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Pharmacologically active substances and dietary supplements used by athletes - the European and Italian regulation

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Abstract. The nutrition has been supposed as an essential component of physical performance and thus the athletes make use of various substances in an attempt to improve their performance. For this reason, the nutritional supplements are widely used at all levels of sport. They are packed in the form of "doses" and can be used to correct nutritional deficiencies or maintain an adequate intake of certain nutrients even if the excessive intake of vitamins and minerals can be harmful or cause side effects. Faced with disparate regulations of its member countries, the European Commission has established harmonized standards to help ensure the safety and proper labeling of food supplements. The main provisions of the EU about are contained in Directive 2002/46/EC on food supplements containing vitamins and minerals that has been implemented in Italy by Legislative Decree n. 169/2004.
Key words: *pharmacologically active substances, dietary supplements, directive*.

Introduction

Hard training and talent are the main factors contributing to the success of an athlete. Furthermore the sports world is solicited by use of pharmacologically active substances and the use of drugs to enhance performance in sports is termed as doping and is prevalent since ancient times (1). Unfortunately, the use erroneously and abuse of pharmacologically active substances have become so common in daytime sports that the safety, the health and the longevity of far too many athletes are now compromised (2, 3). Athletes, both professionals and amateurs, have not been out of danger. Their trainers, physicians and other assistants, have already given them countless pills, tablets, ointments, injections, vitamins and other potions. The goals are numerous: to stimulate, to calm, to numb the pain caused by a injury, to enhance performance, to reduce inflammation, sometimes to suppress anxiety (4).

Progress in the last few decades in the understanding of the human metabolism and of physical exercise physiology has made clear that a variation in nutritional intake may increase sports performance positively (2, 5). This knowledge has given rise to an explosion of products specifically designed for each type of physical activity. These substances are more and more used by athletes not only in competitive sports, but also in fitness and recreational sports (1, 5).

Nutritional supplements can be grouped into dietary supplements, ergogenic aids and food for sport. Their use among athletes is very popular: most studies reported that over half of the athletes use supplements (6,7). Some studies reported that 88% of the athletes use one or more nutritional supplements (7). Therefore, although nutrition and doping are important factors in sports and in the performance in the health of athletes and the nutrition is an essential component of any athletic or physical activity program (8, 9). Supplements are consumed for a variety of reasons. Many exercise active individuals utilize supplements to build muscle, gain strength, prevent future disease or illness and improve performance in sport. The choice of supplements depends also on the reason of the exercise program and/or the type of sport (10).

Legality and safety of some dietary supplements remain an issue of concern and heir use is closely associated with doping problems [25, 9]. Some supplements or their ingredients, like pro hormones, are considered prohibited by the World Anti-Doping Agency (WADA). Furthermore, athletes who use dietary supplements are susceptible to unintentional ingestion of banned substances (11). Identifying the use of non-approved drugs by cheating athletes has been a great challenge for doping control laboratories.
Sources of data. PubMed, using the terms 'dietary supplements' and/or 'pharmacologically active substances' and sport, and official WADA website were reviewed. The research is based on the analysis of the most investigated issues in the studies published in the last years.

Risks of nutritional supplements in sports
Long-term use and the use of multiple-ingredients of dietary supplements were associated with larger number of symptoms and more severe outcome as adverse events (12).
Dietary supplements include vitamins, minerals, herbs, meal supplements, sports nutrition products, natural food supplements, and other related products used to boost the nutritional content of the diet (2).
Some supplements, when used in high doses may do more harm than good: iron supplementation, for example, is potentially harmful. Investigations specifically addressing the supplementation practices of national level athletes are limited, and it is unknown if similar patterns of supplement use occur in elite athletes.
Furthermore, most investigations don't make available details on some of the most valuable information relating to the supplementation practices of athletes: the type of supplements, amounts taken, and rationale for their use, together with issues such as sources of information relating to sports supplements and nutrition knowledge such as sources of information relating to sports supplements and nutrition knowledge (13).
When a product contains one or more of banned substances that could lead to a positive doping results. Identifying the use of non-approved drugs by cheating athletes has been a great challenge for doping control laboratories. This is due to the additional complexities associated with identifying relatively unknown and uncharacterized compounds and their metabolites as opposed to known and well-studied therapeutics (14).
Some supplements contain compounds that will cause an athlete to fail a doping test. Supplement quality assurance programs can reduce, but not entirely eliminate, this risk.
Therefore, most athletes have a massive confusion that leads to trying the "best new supplements", but rarely produces the results promised. Supplements are not the most important aspect of nutrition. Many products have additional compounds that are not listed on the label (15). Doping control laboratories are frequently confronted with new substances that may be misused by athletes. In the Cologne Doping Control Laboratory, different confiscated products and legally obtained nutritional supplements were analyzed in 2009, and various findings were reported including GH-labelled injection vials without any pharmacologically active content; combinations of products indicating the attempt to mask growth hormone abuse; unpurified long-R(3)-IGF-1; nutritional supplements containing the growth hormone releasing peptide-2 (GHRP-2); and ampoules containing the selective androgen receptor modulator Andarine (S-4) (16).
Athletes are not vigilant in sourcing reputable information pertaining to dietary supplements, they may be allocating unnecessary resources to unproven products and also exposing themselves to a small but real risk of committing a doping offence. Consequently, athletes should be encouraged to consult sports medicine professionals with specialist knowledge of dietary supplements in regards to issues such as safety, efficacy, potency, and legality of a product prior to initiating any supplementation regime (17).
Therefore, the amount of dietary supplements consumed should be within the recommended range of protein, carbohydrates, and lipids for that particular product. Information on the use of supplements is usually provided by the athletes' coaches and doctors. It is necessary to educate athletes by providing better information about the risks and benefits of consuming dietary supplements. To reduce the risks from the improper use of supplements, physicians, coaches, athletic trainers, parents, health educators, and other sports professionals should inform supplement users about not proven results and provide warnings about the potential harm of such dietary supplements (18).

The European and Italian regulation

Officially, in 1996 in the United States about 6.5 billion US dollars were spent in general nutritional supplement purchase, reaching in 2002 at 18 billion US dollars, with sports nutritional products covering one-third of the sales. In 1998 worldwide consumption of creatine was 2.7 million kilogrammes (16), and sales of hydroxy-methyl-butyrate (HMB) reached 50-60 million US dollars, despite no evident proof of its efficacy in increasing muscle mass or strength. Use of nutritional supplements, combined with an absence of evidence of their efficacy and a concern for the possibility of "inadvertent" doping (2).

At the European level, the food supplements sector is regulated by the Directive 2002/46/EC, as amended, which was created with the aim of ensuring both a high level of protection of public health, and to allow the free circulation of these products, ensuring also, through adequate and appropriate labeling, better consumer protection [206]. In the preamble to the Directive states that it is increasing the sale of foods containing concentrated sources of nutrients and presented as supplements of nutrients from the normal diet and that the countries of the European community adopt different regulations that may slow down the free circulation of the said products and adversely affect competition. This Directive arises, therefore, as the objective of approximating the laws of the Member States with respect to dietary supplements. The main principles from which to start are that an adequate and varied diet could provide all necessary nutrients for normal development and maintenance of the healthy life and in the presence of particular lifestyle or for other reasons, the consumer may choose to supplement their intake of some nutrients through food supplements but an excessive intake may result in adverse effects and therefore necessitate the setting of maximum safe levels for them in food supplement, as appropriate (19, 20). The maximum amounts of vitamins and mineral in food supplements per daily portion of consumption as recommended by the manufacturer shall be set, taking the following into account: the upper safe level of vitamins and minerals established by scientific risk assessment based on generally accepted scientific data, taking into account, as appropriate, the varying degrees of sensitivity of different consumer groups and the intake of vitamins and minerals from other dietary sources. You must take into account also the reference values for vitamins and minerals for the population (21).

The definition provided by the Directive is as follows *"Food supplements" means foodstuffs the purpose of which is to supplement the normal diet and which are concentrated sources of nutrients or other substances with a nutritional or physiological effect, alone or in combination, marketed in dose form, namely form such as capsules, pastilles, tablets, pills and other similar forms, sachets of powder ampoules of liquids, drop dispensing bottles, and other similar forms of liquids and powders designed to be taken in measured small unit quantities* (20).

With regard to labeling, it expressly refers to Directive 2000/13/EC. Adds, nevertheless, that the labeling, the presentation and the advertising must not attribute to food supplements the property of preventing, treating or curing a human disease, or refer to such properties. Also, it is forbidden to say that a healthy and balanced diet is not able to make nutritive substances in sufficient quantities.

The labeling, in fact, shall contains the name of the categories of nutrients or substances that characterize the product or an indication of the nature of those nutrients or substances, the portion of the product recommend for daily consumption, a warning not exceed the stated recommended daily dose, a statement to the effect that food supplements should not be used as a substitute for a varied diet, a statement to the effect that the products should be stored out of the reach of young children (20, 22).

With regard to Italian legislation, the first act was the Legislative Decree No. 111 of 1992 implementing Directive 89/398/EEC laying down rules on of the only products intended for particular nutritional uses, such as foods for infants and products dietary and that also included dietary supplements and foods containing added vitamins and minerals. Later, in 2004 the Legislative Decree n. 169 has implemented Directive 2002/46/EC. Article 7 of the Decree provides that in case of supplements touted as adjuvant hypo caloric diets aimed at weight reduction, it is forbidden any reference to the timing and amount of weight loss resulting from the intake of the aforementioned supplements. Indeed, the advertisements must invoke the need to follow, in any case, an adequate hypo caloric diet and remove sedentary lifestyles (23).

Moreover, in case of presence of other ingredients such as plants or other natural substances, the advertising must contain the warning that may be incurred in the unwanted side effects. For the purpose, also, of the first marketing of the supplements, the undertaking concerned shall inform the Ministry of Health by forwarding it a model of the label used for the product. For foreign products, the marketing is only allowed 90 days after the receipt of the label, without any observation of the Ministry. In the case in which the Ministry has doubts on the safety of the product, it may request additional documentation and may request that changes are made-labeling, as well as the inclusion of some warnings. The product has received marketing authorization will be entered in a special register that the Ministry of Public Health and constantly updated. If, however, the Ministry believes that the product is dangerous for your health, prohibits the marketing and immediately inform the European Commission. Finally, the Decree, Article 15 provides for a series of penalties for violations of its provisions. Decree 169 was supplemented by the Decree of the Ministry of Health of 09/07/2012 which allows the use of substances and preparations listed in the annex to the decree. In 2006 the EC Directive n.1925 on foods with added vitamins and minerals (22). At the same time the EC Directive was enacted n.1924 on nutrition and health claims provide the products supplied, the so-called claims, which apply to all foods, including supplements. A nutritional claim suggests a food has beneficial nutritional properties, such as “low fat”, “no added sugar” and “higher in fiber”.

