **Kaltrina Feka**, Antonino Bianco, Scott L Davis & Ollie Jay

ABSTRACT

We investigated whether and how multiple sclerosis (MS) alters thresholds for perceiving increases and decreases in local skin temperature, as well as the sensitivity to progressively greater temperature stimuli, amongst heat-sensitive people with MS. Eleven MS patients (5 M/6 F; 51.1 ± 8.6 y, EDSS 5.7 ± 1.9) and 11 healthy controls (CTR; 7 M/4 F; 50.3 ± 9.0 y) performed warm and cold threshold tests on a hairy skin site, on both sides of the body. They also underwent a thermosensitivity test where they rated (visual analogue scale) perceived magnitude of 4 local skin stimuli (i.e. 22, 26, 34, 38°C). Individual thresholds and slopes of linear regression for thermosensitivity were z-transformed for each MS patient, and used to determine individual thermosensory abnormalities. When considering both threshold and thermosensitivity, six out of our 11 heat-sensitive patients (54.5%) exhibited skin thermosensory abnormalities. Those abnormalities varied amongst patients in terms of type (threshold vs. thermosensitivity), quality (warm vs. cold), location (left vs. right side of the body) and extent. Each of those six patients presented unique thermosensory profiles. While some patients experienced thermosensory loss in both thresholds and sensitivity and on both sides of the body, others experienced cold thermosensory loss on one side of the body only. The observed individual variability in thermosensory function among heat-sensitive MS patients highlight the need for a patient-centered approach to assessing thermosensory dysfunction and its potential implications for heat stress vulnerability in this patient group

Journal: Temperature

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Is bodyweight affecting plantar pressure distribution in children? An observational study

Kaltrina Feka, Jessica Brus, Rosanna Cannata, Valerio Giustino, Antonino Bianco, Masar Gjaka, Angelo Iovan, Antonio Palma, Giuseppe Messina,

ABSTRACT

The aim of this study is twofold: firstly, to investigate the plantar pressure distribution differences in children coming from 4 different weight categories and secondly to analyze the presence of sex-related plantar pressure distribution differences. Overall, 416 children, aged 7 to 12 years old were randomly selected from 6 different local schools, and voluntarily participated in the study. Two hundred twenty-six of them were men, while 190 were women (mean age: 9.93±1.02 years; height: 1.39±0.8m; body mass: 37.76±10.34 kg; BMI: 19.24±4.02 kg/m2). Based on the body mass index (BMI) the sample was grouped in the following categories: underweight (UW); normal weight (NW); overweight (OW), and obese (OB). Besides, the plantar load distribution parameters (total plantar load distribution and load distribution in forefoot and rearfoot) were assessed employing freeMed Maxi; Sensor Medica device. Shapiro-Wilk test was used to test the data distribution. Between-groups comparisons were conducted using Mann–Whitney U test, or using Kruskal-Wallis test associated with pairwise comparisons. There were significant differences in load distribution between weight categories, with (OW) and (NW) being significantly different with (O), P=.03 and P=.04, respectively. No significant differences were found on load distribution on the rearfoot and forefoot between categories. The sex effect, particularly among boys, revealed a different pattern of load distribution among (O) compared with other categories. This effect was not detected among women. Different profile of load distribution on the rearfoot and forefoot between boys and girls was found, with girls bearing significantly more weight in the right rearfoot compared with boys (P=.001). It can be concluded that the weight status of the children can affect the plantar load distribution, with obese category being different from (NW) and (OW). Additionally, the sex plays a role when it comes to the load distribution in different regions of the foot. Moreover, since the young age, due to growth and development process, is accompanied with anatomical foot changes which might be affected from numerous factors, assessing plantar pressure distribution in young children results to be a quite complicated matter.

Journal: Medicine

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The Effect of COVID-19 Lockdown Measures on Physical Activity Levels and Sedentary Behaviour in a Relatively Young Population Living in Kosovo

Masar Gjaka*, **Kaltrina Feka***, Antonino Bianco, Faton Tishukaj, Valerio Giustino, Anna Maria Parroco, Antonio Palma and Giuseppe Battaglia

ABSTRACT

To abate the spread of the COVID-19 virus, different restriction measures were imperative, limiting the possibility to be engaged in physical activity. Therefore, this study aimed to evaluate the effect of COVID-19 lockdown on physical activity (PA) levels expressed as energy expenditure (MET-min/week) and sedentary behaviour in Kosovo. The possible association between PA levels and other factors was analyzed. 1633 participants (age range: 13 to 63 years; mean: 24.70 ± 9.33 years; body height: 172 ± 10.57 cm; body mass: 69.10 ± 13.80 kg; BMI: 23.09 ± 3.63 kg/m2) participated in the study, categorized by age, gender, BMI, and living area. An online survey, including an adapted version of the IPAQ-SF, was administered once during lockdown to assess PA levels and sedentary behaviour both before and during COVID-19 lockdown. The Wilcoxon signed-rank, Mann–Whitney U and Kruskal–Wallis rank of sum tests were used for statistical analysis. COVID-19 restrictions had a negative impact on the types of and overall PA levels MET-min/week ($p < 0.001$). Sedentary behaviour significantly increased during COVID-19 restrictions ($p < 0.001$). Higher decreases in METmin/week during lockdown were observed among males, young and young adults, overweight, and urban-living participants. Finally, COVID-19 restrictions decreased the PA levels and METmin/week, and increased sedentary behaviour also in a relatively young cohort. Such differences were dependent on several factors.