A health claim is a statement that suggests a relationship between food and health. This Directive, however, considers supplements, only those products that do not have a significant impact on food intake in terms of energy, i.e. calories.

Therefore, the products previously considered as "energy supplements" and "protein supplements" to caloric significant impact, such as the bar that are consumed by athletes, are excluded from the scope of Directive EC 1924, falling within the scope of Directive EC 1925 .

To try to make things clear, in the Italian Ministry of Health has issued the Circular of 11/05/2009 - replacing the previous circular of 11/30/2005 - whose Annex I is devoted to products intended to meet the intent muscular effort, especially for sportsmen. According to the said Annex, the products must submit a composition nutritionally adapted to the particular needs of sportsmen and be appropriate for the specific uses for which they are proposed. If there are vitamins and minerals, the content of the portion should not be less than 15% of its RDA.

In any case, through self-control plans should be excluded even in the presence of traces of possible doping contaminants and/or substances included in the list referred to in Law no. 376 of 2000 relating to the regulation of the health protection of sport and the fight against doping. As a general rule, formulated products to meet the specific nutritional needs of athletes can be traced to the following categories: energy products, protein-concentrated amino acids to support the nitrogen demand, products intended to replenish the losses idrosaline due to profuse sweating, other products specifically adapted (22, 23).

Conclusion

Reasons for nutritional supplements usage were supported scientifically in some cases (e.g., muscle gain upon protein supplementation), but others did not have a scientific basis (e. g., use of glutamine and magnesium) (24). While athletes may periodically attempt to promote skeletal muscle hypertrophy, key nutritional issues are broader than those pertinent to hypertrophy and include an appreciation of the sports supplement industry, the strategic timing of nutrient intake to maximize fuelling and recovery objectives, plus achievement of pre-competition body mass requirements (25).

A lot of study showed that the use of dietary supplements varies with each individual professional athlete for several reasons. When asked about their use of supplements and their reasons for consumption, a majority of athletes expressed their desire to improve health and performance (26). Use of nutritional supplements, combined with an absence of evidence of their efficacy and a concern for the possibility of "inadvertent" doping. Market regulation is complicated by the increasing popularity of Internet sales.

There is evidence that some of the apparently legitimate dietary supplements contain ingredients that are not declared on the label, which are prohibited by the doping regulations of the International Olympic Committee and the World Anti-Doping Agency (WADA). Consequently, it is recommended to use the certified nutritional supplements.

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Pattern of sports injuries and physiotherapy interventions at the 23rd Nigerian University Games

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Abstract. *Introduction*. Sports injuries represent the most significant adverse consequences of sports activities and a common reason for non performance and non participation at sport events. This study investigated the pattern of sports injuries and physiotherapy interventions during the 23rd Nigerian University Games (NUGA). *Material and Method*. A retrospective case charts review of incidences of sports injuries recorded at the 23rd NUGA held between March 16th to 27th 2011 at the University of Benin was carried out. Data were gleaned on age, sex, type of sport, type of injury, anatomical location affected and physiotherapy intervention received. Data were summarized using descriptive statistics. *Results*. Sports injuries constituted 51.5% (188/365) of all reported medical conditions with a female to male ratio of 1:1.7. Football had the highest incidence (20.2%) of sports injuries followed by athletics (13.8%). Soft tissue injuries were prevalent in both contact (79.3%) and non-contact (82.1%) sports. The most injured anatomical parts were the head 22 (18.2%) and knee joints 17 (14.0%) in contact sports; the knee 14 (21.2%) and ankle 9 (13.6%) joints in non-contact sports. Cryotherapy was the mainstay of physiotherapy for sports injuries (47.2%) and was mostly in combination with soft tissue massage and bandaging (13.8%). *Conclusion*. Sports injuries were common medical conditions in the Nigerian University Games and it constitutes a significant burden for physiotherapy interventions. The observed sports injuries profile are consistent with most epidemiological reports. Advocacy for policy to minimize injuries and institutionalize physiotherapy interventions at subsequent NUGA is warranted.
Key words: *sports injuries, sports activities, physiotherapy*.

Introduction

Sports injuries has become increasingly a public health challenge (1,2) and represent the most significant adverse consequence of sports activities and a common reason for non performance and non participation at sport events (2-6). Injuries resulting from sports are *sine qua non* of an intricate interaction between intrinsic (athlete-related) and extrinsic (environmental) risk factors (7-10). Some studies posit that the extrinsic factors play a more dominant role in the aetiology of sports injuries (9-11).

The occurrence and pattern of sports injuries are sport specific (11-13). Each sport has its characteristic injury profile and degree of risk (13-16) with severity ranging from mild to lifelong physical impairment, disability and even death (4, 8, 17, 18).

Consequent to the foregoing, it is believed that injury surveillance and profiling in multi-sports events are of immense advantage in providing epidemiological information, policy formulations aimed at injury prevention and proper management programme and the opportunity tomonitor long-term changes in incidences of injuries (19-21).

Injury surveillance studies at local, national, continental and world level are being advocated as the first step in the process to reduce the incidence of sports injuries (22-24). In spite of the rapid growth of amateur and professional sports in Nigeria, there is still paucity of studies on pattern of injuries and management during local and national single and multi-sports events. Therefore, the objective of this study was to investigate the pattern of sports injuries and physiotherapy interventions during the 23rd Nigerian University Games (NUGA).

Material and Method

A retrospective study of incidence of sports injuries recorded at the 23rd NUGA which held at the University of Benin (Edo State, Nigeria) between March 16th to 27th, 2011.

The NUGA also called "University Games" is a biannual sports competition founded in 1966 at the University of Ibadan, Nigeria.
NUGA is the foremost platform to showcase young elite athletes and has since served as a breeding ground and springboard for world class athletes in Nigeria. NUGA typically comprises of 16 sporting events involving the track and field, badminton, basketball, chess, cricket, football, handball, hockey, judo, soccer, squash, swimming, table tennis, taekwondo, tennis and volleyball.
This retrospective review was delimited to cases of sports injuries recorded by the NUGA clinic for which physiotherapy intervention was received. Information were gleaned on age, sex, type of sport, type of injury, anatomical location affected and the type physiotherapy treatment received. For the purpose of analysis, sports injures sustained were classified as fracture, head injuries, spinal cord injuries, soft tissue injuries, chest injuries, abdominal injuries, peripheral injuries and ocular injuries respectively (6). Ethical approval for this study was obtained from Ethics and Research Committee of Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria. Permission of the Head of the NUGA Medical Team was obtained to facilitate access to the case notes of the participants.
Data Analysis. Data was analysed using descriptive statistics of mean and standard deviation, frequency and percentage using Statistical Package for Social Sciences software version 16.0 (SPSS Inc., Chicago, USA).

Results

A total of 365 case notes of athletes reporting various medical conditions were reviewed. However, only 188 (51.5%) - 119 (63.3%) males and 69 (36.7%) females cases, with a female to male ratio of 1:1.7, met the eligibility criteria. The age range of all injured athletes was 17-32 years (mean 22.75±2.88 years) (table I).
Table II showed the incidences of sports injuries by sports types. Football had the highest incidence with 38 (20.2%) reported cases, followed by athletics 26 (13.8%). However, swimming and badminton had the least reported cases of sports injuries of 0.5% respectively (table II).
Type of sports injuries is presented in table III. The result of this study showed that some athletes had multiple types of injuries or more than one diagnosis at a time. However, 151 (81.3%) athletes had soft tissue injuries, 22 (11.8%) had head injuries while 7 (3.8%) had spinal injuries.
Distribution of sports injuries by contact and non-contact sports categories is presented in table IV. The result of this study showed that contact sports such as football and hockey had 96 (79.3%) athletes reporting soft tissue injuries and 1(0.5%) athlete reporting fracture of the bone.
Also 3 (2.5%) athletes reported spinal injuries, 18 (14.9%) athletes reported head injuries, while 2 (1.7%) athletes reported chest injuries (table IV). The result of this study also showed that soft tissue injuries 55 (82.1%) was the most common injury type among non-contact athletes followed by 4 (6.0%) head injuries (table IV).
The distribution of sports injuries by anatomical parts are presented in table V. The knee joint was the most injured anatomical part with 31 (16.6%) incidences, followed by the head 26 (13.9%). 12(6.4%) athletes had injuries to multiple anatomical sites. 11 (5.9%) athletes each sustained injuries to the foot, hand and thorax. 7 (3.7%) athletes each sustained injuries to the spine and shoulder joint while 3 (1.6%) athletes sustained injuries to the wrist joint (table V).
Distribution of sports injuries by anatomical parts by contact and non-contact sports categories is presented in table VI. The result showed that most of the athletes in contact sports had sports injuries affecting the head 22 (18.2%) and knee joints 17 (14.0%) respectively. On the other hand, non-contact sports athletes had injuries affecting the knee 14 (21.2%) and ankle 9 (13.6%) joints respectively (table VI).
The pattern of physiotherapy for the injured athletes is presented in table VII. The result showed that most athletes were treated by combination of different modalities. Cryotherapy was the mainstay of physiotherapy for sports injuries (47.2%). Cryotherapy was often in combination with soft tissue massage and bandaging 26 (13.8%), followed by a combination with soft tissue massage only 24 (12.8%) while a combination of cryotherapy, bandaging, exercise and rest was received by 9 (4.8%) athletes. However, 14 (7.4%) athletes received cryotherapy only.

Table I. Socio-demographic characteristics of the participants with sports injury (n=188)

Variable	Number of athletes	Percentage
Sex		
Male	119	63.3
Female	69	36.7
Age (years)		
15-19	15	8.0
20-24	128	68.1
25-29	39	20.7
>30	6	3.2

Table II. Distribution of injuries by sport types and gender

Type of sport	Male, n (%)	Female, n (%)	Total number of athletes	(%)
Athletics	18	8	26	13.8
Badminton	0	1	1	0.5
Basket ball	16	9	25	13.3
Boxing	8	3	11	5.9
Chess	2	0	2	1.1
Cricket	8	6	14	7.4
Football	21	17	38	20.2
Handball	5	6	11	5.9
Hockey	12	8	20	10.6
Judo	5	3	8	4.3
Lawn tennis	8	1	9	4.8
Squash	3	1	4	2.1
Swimming	0	1	1	0.5
Table tennis	2	0	2	1.1
Taekwando	6	2	8	4.3
Volleyball	5	3	8	4.3

Table III. Distribution of types of sport injuries

Types	Number of athletes	(%)
Abdominal injuries	1	0.5
Chest injuries	3	1.6
Dental injuries	2	1.1
Fracture	2	1.1
Head injuries	22	11.8
Ocular injuries	2	1.1
Soft tissue injuries	151	81.3
Spinal injuries	7	3.8
Soft tissue and ocular injuries	1	0.5
Spinal and soft tissue injuries	1	0.5
Fracture and chest injuries	1	0.5
Soft tissue and abdominal injuries	1	0.5

Table IV. Distribution of sports injuries by contact and non-contact sports categories

	Sport type	
	Contact	Non-contact
Type of injury	n (%)	n (%)
Abdominal injuries	1 (0.8)	--
Chest injuries	2 (1.7)	1 (1.5)
Dental injuries	1 (0.8)	1 (1.5)
Fracture	1 (0.8)	2 (3.0)
Head injuries	18 (14.9)	4 (6.0)
Ocular injuries	2 (1.7)	--
Soft tissue injuries	96 (79.3)	55 (82.1)
Spinal injuries	3 (2.5)	4 (6.0)
Body disorder	--	2 (3.0)

Table V. Distribution of sport injuries by anatomical part

Part of the body injured	Number of athletes	(%)
Ankle	21	11.2
Arm	9	4.8
Chest	4	2.1
Elbow	9	4.8
Foot	11	5.9
Groin	1	0.5
Hand	11	5.9
Head	26	13.9
Hip	5	2.7
Knee	31	16.6
Leg	16	8.6
Mouth	3	1.6
Neck	1	0.5
Shoulder	7	3.7
Spine	7	3.7
Thigh	10	5.3
Wrist	3	1.6
Multiple sites	12	6.4

Table VI. Distribution of sports injuries by anatomical part by contact and non-contact sports

Injuries distribution	Contact sports, n (%)	Non-contact sports, n (%)
Ankle	12 (9.9)	9 (13.6)
Arm	4 (3.3)	5 (7.6)
Chest	3 (2.5)	1 (1.5)
Elbow	8 (6.6)	1 (1.5)
Foot	3 (2.5)	8 (12.1)
Groin	1 (0.8)	---
Hand	6 (5.0)	5 (7.6)
Head	22 (18.2)	4 (6.1)
Hip	5 (4.1)	---
Knee	17 (14.0)	14 (21.2)
Leg	11 (9.1)	5 (7.6)
Mouth	1 (0.8)	2 (3.0)
Neck	1 (0.8)	---
Shoulder	4 (3.3)	3 (4.5)
Spine	3 (2.5)	4 (6.1)
Thigh	6 (5.0)	4 (6.1)
Wrist	3 (2.5)	---
Multiple sites	11 (9.1)	1 (1.5)

Table VII. Pattern of physiotherapy received by the injured athletes

Physiotherapy	Number of athletes	(%)
Cryotherapy	14	7.4
Cryotherapy, bandaging	1	0.5
Cryotherapy, bandaging, exercise and rest	9	4.8
Cryotherapy, immobilization	1	0.5
Cryotherapy, soft tissue massage	24	12.8
Cryotherapy, soft tissue massage, bandaging	26	13.8
Cryotherapy, soft tissue massage, bandaging, elevation and rest	7	3.7
Cryotherapy, soft tissue massage, bandaging, exercise and rest	3	1.6
Cryotherapy, soft tissue massage, elevation and rest	1	0.5
Cryotherapy, soft tissue massage, exercise and rest	3	1.6
Immobilization	6	3.2
Infra red, soft tissue massage	4	2.1
Infra red, soft tissue massage, back extension exercises	5	2.7
Rest	8	4.3
Rest, bandaging	2	1.1
Soft tissue massage	26	13.8
Wound dressing	2	1.1
Wound dressing, cryotherapy, soft tissue massage	1	0.5

Discussion

This study investigated the pattern of sports injuries and physiotherapy interventions during the 23rd NUGA. The result of this study showed that more than half of all cases seen at the medical clinic were related to sports injuries.

From this study, the most commonly injured parts of the body were the knee joints followed by the head and ankle joint. Similarly, Hamzat et al (12) in a study on injury profile during 2002 FIFA male senior world cup, CAF male nation's cup and UEFA clubs championship competitions found that the knee was the most commonly injured part of the body in each of the three competitions (FIFA 23.5%, CAF 14.9% and UEFA 20.0%).

The knee and ankle joints have been reported to be extremely prone to sports injuries as they are indispensable for competing in almost every sport events (25-29). Constant sports-related demands of bending and lifting in one plane of motion-backward, not forward or sideways of the knee joint coupled the torque generated by the two lever-like articulating bones at the joint makes them injury prone (16, 28). On the other hand, the vulnerability of the ankle joint has been implicated on lack of bony congruence, and biomechanical restraints in static and dynamic joint stability, muscle strength/range-of-motion deficits and sports peculiarities (30, 31).

This present study also found that there were higher injuries in contact sports when compared to non contact sports. This finding is similar to earlier reports on higher rates of injuries in contact sports compared with non-contact sports (6, 8, 32, 33). Furthermore, the result of this study indicated that male athletes had higher incidences of injuries than females in all sports except in badminton, handball and swimming. Awotidebe et al (6) submitted that gender pattern of sport injuries according to sport types has been inconsistent and inconclusive. Patterns of injuries in athletes are more sport-specific than gender specific. Some studies found similar overall injury rates in men and women (34, 35), other studies have shown male athletes to be at greater risk for injury than female athletes (36, 37) while some other reported higher preponderance of injuries in female athletes in some sport (38, 39).

Soft tissue injuries were the most common type of sports injuries with a higher incidence in contact sports than non-contact sports (64.7% and 35.3%) in this study. This finding corroborates the findings of Ladani (2002) who reported that sprains, contusions, strains, dislocation, inflammation and infection are frequently sustained injuries in any sporting activities. This study also found that cryotherapy was the mainstay of physiotherapy for sport injuries in NUGA and it was mostly in combination with soft tissue massage and bandaging. This finding is consistent with numerous reports that cryotherapy is the most common and generally accepted treatment method in acute sports injuries as well as in the rehabilitation of the injured athlete (22,

41-43). However, cryotherapy in the rehabilitation of injured athletes is often in combination with other treatment methods. Similar to the finding of this study, Akinbo et al (11) and Owoeye (11) reported that massage with anti-inflammatory gel and bandaging were mostly combined with cryotherapy in the management of injured athletes in Nigeria.

Conclusion

Sports injuries were common medical conditions in the Nigerian University Games and it constitutes a significant burden for physiotherapy interventions. The observed sports injuries profile are consistent with most epidemiological reports. Advocacy for policy to minimize injuries and institutionalize physiotherapy interventions at subsequent NUGA is warranted.

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The relationship between alignment of upper limb and postural control in adolescents with Down Syndrome

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Abstract. The purpose of this research was the study of relationship between alignments of upper limb and postural control in adolescents with a mild to moderate Down syndrome (DS) to age matched adolescents without intellectual disability (ID). *Material and Method*. The study involving 30 male subjects with DS (mean age = 15.02±2.07 years, mean body weight = 61.63±12.80 kg, mean height = 155.00±10.65cm, body mass index (BMI) = 25.85± 4.21) and 25 non-ID male subjects (mean age = 15.04±2.13 years, mean body weight = 56.24±12.01, mean height = 164.36±11.42, body mass index (BMI) = 20.72±3.58). Biodex Balance System (BBS) (Double Leg Eyes Open) was used for the assessment of postural control. Flexi curve ruler was used for the assessment of thoracic kyphosis and lumbar lordosis. Photo of child were examined in sagittal and frontal planes for head and shoulder deviation and independent t-test was used to compare groups and correlation Pearson test was used relation between variables by using SPSS (21 version) software. *Results*. Statistical analysis revealed significant difference in forward head, forward shoulder angle and dorsal kyphosis between two groups (p = 0.001). As well as revealed no significant difference in torticollis and lumbar lordosis between two groups. Statistical analysis revealed significant correlations between the balance value for Overall Stability Index (OSI) with forward shoulder angle and kyphosis posture (p = 0.050, p = 0.014) and for Anterior - Posterior Index (API) with forward shoulder angle and kyphosis posture and forward head posture (p = 0.010, p = 0.007, p = 0.016). There are no significant correlations between the balances for Medial–Lateral Stability Index with upper-limb alignments. *Conclusion*. According to the finding of the present study in the individual with DS. Structural profile lead to poor control posture. These main results suggest that therapeutic remediation of balance problems in subjects with DS and should conduct periodic reviews in order to prevent alterations of the spine and to counsel families about the type of exercises and activities to be undertaken to prevent future children deformities.
Key words: *intellectual disability, balance control, children deformities*.

Introduction

Down Syndrome (DS) was clinically described for the first time by English physician John Langdon Down in 1866. Down syndrome (DS) is a chromosomal anomaly with incidence of around 1/700 to 1/1000 live births (1) as a result of the presence of all or a portion of an extra copy of chromosome 21.

Individuals with DS are mainly characterized by several clinical symptoms including orthopedic, cardiovascular, musculo- skeletal, perceptual impairments chaplinesque gait with external rotation of the hip, increased knee flexion and valgus, hallux valgus, hammer toe deformities and external rotation of the tibia. DS are associated with a distinct profile of developmental outcomes regarding body functions and activity performance with evidence for great variation in the range and level of deficits resulting from biological and environmental factors (2).

Dynamic motor dysfunction is widespread among individuals with DS. It includes longer motion and reaction times, balance and postural deficits and co-contraction of agonist and antagonist muscle pairs (3, 4).