Journal: Journal of Clinical Medicine

Doi: https://doi.org/10.3390/jcm10040763

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DO NON-RESPONDERS TO RESISTANCE TRAINING EXIST IN PROFESSIONAL SPORT?

Masar Gjaka, **Kaltrina Feka**, Antonino Bianco

ABSTRACT

Resistance training (RT) is the most popular form of exercise that exerts several benefits (muscle hypertrophy and strength). Furthermore, we are witnessing several athletes competing at the highest level of their respective sport have undergone an enormous physical transformation. Nonetheless, lack of RT training, especially after a long detraining period, causes loss of muscle mass, and consequently, a decreased muscle strength, power, and lower muscle activation, and consequently, performance deterioration. In light of these facts, several authors recently have arisen the existence of responders and non-responders to RT. In order to improve athletic performance, the scientific community has tried to define the right RT method to be applied with athletes. In this regard, complex training compared to traditional training methods is reported to be a useful method providing superior benefits for improving athletic performance. With this editorial we encourage the research community to investigate this very interesting and complex matter, making the picture clearer and giving the opportunity to the athletic community to adjust RT programs based on the individual needs in order to maximize the outcome.

Journal: Acta Medica Mediterranean

Doi: https://10.19193/0393-6384_2020_6_565

Cite:

Gjaka, Masar, Feka, Kaltrina, Bianco, Antonino (2020) Do non-responders to resistance training exist in professional sport? Acta Medica Mediterranea 36: 3577

Raw data for test-retest reliability of physical performance in young and old adults

Arben Boshnjaku, Abedin Bahtiri, **Kaltrina Feka**, Ermira Krasniqi, Harald Tschan, Barbara Wessner

DESCRIPTION

The present data focus on test-retest reliability of functional performance tests together with strength, power and body composition assessments in young and older Kosovan adults. The data set comprises various parameters relevant to assess age-related changes in physical performance. Those parameters have been suggested by the European Working Group in Sarcopenia for Older People (EWGSOP) in its initial and revised consensus statements to be used for the diagnosis and treatment of sarcopenia. In total, 57 healthy young (18-35 years) and 61 older (>60 years) participants took part in two identical test sessions, with a median [25th – 75th percentile] of 14 [13 – 21] days in between. Functional performance tests included 30-s chair stand test (CST), 30-s arm curl test (ACT), six-minutes walking test (6MWT), sit and reach test, timed up and go test (TUG), as well as the assessment of gait speed (GS) at normal and fast pace. Isometric handgrip strength (HGS) was used to estimate strength of the dominant hand. Isokinetic peak torque (PT) and average power (avgP) for knee extension and flexion were determined at velocities of 600/s and 1200/s. Body composition assessments included body fat percentage, skeletal muscle mass (SMM) and index (SMI) as well as appendicular skeletal muscle mass (ASMM) and index. Secondary endpoints included self-perceived health status and potential co-morbidities.

Journal: Data in Brief / Mendeley data

Doi: https://10.17632/ntsrj6hf87.1

Cite: Boshnjaku, Arben; Bahtiri, Abedin; Feka, Kaltrina; Krasniqi, Ermira; Tschan, Harald; Wessner, Barbara (2021), “Raw data for test-retest reliability of physical performance in young and old adults”, Mendeley Data, V1

IS DIETING A SOLUTION DURING PANDEMIC FOR WEIGHT CONTROL?

Kaltrina Feka, Masar Gjaka, Faton Tishukaj, Antonino Bianco.

ABSTRACT

Unforeseen COVID-19 pandemic paralysed the entire world and its normal function. Although governmental restrictions might help the spreading rate of infection throughout the lockdown, health related issues such as lack of physical activity and malnutrition are having a tremendous negative impact in the general population. COVID-19 and its effects on the lifestyle of population at the moment is considered as a “hot topic” and different affected areas are being highly investigated. Despite scientific recommendations on PA and healthy eating, we were somehow forced to stop engaging in physical activity, affecting and making more difficult body mass management, which still remains an area of interest for the scientific community. Considering the failure to fulfilling physical activity recommendations, using this editorial, we suggest to the scientific community on creating an illustrated and clear guidance for general population regarding healthy nutrition accompanied with exercises in such circumstances.

Journal: Acta Medica Mediterranea

DOI: https://10.19193/0393-6384_2021_2_194

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February 26, 2019

To Whom it May Concern:

This letter is to confirm that Kaltrina Feka has been completed 6 months at the University of Colorado Boulder as a Visiting Scholar in the Department of Integrative Physiology. She was established here from August 27, 2018 to February 27, 2019.

If you have any questions or need further information, please feel free to contact me via email or telephone.

Thank you,

Hannah Bethke
Human Resources Manager
Department of Integrative Physiology

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Loughborough University

TO WHOM IT MAY CONCERN

E-mail: pgresearch@lboro.ac.uk

16 December 2020

This is to certify that Ms Kaltrina Feka is registered as a temporary research student in the School of Design and Creative Arts of this University.

Ms Feka initially is currently registered for the period 10 November 2019 to 31 December 2020.

Dr Sam Marshall
Senior Assistant Registrar
Doctoral College Office

Loughborough University

CITI PROGRAM

Completion Date 05-Sep-2018
Expiration Date 04-Sep-2021
Record ID 28493159

This is to certify that:

Kaltrina Feka

Has completed the following CITI Program course:

Human Research (Curriculum Group)
Biomedical Research Investigators and Key Personnel (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of Colorado at Boulder

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