Postural control requires two different processes, the sensory organizational process, in which multimodal sensory systems, including the visual, somatosensory and vestibular ones, are involved and integrated within the central nervous system (CNS), and the motor adjustment process, involved in executing coordinated and properly scaled musculoskeletal responses (5, 6). The somatosensory system seems to mature at 3–4 years of age, while the visual and vestibular systems reach adult level at 15–16 years of age (7). It is known that subjects with Down syndrome (DS) often show deficits in maintaining static standing balance (8).

Falls have been reported to be more common in adolescents with DS compared to their peers without DS (9). These studies showed that the development of postural control is particularly delayed in young children with DS (10, 1). Various studies show that a high Body Mass Index (BMI) and height can influence postural balance among children, adults and elderly people without DS (11, 12).

Ineffectively dynamic motor in patients with Down syndrome include slower reaction and movement disorders and postural balance and muscle co-contraction of agonists and antagonists. The disorder is caused by delayed growth and motor skills. Delays in motor development in Down syndrome individuals suffering due to ligament laxity and muscle tension associated with pathological - ineffectively of motor neurons is unknown in patients suffering Down syndrome (13). Postural control and balance stability and skill as a central device, using different body systems, including all parts of the brain and the neuromuscular system is integrated. The data processing system of the central nervous system with visual, vestibular, and proprioceptive and pre-learned motion patterns with regard to the pattern of muscle activation of the limbs is synergy. The patterns of mobility strategies that will create muscle a person can follow to keep your balance (14).

Upper Cross Syndrome is an imbalance musculoskeletal system affects muscle anterior and posterior part of the upper body muscles and facilities. This syndrome con is seen through the head and shoulders. In which, muscular imbalance is occurred between the deep neck flexor and scapular stabilization associate with weak lower upper trapezius, elevator scapula and pectorals are short and stiff. The syndrome usually includes a forward head posture, forward shoulder angel and kyphosis. The muscles such as sub-occipital muscles, sternocleidomastoid, scalene, and pectorals minor are contracted.

Sinak et al (15) researched elderly women with osteoporotic-kyphotic postural control characteristics during 3 stages. At the stage 1 (baseline), 12 women in the kyphotic group were compared with 13 healthy controls to assess the risk of falls and balance disorder in the kyphotic group. At the stage 2, 12 kyphotic women began the SPEED program with a WKO (2 supervised sessions in an outpatient clinic and a 4 week, daily home-based training program). At the stage 3, baseline and follow-up data of the kyphotic group were compared to determine the effect of intervention. At baseline, there were significant differences between the osteoporotic-kyphotic group and the control group in balance, gait, and strength. After 4 week intervention, comparison of the kyphotic group's baseline and follow-up results showed a significant change in balance and several gait parameters. Mean back extensor strength improved significantly from baseline to follow-up. Lower extremity muscle strength was not changed significantly, except for improved left ankle plantar flexors. Back pain decreased significantly.

Kokubun et al compared balance with unilateral support in DS children to that of children with other kinds of mental impairment. The authors observed that the frequencies of sway waves were higher in children with DS, suggesting that higher frequencies of sway wave may be related to muscle hypotonia (16). Rahmani (2011), in the study about posture and physical fitness in subjects with Down syndrome, observed that a significant difference between all spinal abnormalities except lordosis (17).

The importance of normal upright posture has been proposed since the early 1900s when it was described as a state of balance requiring minimal muscular effort to maintain (18).

The musculoskeletal system of children with Down syndrome is more vulnerable (due to the incidence of hypotonia, ligamentous laxity, shortening of the upper and lower limbs, joint hypermobility and greater flexibility) (12).

The main purpose of this study was to investigate the relationship between relationships between upper-limb alignments with postural control in adolescents with Down syndrome, and make comparisons with age-matched healthy adolescents with no medical conditions.

Material and method

The study involved 30 male subjects with DS (mean age =15.02±2.07 years, mean body weight = 61.63±12.80 kg, mean height = 155.00±10.65cm, body mass index (BMI) = 25.85± 4.21) and 25 Non-ID male subjects (mean age = 15.04±2.13 years, mean body weight = 56.24±12.01, mean height = 164.36±11.42, body mass index (BMI) = 20.72±3.58) from different schools and institutions of Tehran (Iran). Inclusion criteria for the DS group subjects were: the presence of trisomy 21, the absence of any gross visual or organic defect and independence in stance and ambulation.

All participants without DS were healthy, without signs of any orthopedic or neurological disorders, impairment of somatosensory activity, hearing, vestibular or uncorrected visual functions and free of medications. Two upper secondary schools in Iran were contacted, one for adolescents with DS and one for Non-ID adolescents. Permission was given by the principals of the two schools for a visit to all classes to provide information about the study. All students, both DS and Non-ID, received verbal information about the study and were asked to participate.

Balance assessment. The BBS was used to measure balance and postural stability under dynamic stress (BBS; Biodex Inc., Shirley, NY). Reliability in repeated overall stability index (OSI) (%94), Anterior - Posterior index (API) (%95) and Medial–Lateral Stability Index (MLS) (%93) as noted, the BBS uses a circular platform that is free to move in the anterior–posterior and medial - lateral axes simultaneously. The BBS allows up to 20° of foot platform tilt and calculates three separate measures: MLSI, APSI and OSI. A high score in the for example, OSI, indicates poor balance. The OSI score is believed to be the best indicator of the overall ability of the patient to balance the platform. The stability of the platform can be varied by adjusting the level of resistance given by the springs under the platform. The platform stability ranges from 1–8, with 1 representing the greatest instability. The lower the resistance level the less stable the platform (19, 20) in this study, we assessed bilateral stance with eyes open with the BBS over a period of 20s. Stability levels were changed from level 8 to level 3 and from level 8 to level 3 for bilateral stance assessment respectively, and subjects were instructed to maintain their center of pressure in the smallest concentric rings (balance zones) of the BBS monitor, named a zone. To begin, participants stood on the BBS's locked platform. To assess the foot position coordinates and establish the subjects' ideal foot positioning for testing, the stability platform was unlocked to allow motion. Participants were instructed to adjust the position of the foot until they found a position at which they could maintain platform stability. The platform was then locked. Foot position coordinates were constant throughout the test session. Next, testing began as the platform was released for a 20s trial and participants were asked to maintain an upright standing position on their limb/limbs. For the trial to be complete, balance needed to be maintained for 20 sec (21, 22) all participants were trained 1 min for adaptation to the machine, following which three practice trials, to reduce any learning effects, and three test evaluations were performed in each measurement session. A mean score was calculated from the three trials.

Thoracic kyphosis assessment. Thoracic kyphosis was measured in each subject using the flexi curve ruler (Staedtler Mars Inc, Nurnberg, Germany), which is a malleable band of metal covered with plastic and approximately 60 cm in length. The ruler can be bent in only one plane and retains the shape to which it is bent. It is available from most drafting supply stores. The subject was instructed to stand up straight and as tall as possible, and the flexi curve ruler was aligned to the anterior-posterior curves of the spine from T2 to T12 (Fig. 2). The ruler was then placed flat on paper and its outline was traced. A straight line was then drawn from the ruler position of T2 to T12 that corresponded to the length of thoracic kyphosis (l) and was measured in cm. The height of the thoracic kyphosis (h) in cm was determined by drawing a perpendicular line from the highest point in the thoracic curve to the point at which it intersected the straight line drawn from T2 to T12.

The index of kyphosis was calculated by applying the formula (17): Kyphosis Angle = 4 × [arc tan (2H/L]

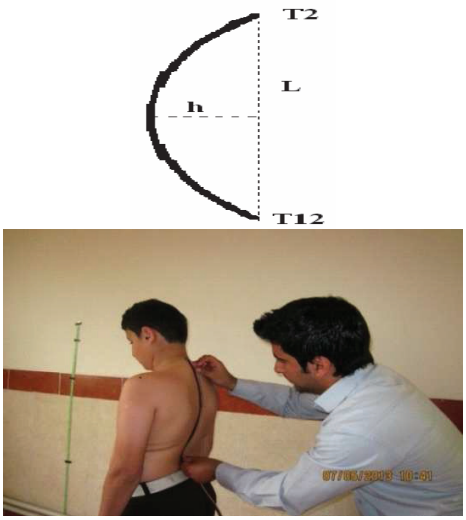

Figure **2.** Measurement of thoracic kyphosis using the flexi curve ruler

Forward head and Forward Shoulder angle assessment. In order to measure the forward head imaging the subjects were placed in a standing position from the sagittal view. The pictures were taken by digital camera (Canon power shot A1200 HD), and the angle between the seventh cervical spine and appendage tragus of the ear horizon line, and the angle between the line passing through the seventh cervical vertebra and the acromion process was measured in order to assess the Forward Shoulder angle in which the seventh cervical vertebra and acromion process were marked by the markers. This process was accomplished in AutoCAD 2007 (9, 11).

Torticollis assessment. In order to measure the torticollis imaging the subjects were placed in a standing position from the frontal view. The pictures were taken by digital camera (Canon power shot A1200 HD), and the angle between Two soft ears. This process was accomplished in AutoCAD 2007 (9, 11).

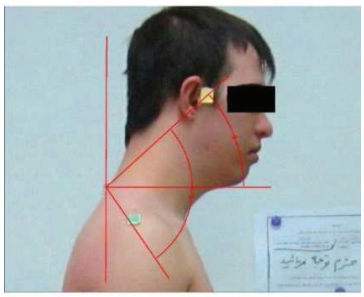

Figure 2. Measurements of forward head and forward shoulder angel using the photography

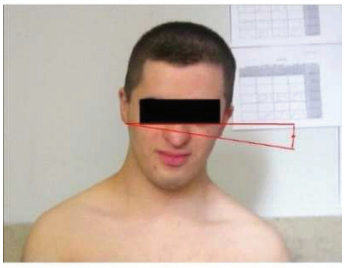

Figure 3. Measurement of torticollis using the photography

Table I. Descriptive characteristics of subjects.

	Non-ID (n=25)	With DS (n=30)
Age (years)	15.04±2.13	15.02±2.07
Weight (kg)	56.24±12.01	61.63±12.80
Height (cm)	164.36±11.42	155.00±10.65
BMI (kg/m^2)	20.72±3.58	25.85± 4.21

Table II. Descriptive characteristics postural controls of subjects

	Non-ID (n=25)	With DS (n=30)
OSI	4.33±1/61	2.02± 0.67
APSI	3.42±1/21	1.45± 0.58
MLSI	2.78±1/00	1.47± .64

DS: Down syndrome, MR: Mental retardation, APSI: Anterior–Posterior Stability Index, OSI: Overall Stability Index, MLSI: Medial–Lateral Stability Index

Table III. Descriptive characteristics upper-limb alignments of subjects

	Non-ID (n=25)	With DS (n=30)
Forward head posture	52.50±7.57	40.30±6.28
Forward shoulder angle posture	123.84±12.07	90.96±15.23
Torticollis posture	177.40±2.4	177.26±3.06
Dorsal kyphosis	30.03±7.48	38.16±7.47
Lumbar lordosis	42.6±10.16	40.53±8.18

Result

Statistical analysis (independent *t* test) revealed significant difference in balance variables including the Anterior - Posterior Index (API), overall stability index (OSI) and Medial–Lateral Stability Index (MLSI) between two groups (table II). ($p \geq 0.05$).

Statistical analysis (independent *t* test) revealed significant difference in forward head, forward shoulder angle and dorsal kyphosis between two groups. (Table III) (p≥0.05). As well as independent t-test revealed no significant difference in torticollis and lumbar lordosis between two groups (table IV) Statistical analysis (bivariate correlations Pearson) revealed significant correlations between the balance value for overall stability index (OSI) with forward shoulder angle and kyphosis posture the (p = 0.050, p = 0.014) and for Anterior - Posterior index (API) with forward shoulder angle and kyphosis posture and forward head posture (p = 0.010, p = 0.007, p = 0.016). There are no significant correlation between the balances for Medial–Lateral Stability Index with upper-limb alignments (Table V). Statistical analysis (bivariate correlations Pearson) revealed no significant relationship between the overall stability index of each variable with forward head, torticollis and lumbar lordosis in individual DS.

As well as statistical analysis revealed no significant relationship between the Anterior - Posterior Index of each variable with torticollis and lumbar lordosis in individual DS (table VI).

Table IV. Comparison forward head posture (FHP), forward shoulder angle (FSA), torticollis posture and kyphosis in mental retardation with Down syndrome and without mental retardation (MR) (Healthy)

	Different mean	T	df	sig	F
Forward head	11.89	-6.37	53	**0.001***	1.74
Forward shoulder angle	32.87	-8.74	53	**0.001***	3.20
Torticollis	0.133	-0.177	53	0.860	0.556
Dorsal kyphosis	8.13	4.01	53	**0.001***	0.049
Lumbar lordosis	2.07	-0.838	53	0.406	0.049

Table VI. Comparison Overall Stability (OSI) Anterior–Posterior Stability (APS) Medial–Lateral Stability (MLS) in mental retardation with Down syndrome and without mental retardation (Healthy)

	Different mean	T	df	sig	F
OSI	2.32	6.71	53	**0.001***	18.86
APS	1.76	6.65	53	**0.001***	8.49
MLS	1.42	6.12	53	**0.001***	8.21

Table VI. Relationship between postural controls with upper-limb alignments individual Down syndrome

	MLSI		APSI		OSI	
	Sig	Correlation coefficient	Sig	Correlation coefficient	Sig	Correlation coefficient
FHP	0.618	0.095	**0.016***	0.437	0.070	0.335
FSA	0.489	0.131	**0.010***	0.463	**0.050***	0.362
Torticollis	0.302	0.195	0.873	0.030	0.716	0.069
Dorsal kyphosis	0.069	0.337	**0.007***	0.483	**0.014***	0.444
lumbar lordosis	0.636	0.090	0.083	0.321	0.283	0.202

APSI: Anterior–Posterior Stability Index, OSI: Overall Stability Index. MLSI: Medial–Lateral Stability Index, FHP: Forward head posture, FSA: Forward Shoulder angle

Discussion

The purpose of this study was to the relationship between upper-limb alignments and postural control in adolescents aged between 12 and 20 years with a mild to moderate Down syndrome. The results indicated that significant difference in balance variables including the Anterior - Posterior Index (API), Overall Stability Index (OSI) and Medial–Lateral Stability Index (MLSI) between two groups ($p \geq 0.05$). Present results agrees with researches of Galli and al (8). The DS adolescent group as a whole performed less well on the postural balance than the non-ID group, which confirmed our hypothesis. Indicated signification correlations between postural balance test and upper-limb alignment. Kokubun compared balance with unilateral support in DS children to that of children with other kinds of mental impairment. The authors observed that the frequencies of sway waves were higher in children with DS, suggesting that higher frequencies of sway wave may be related to muscle hypotonia (16). Rahmani study of posture and physical fitness in subjects with Down syndrome observed a significant difference between all spinal abnormalities except lordosis. This is in agreeing with the results of the present study (23). Dellavia found that athletes (20–30 years) with ID had a greater mean body sway than controls without ID. Further, it was reported that the ratio between EO and BF (blindfolded) sway area increased more for the control group than with the ID group, which is in agree with the results of the present study (24). The ability to control balance of the body is an important prerequisite to functional activities and failure in this control can seriously limit performance (25). Thus, it is necessary to improve the precarious balance of the adolescents with DS. Aydoğ E (2006) evaluates the dynamic balance with Biodex system in the patent ankylosing spondylitis. They reported that no difference among patients and controls ankylosing spondylitis in the performance of dynamic equilibrium. However, they not report information regarding the removal of visual information (eye closure) and role in the deviation of postural. This is in agreeing with the results of the present study (26). M. Adoracion (2012), compared static standing balance in adolescent's aged 10–19 years with Down syndrome, under four conditions (C1: open eyes/ fixed-foot-support; C2: closed eyes/fixed-foot-support; C3: open-eyes/compliant foot- support; closed eyes/compliant-foot-support) was examined by means of time and frequency Postural-Parameters (PPs). Mean values of time PPs were higher in both groups on compliant-foot-support (with open and closed eyes) than on fixed-foot-support. Ratios C2/C1 were significantly lower in DSG than in CG; ratios C3/C1 presented higher values in DSG than in CG, with significant differences in length path and RMS-velocity; there were no differences in ratios C4/C1. These results are in agree with the results of the present research (27). In Blanco's study (28), the results of analysis realized in three planes of the space in adolescent's aged 10–11 years with DS (10 (71.42%) had a lateral tilt of the head, 11 (78.57%) elevation of one of the two shoulders, 8 (57.14%) alterations of the pelvic girdle, 13 (92.85%) suffering from calcaneal valgus, 4 (28.57%) had chest abnormalities, 8 (57.14%) knee valgus, 2 (14.28%) had hallux valgus, 11 (78.57%) antepulsion head, 10 (71.42%) antepulsion right shoulder, 10 (71.42%) cervical kyphosis, 6 (42.85%) dorsal kyphosis, 3 (21.42%) back plane, 11 (78.57%) lumbar lordosis, 9 (64.28%) hypotonic abdominal muscles and 8 (57.14%) shortening of the hamstrings) are in agree with the results of the present study. Vuillerme (2001) obtained the same conclusion as we did in their group of adolescents with DS (29). However, these last authors found a similar behavior in their two groups of adolescents, with and without DS, under both conditions: no differences in the COP range, although a higher COP mean velocity with closed eyes. Rigoldy (2011) examined the postural control in children, adolescents and adults who have DS (26). The aim of this study was to analyze changes in center of pressure (COP) time in two dimensions and three were repeated during the standing position. The results showed that differences in postural control in young people with DS and controls related to the early years of growth. In the following analysis, COP motion in the interior - for both study groups (pathology and control), which represents a decrease of their growth strategy. But then repeat the analysis further indicates the number of occurrences in the interior - for young people with DS in the young control group there (26). Their condition generally led them to an inactivity which contributes to an even worse postural control. Therefore, adapted training programs could improve balance in these

adolescents. From our results, we must not forget that postural control involves not only the sensory system but also the motor system, responsible of executing coordinated musculoskeletal responses. It is known that problems in the motor system in DS population (reduced strength, low levels of lean mass (30), ligament laxity and hypotonia can also contribute to their precarious balance. Therefore, these programs should also insist on strength and muscular coordination (30). Adolescents with ID have poorer postural balance than age-matched controls. Adolescents with ID do not rely more on vision to keep their postural balance than to their peers without ID. Muscle performance and muscle- skeletal abnormality a role in postural balance performance. These main results suggest that therapeutic remediation of balance problems in subjects with DS should focus on assisting children in the development and corrective exercise in the muscle- skeletal abnormality, specifically enhancing corrective forward head, kyphosis and forward shoulder angel in subject with DS.

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A cross-sectional study for the relationship of left atrial remodelling with body composition and body surface area in athletes of various sports

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Abstract. *Introduction*. The significance and prevalence of left atrial enlargement in athletes on endurance, strength and combined (endurance and strength) training is unresolved. The present study was done with aim to assess relationship between left atrial remodelling with body surface area and body composition and to compare the results in athletes and non athletes. *Material and Method.* We assessed left atrial and left ventricular dimension in competitive athletes of various sports under endurance (22 long distance runners, 16 cyclists, 12 swimmers), strength (32 wrestlers, 10 weight lifters) and combined (endurance and strength) trained (25 hockey players, 21 football players, 20 basketball players and 20 volleyball players) in the age group of 18 -25years of age. *Results*. The left atrial enlargement was observed in all athletes as compared to non athletes. Body surface area and body composition did not relate to the left atrial enlargement but multivariate regression analysis showed that left atrial enlargement in athletes was largely explained by the left ventricular cavity enlargement (R^2=0.52) and participation in sports and minimally to body size and measurements. *Conclusion*. It can be concluded that in the population of differently trained athletes, enlarged atrial dimension was relatively common with the upper limit (>40mm) not being crossed in this age group distinguishing physiologic cardiac remodeling (athlete's heart) from pathologic cardiac diseases. Atrial fibrillation was found to be uncommon in this age group. Left atrial remodeling in athletes may be regarded as a physiologic adaptation to exercise conditioning, largely without adverse clinical consequences.
Key words: *athlete's heart, cardiac diseases, exercise conditioning*.

Introduction

Left atrial enlargement has been found to be an independent predictor of atrial fibrillation (AF) in the general population and also in patients with cardiac disease such as hypertrophic or dilated cardiomyopathy (1, 2). The prevalence of AF in the general population increases gradually after 40 years of age but increases sharply after the age of 65. But in young population of 25 years of age (3-5), the incidence has been found to be less. In the recent years, the research was focused to see the effect of left atrial remodelling in athletes as compared to general population. Several observations have concluded that the prevalence of AF increases in many years of training (6-9). This observation was further confirmed in case control studies to confirm the findings (10-15). Some researchers (16-24) have showed that the athletes are predisposed to paroxysmal atrial fibrillations as a consequence to the cardiac remodelling they undergo as a result of training. Out of the tachyarrhythmias, found in athletes, atrial fibrillation has been found to be the most common, and the pathogenesis of this condition is poorly understood (25).The vulnerability of athletes to AF has been largely explained by the increased vagal tone and consequent bradycardia, which lead to atrial repolarisation, increasing the susceptibility to AF (26). Other studies have recognized remodelling process and atrial size enlargement in athletes to cause AF (27). A published review has heightened this subject and has suggested longitudinal studies to clarify the association between AF and physical endurance (28). Pellicia et al (29) reported that in large population of highly trained athletes, the left atrium dimension (≥40mm) was relatively common with upper limit in men being 50 mm and in women being 45mm. But the frequency of atrial fibrillation and supraventricular tachyarrhythmias were found to be <1% in athletes as compared to general population despite the frequency of left atrial enlargement.

Atrial fibrillation may impair athletic performance and deteriorate the quality of life of an athlete. So this poses an increasing demand to stratify the risk factors of AF in athletes. The factors predicting the increased atrium size have not been reported in previous studies. The left atrial relationship with body composition and body surface area was also found to be deficient. Thus, in present study we intend to examine a cohort of athletes of various competitive sports and trained on endurance, strength and combined endurance and strength trained protocols, to assess the distribution and clinical significance of left atrium size in the context of athlete's heart and the relationship of left atrial size with body surface area and body composition.

Material and Method

Subjects. One hundred and ninety six males were included for the study which consisted of one hundred and seventy eight athletes (n=178) and eighteen sedentary males (n=18) with minimum sporting activity in the age group of 18-25 years. All athletes were members of professional sports teams and were taken from endurance - 22 long distance runners (LDR), 16 cyclists, 12 swimmers, strength - 32 wrestlers, 10 weight lifters) and combined trained - 25 hockey players, 21 football players, 20 basketball players and 20 volleyball players. All subjects were screened by history, physical examination and electrocardiography and they were all free from cardiac diseases. Subjects who had history cardioactive medication or anabolic steroid use were excluded from the study. The ethics committee of our institute approved the study protocol and all subjects gave written consent for the study. All participants were informed about the purpose and procedures of the study before providing written informed consent.

*Echocardiographic study***.** The Philips iE33 Matrix (U.S.A) was used as the echocardiographic unit for testing on all the subjects. Maximum transverse LA dimension was measured from the M-mode echocardiogram during systole as the average of three consecutive cycles. The left ventricular end diastolic dimension was measured at the maximum width of the ventricular wall during diastole in 2D and M-mode. The same investigator performed all echocardiograms. *Body Surface Area.* Anthropometric measurements were made on each subject. Height was measured in the upright position to the nearest millimetre. Body mass was determined using a balance. Body surface area (BSA) was estimated through applying height and weight using the equation of Dubois and Dubois (30).

Dual Energy X-ray Absorptiometry (DEXA). Total body composition was estimated by dual-energy X-ray Absorptiometry (DXA) (QDR-1000; Hologic, Waltham, MA). And the fat percentage, fat mass lean body mass was calculated for all subjects.

*Statistical analysis***.** Data were expressed as mean±SD. The differences between athletes and controls were assessed with Student's t-test. Analysis of variance was used to assess the differences between controls and athletes' groups. The inter group differences among various sport categories i.e. (cycling, LDR, swimming, wrestling, weightlifting, hockey, football, basketball, volleyball and control) with regard to LA dimension differed significantly, therefore, Post-hoc test (Scheffe's) was applied to find out the degree and direction of differences between paired means among various sport categories. For correlation among different variables Pearson's Correlation test was applied. A multivariate regression analysis was done to look for the predictors of left atrium dimension. A value of $p<0.05$ was taken as statistically significant.

Results

Participant characteristics of the subjects are summarized in table I. The athletes had been active in their individual sport for minimum 5 years. The results of the study showed enlarged left atrial dimension in athletes as compared to sedentary non athletic group. The LA dimension found in all athletes is represented in figure I for all the games and sports.

Table I. Participant characteristics of the subjects

Variables	Endurance trained sports (N=50)	Strength trained sports (N=42)	Combined trained sports (N=86)	Control group (N=18)
Age (years)	19.96±1.70	20.50±1.71	19.53±1.34	21.72±1.84
Body Height (cm)	167.58±8.11	173.23±6.04	174.06±4.66	167.77±7.47
Body mass (kg)	55.66±8.34	76.40±15.1	63.00±9.97	66.11±9.02

N; sample size, SD; standard deviation, cm; centimeters, kg; kilograms; Values are mean±SD

It is evident from table II that the results of One-Way Analysis of Variance (ANOVA) among various sport categories (cycling, LDR, swimming, wrestling, weightlifting, hockey, football, basketball, volleyball) and control group with regard to echocardiography on the sub-variable left atrium dimension (LA Dimension) were found statistically significant ($p<0.05$).

Table II. One-way analysis of variance (ANOVA) of left atrium dimension (LA Dimension) among various sports categories and control group.

Variables	ANOVA				
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1011.610	9	112.401	18.392*	0.000
Within Groups	1136.740	186	6.112		
Total	2148.350	195			

*$F_{0.05}$ (9, 186) =1.99

As the obtained value of f-ratio that is 18.392* is greater than the tabulated value 1.99 for the selected degree of freedom and level of significance. Thus it may be concluded that inter group differences among various sport categories i.e. cycling, LDR, swimming, wrestling, weightlifting, hockey, football, basketball, volleyball) and control group with regard to echocardiography on the sub-variable left atrium dimension (LA Dimension) differ significantly, therefore, Post-hoc test (Scheffe's) was applied to find out the degree and direction of differences between paired means among various sport categories. The post hoc test revealed that all data was significantly higher for athletes of all games as compared to controls ($p<0.001$).

The correlation of LA dimension with body surface area and body composition (Fat weight, Body Fat % and Lean Body weight) is mentioned in table III. The data of correlation is given for all the games. The LV dimension was found to be significantly higher in the athletes than non athletes, probably due to the conditioning and training.

Table III. The association between left atrium dimension and body surface area & body composition variables. The values of r and p are represented.

Sports	BSA	Body Fat %	Fat Weight	Lean Body Weight
Endurance sports				
Cycling	0.056, 0.83	-0.094, 0.72	-0.334, 0.20	0.468, 0.46
LDR	0.186, 0.40	0.188, 0.41	0.123, 0.58	-0.138, 0.53
Swimming	0.458, 0.13	0.184, 0.56	0.008, 0.97	0.453, 0.13
Strenghts sports				
Wrestling	0.127, 0.48	0.166, 0.36	0.099, 0.58	0.071, 0.69
Weight Lifting	0.298, 0.40	0.551, 0.09	0.403, 0.24	0.478, 0.16
Combined endurance and strenghts sports				
Hockey	0.137, 0.51	0.068, 0.74	0.013, 0.94	0.042, 0.83
Football	0.252, 0.27	-0.236, 0.30	-0.083, 0.71	-0.262, 0.25
Basketball	0.205, 0.38	0.121, 0.61	0.137, 0.56	0.122, 0.66
Volleyball	0.053, 0.82	-0.158, 0.50	0.020, 0.92	-0.115, 0.62
Control				
Control	0.493, 0.03	0.330, 0.18	0.450, 0.06	0.367, 0.13

LDR- Long Distance Running; BSA- Body Surface Area. The level of significance kept at $p<0.05$.

Discussion

The study taken up is relevant to the clinical perception now widespread based on previous researches in selected athletes (17-19), that AF occur disproportionately in highly competitive athletes in the absence of any cardiac abnormality

(21,23). Left atrial enlargement in the context of the physiologic cardiac remodeling in trained athletes (i.e., athlete's heart) has been considered responsible by itself for a tendency to produce atrial fibrillation, especially when associated with marked sinus bradycardia (16-18). The present data shows, however, that LA remodeling associated with chronic exercise and athletic conditioning does not predispose to tachyarrhythmia.

In our investigation, left atrial enlargement was found in athletes of various games as compared to controls. Our data do not support the clinical concern that LA enlargement in athletes may predispose them to adverse clinical sequelae, such as stroke or other embolic events (31-33). In contrast to previous studies (16-23), our observations show that LA enlargement does not represent a preclinical abnormality in trained athletes but rather likely represents an innocent consequence of chronic and intensive exercise conditioning.

The present data shows that the athletes in the age group of 18-25 years of age do not as such show any AF, but do show left atrial enlargement but not higher than the arbitrary cut off value of >40mm (29).Recognition of the upper limits of atrial size in trained athletes is of particular clinical relevance by offering the prospects to distinguish physiologic and benign cardiac remodeling in athletes from structural heart diseases, such as dilated or hypertrophic cardiomyopathy (2, 34). This differential diagnosis has important implications because the identification of these diseases often represents the basis, to minimize the risk of disease progression or sudden death, for disqualifying athletes from competition (35, 36).

The relationship of atrial dimension with body surface area and body composition showed no positive significant results, so the possible determinants of LA cavity dimension are not body size or body composition. Multivariate regression analysis (R^2= 0.52), however, showed that LA enlargement occurs in close association with LV cavity enlargement and that this morphologic change is minimally related to body size. Our observations suggest that both LA and LV cavity remodeling observed in trained athletes represent the physiologic consequence of a global cardiac adaptation with intensive and chronic exercise training, may it be endurance or strength or combined trained sports (37).

Conclusion

Atrial fibrillation was uncommon in athletes under endurance, strength and combined endurance and strength trained sports in the age group of 18-25 years of age, though left atrial enlargement was shown in all the sports. Therefore, left atrial enlargement can be regarded as a physiologic and benign adaptation to chronic exercising and another component of "athlete's heart".

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The effects of short-term extract of Melissa officinalis supplement on hip circumference (swelling) after aerobic exercise in a negative slope

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Abstract. The purpose of this study was to investigate the effects of downhill running short of Melissa officinalis (MO) supplementation on the circumference (swelling) amount in the male athletes. For this purpose, 20 male athletes were randomly divided into two groups of 10 (supplement and placebo). Levels of total level of understanding thigh bruising and swelling in the ground state before and after the supplementation was measured. After collecting the data, ANOVA for repeated evaluation of time series and the Bonferroni post hoc test was significant, and t-test was used to evaluate difference between-groups. Meaningful level $p>0.05$ has been used. The findings of the study was that total circumference (swelling) levels less were increased in the supplement group than placebo. The amount of perceived soreness was lower in the supplement group, although the difference between groups was observed in the swelling of the thigh. But in both groups compared to the ground state of the thigh was swollen. Generally, it is concluded that the herbal supplement can affect on reduce swelling, bruising, elevated and perception of fatigue.
Key words: *Melissa officinalis, swelling, perceived soreness, eccentric contraction*.

Introduction

Running downhill like coming down from the mountain or stairs with eccentric contractions cause more muscle soreness than other muscle contractions (1,2). The main feature of this type of additional pressure is contraction of muscle fibers, connective tissue and the muscle damage while doing these activities. Although eccentric contractions of metabolism requires less energy than other activities, this kind of damage to small contraction of skeletal muscles, is also larger inflammatory response, oxidative stress than the other contractions (3).

Delayed muscle soreness (DOMS) is an unpleasant state of feeling which associated with pain spasms, stiffness, weakness, muscle (2). DOMS usually 24 to 72 hours after a bout of activity reached its peak and eventually disappears after 5 to 7 days (4). Several theories expressed to explain the mechanism of DOMS including lactate accumulation, inflammation, muscle spasm, muscle injury, damage connective tissue and increase muscle temperature (5,6). A common feature of most of these theories is that the production of free radicals increases during DOMS (4,7,6).

Exercise, especially aerobic exercise increases the oxygen consumption of cells, so muscle cells can produce more energy. The result is an increase in oxygen, creating reactive molecules that is called free radicals (4,8). Free radicals can combine with other molecules that are capable of causing oxidative stress and damage in this case is more in extroverted aerobic activity (9).

Different strategies have been conducted in order to reduce DOMS, which include: massage, cryotherapy, ultrasound, anti-inflammatory drugs, such as aspirin, and the use of artificial and natural supplements (10,11).

The use of antioxidants may be beneficial, the process of rebuilding muscle fibers supposed as mechanically damaged, including inflammatory processes causing muscle pain, stiffness and loss of muscle strength, particularly in the 2 to 5 days after the exercise.

Free radicals are thought to play an important role in inflammatory processes and significant amounts of antioxidants may reduce the severity and duration of muscle pain (2). Antioxidants are compounds that are powerful without being reactive radicals to become easily lose an electron

or hydrogen to neutralize the destructive effects of free-radical form (7). Some studies suggest that the consumption of sports supplements have anti-inflammatory and antioxidant that effectively reduces muscle soreness and muscle pain (2,12). Many nutritional supplements that claim to prevent or recover faster onset muscle soreness affected, but these studies are often incomplete and not the general consensus (13).

Gldfarb and colleagues (2004) with a combined supplementation of antioxidants (vitamins E and C and selenium) for 14 days before and two days after eccentric activity that the indicators of cell damage were reduced, and the subjects reported less pain and blood creatine kinase level (14). But the range of motion and maximal isometric contractions, in both experimental and control groups, was reduced to similar size. Shaft and colleagues (2004) using higher doses of vitamin E and C in the longer term (37 days) conclude that the reduction peak was less observed (15). Oxidative stress and inflammatory markers are listed which were measured in the study. Bloomer et al (2006) in their review showed that supplementation didn't measure and 2 weeks before aerobic exercise, vegetables and fruits reduce oxidative stress in men and women which act like vitamins C and E supplementation (16).

Besides fruits and vegetables, scientists have been studied antioxidant herbs like saffron, cinnamon and green tea (17). Melissa officinalis (MO) is an herb that has anti-oxidation properties. Rostami et al (2011) investigate the antioxidant effect of Melissa officinalis, vitamin C, and concluded that have a similar effect with vitamin C and suggested that it be named as natural antioxidants (18).

Melissa officinalis is an aromatic plant of the family Lamiaceae, mainly grows in central and southern Europe, North Africa, the Mediterranean and the northern part of the country. This plant is native to the name of Melissa, and was musk odor and is rich in antioxidant compounds. Antioxidant capacity of plant and laboratory is measured by conventional methods (19). And in previous studies the impact of antioxidant nutrients has been investigated on radiology staff (20), of aluminum workers (21) and patients with liver fat (22) and noticeably that there isn't any study on athletes about the effect of water plant. Therefore, the aim of this study was to investigate the effects of downhill running (on treadmill for 30 minutes with an intensity of 65% peak aerobic power and the negative slope of 5/8 grade) and short-term supplementation of MO (5/1 g twice daily as T-Bag and 14 days) on serum creatine kinase (CK) and rate of perceived soreness (pain) on athletic.

Material and Method

This study was approved by the Research Ethics Committee of the University Borojerd and quasi-experimental design was used. The subjects consisted of 20 male athletes who had regular exercise. They were not smokers and didn't have the medical history of cardiac, renal, hepatic, and physical and announced the lack of sensitivity to the blood taking or not stated MO. Subjects then were ready to cooperate voluntarily by filling consent form.

Thus, after introducing the whole subject, objectives and methodology of research ,healthy subjects were selected by taking measurements of age, weight, body mass index, body fat percentage, exercise history and no history of previous injuries due to health questionnaires. The sample size was based on previous studies, was determined for each group in the level of significance (alpha or Type I error) of five percent and one (beta or Type II error) 2/0 Mdkal using software to version 10.0.2.0. In each group 10 patients randomly were replaced into two groups, supplementary training (MO) and placebo.

Before starting the test, the objectives, the details and risks of implementing the activities described for subjects and then they written consent was obtained from them. In this session, participants' height was measured to an accuracy of 1 cm/0 by meter height built which made in Iran. Subjects' body fat was measured by the thickness of subcutaneous fat layer in thoracic, abdominal, and femoral measurements using calipers Lafayette Building America, and by replacing the equations for estimating body fat percentage, which was estimated by Jackson Pollock (23, 24).

Baseline blood samples for the study of the underlying indices was taken from a vein, ten days before the eccentric aerobic exercise in elbow crutch. A second blood sample were measured immediately after the exercise protocol, as well as measure the perception of fatigue and circumference around thigh (Before supplementation). A week before the exercise protocol, the subjects were measured in aerobic and anaerobic power. Also, early circumference around thigh were measured in both groups. Each of the supplement and placebo groups was used

respectively, MO (daily 5/1 mg per kg of body weight, MO) and dextrose (day 5/1 mg per kg of body weight CSP) for 14 days.

After 14 days, subjects protocol run again immediately after that, a third blood sample taken from the subjects also perceived fatigue group and the activity of serum CK. Before each blood sampling, participants were asked to complete the 24-hour dietary recall. In addition, they were asked to avoid taking any medication, smoking, antioxidant supplements and anti-inflammatory supplements such as ibuprofen, ginger during research.

Eccentric exercise. Each of the subjects ran on a treadmill for 30 minutes with an intensity of 65% maximal oxygen consumption and 5/8 - steep grade (15%). Baseline heart rate of each individual after 10 minutes of rest (sitting) were recorded with a stethoscope polar. Also, the maximum heart rate during the exercise test was recorded Bruce treadmill through the display device.

On the other hand to control the exercise intensity of 65% maximum heart rate Karonen method was used. Prior to conducting protocol, for warm-up, subjects performed a 5-minute stretch and then 3 minutes running on a treadmill with no tilt.

After this stage, the treadmill speed and incline to reach target heart rate (65% heart rate reserve) was grown in two minutes. Each participant approached with an intensity of 65% heart rate reserve and 15 percent negative slope ran on a treadmill for 30 minutes. Heart rate, incline and speed up the treadmill exercise test was controlled by the researcher (2).

Measuring thigh circumference (adjusted for inflation). Swelling of the muscles around the hip measurement stages were assessed before and after the exercise protocol. For this purpose, the person was asked to put his right foot on a chair, So that the knee angle is 90 degrees. The same pattern Hart and colleagues (2005) of China to the thigh patellar tape measure and divide the resulting number by two, and was marked with a marker (25) . The distance of four inches from the midline to the four points marked on both sides.

In this case, the person was asked while the body weight on the left leg was thrown, no motility and contractility, hold his foot loose position. At this moment, the five points marked tester tape, measure around hips and thighs mean as far away subjects in the form. In order to increase the reliability of repeated measurements of a single tester and the same method was used to avoid the effect of time on all tests which were performed at the same time of day. When performing multiple tests, the tester had no result of previous tests and participants were also not able to observe information.

Statistical analysis. After calculating data and index of serum and nonserum levels DOMS, the general characteristics of the subjects and the research data in the form of charts and tables using the software EXCEL2007 cross was studied .Then hypothesis (after approval of Normality data: Komologroph Smirnov test results and homogeneity of variances), inferential statistics, repeated ANOVA followed by Bonferroni test was used to compare differences in time-series.

Also, the effect between groups and within groups determined (two-way analysis) and t –test used if there was any significant between-groups 0.05 significance level for all tests has been used by SPSS software under Windows version 17. Also, the rate of effectiveness of each of the independent variables were determined by using eta squared.

Results

The characteristics of subjects are presented in Table 1 and other details are given in Table II, Figure 1 and Figure 2.

Table 1. Mean and standard deviation (SD) of anthropometric and physiological parameters

Indexes under study	Group	Mean	SD
Age (year)	MO	15.70	1.25
	placebo	15.90	1.20
Weight (kg)	MO	61.85	9.103
	placebo	58.10	8.949
Height (cm)	MO	176.10	5.405
	placebo	174.10	5.446
Index of body mass	MO	20.589	2.394
	placebo	20.559	2.308
Fat (%)	MO	11.607	0.247
	placebo	11.711	0.130
Maximum of consumed Oxygen (ml)	MO	50.00	4.761
	placebo	49.80	2.936

Table II. Thigh circumference in both groups before and after supplementation (mean ± SD)

Around thigh size (cm)	Resting	Immediately after activity (before supplementation)	24 h after activity (before supplementation)	Immediately after activity (after supplementation)	24 h after activity (after supplementation)
MO group	46.83±3.21	47.12±3.03†	47.72±3.13†‡	46.62±3.23	47.09±3.05†
Placebo group	46.94±4.11	47.38±3.09†	48.02±3/9†‡	47.26±3/12†*	47.93±2/91†

Represents a significant difference between the group (p<0.05). †: represents a significant difference compared to the base case (p<0.05). ‡: denotes significant difference compared to the active state before supplementation (p <0.05).

Figure 1. Changes in circumference around thigh and during different stages in placebo before supplementation

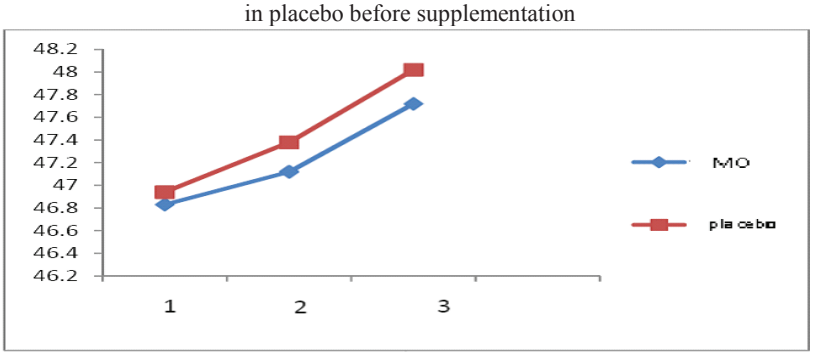
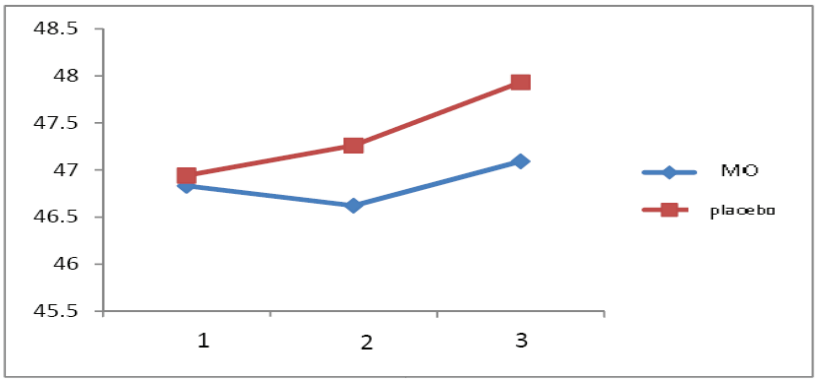


Figure 2. Changes in circumference around thigh in placebo group and MO group stages after supplementation



Circumference around thigh. Analysis of variance circumference around thigh (the measurement of group differences) suggests that it is running downhill also affect the thigh swelling, even without the benefit of complementary activities. However, despite the significant increase after 24 hours of activity, both groups showed, there isn't a significant difference between stage 1 (base case) and 3 (24 h after exercise) (Table III). Both of short-term supplementation of MO and downhill running changes in the environment affect the thigh circumference (Table III). Bonferroni post hoc test results showed that thigh circumference in both groups significantly increased immediately 4 hours after downhill running.

Although, in MO supplementation group from base state to 24 hours after activity, food inflation was not significant. So that the share effect (eta squared) in the placebo group was 747/0, and the complement of MO was 643/0. It should be noted the mean and range of thigh circumference immediately and 24 hours after exercise protocol implementation is more in placebo group than received group MO (Figure 4). Regarding the range of this indicator, it can be say that short-term supplementation prevented significantly relative increased MO thigh circumference in male athletes 24 hours after the downhill running. Although the values of these parameters are not returned within 24 hours to the base case (Table III and Figure 4).

Table III. Mean and standard deviation of anthropometric and physiological

Variables	Groups	Basic rate	After activity (before upplementation)	After activity (after supplementation)
Creatine kinase (U/I)	MO	91.90±10/51	161.88±12.26†	185.78±13.59*†‡
	placebo	90.75±8/22	164.53±8.2†	204.33±9.43†‡
Level of perceived sorensse	MO	------	1.87±1.02	1.11±0.65*‡
	placebo	------	1.89±0.81	1.84±0.76

Table IV. Serum total creatine kinase level in two groups and level of perceived soreness (mean ± SD)

Indexes under study	Group	Mean	SD
Age(year)	MO	15.70	1.25
	placebo	15.90	1.20
Weight(kg)	MO	61.85	9.103
	placebo	58.10	8.949
Height(cm)	MO	176.10	5.405
	placebo	174.10	5.446
Index of body mass	MO	20.589	2.394
	placebo	20.559	2.308
Fat(percent)	MO	11.607	0.247
	placebo	11.711	0.130
Maximum of consumed oxygen	MO	50.00	4.761
	placebo	49.80	2.936

Represents a significant difference between the group (p<0.05). †: represents a significant difference compared to the base case (p<0.05). ‡: denotes significant difference compared to the active state before supplementation (p <0.05).

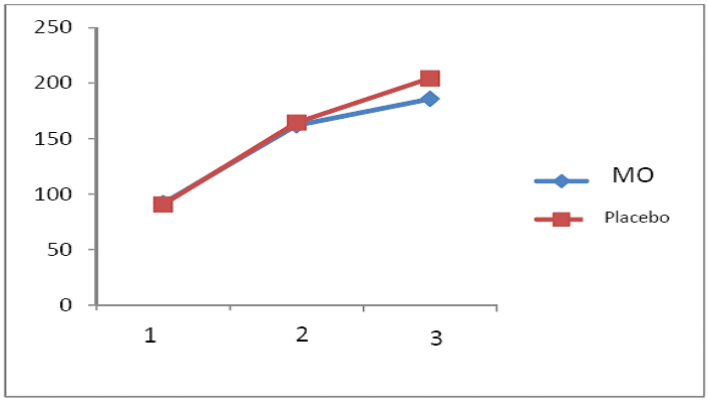


Figure 3. Changes in total serum creatine kinase group and placebo

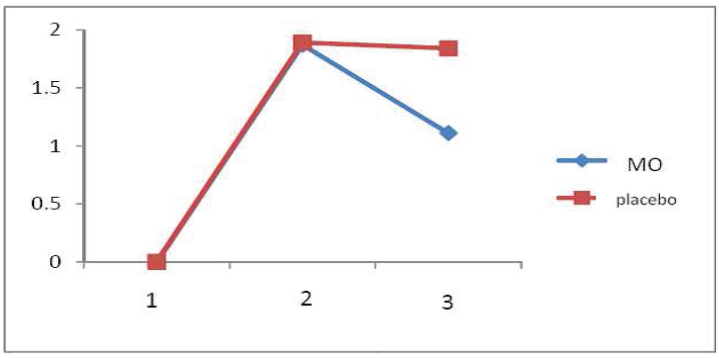


Figure 4. Changes in perceived muscle soreness and placebo group in different stages

Discussion

The results suggest that short-term supplementation of MO and downhill running affect in both the changes in the environment the thigh.

Regarding the range of this indicator,it can be say that short-term supplementation is prevented significantly increased relative MO thigh circumference male athletes 24 hours after downhill running. However, after a significant change in activity was observed in both groups. These findings are consistent with results of Milias et al (2005) (26). Some studies changes in range of motion between 24 to 72 hours after exercise were observed. Rate of inflation, measured as the maximum change in range of motion and thigh circumference was associated with an increase in size (26). Correspondence between these two periods, the researchers suggest, is caused by swelling of connective tissue surrounding muscles, restricting range of motion.

Some experts accepted that muscle injury is responsible for some of the local muscle pain, tenderness and swelling during DOMS (10). According to some researchers, injury and trauma trigger an inflammatory response that results in neutrophils migrate to the damaged tissue and then begins to increase monocytes. To obtain the phagocytic ability of monocytes to macrophages has been changed. Macrophages may also release prostaglandins. Prostaglandins can also cause inflammation of damaged tissue. Possible mechanism of MO in reducing swelling around the hip, preventing pre-inflammatory cytokines as well as prevent the formation of prostaglandins that cause swelling and inflammation (27). As noted in the introduction, Melissa officinalis is an aromatic plant of the family Lamiaceae. Melissa was one of the world's most important medicinal plants due to certain aromatic compounds which found in taste, the pharmaceutical industry, health and functional food is abundant (28).

And because of its content (anti-oxidant, anti-inflammatory, etc) is faster possibly through the prevention and rehabilitation of many of DOMS .As seen in this review MO is a short-term supplementation beneficial effect on cell damage)increased serum creatinekinase (and also, to understand the extent of the bruising and swelling has reduced. Due to the limitations of the study, the researcher was unable to measure creatine kinase levels 24 to 48 hours later.

Therefore, more research is needed to determine the precise effect of MO with different doses and periods when it is necessary. To determine whether supplementation of the plant can cause inflammation and oxidative stress,and reduced the soreness caused by the eccentric exercise.

The study identified factors on inflammation oxidative damage and soreness such as leukocytes, lactate dehydrogenase and necessary malondialdehyde.

The general findings. This was the first study to investigate the efficacy of short-term supplementation on serum creatine kinase and review delayed soreness MO. And the general conclusion is that this herbal supplement can reduce swelling, bruising, elevated serum creatine kinase levels which may affect the perceived soreness. But before any nutritional prescribed athletes to further explore must be performed on the biochemical approach (measurement of enzymes and other inflammatory agents) and running (prevents loss of strength and range of motion).

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The effect of PNF stretching on the hamstring muscles at the speed sprinters

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Abstract. *Introduction*. The aim of this study is the effect of PNF stretching in the hamstring muscles on the speed sprinter young. *Material and Method*. Sixteen healthy young male volunteers were tested between the ages of 14-19, training (TRN, n=8) and control (CTL, n=8). Two separate speed testing days were scheduled 5 days apart. All 16 subjects were timed individually during two, 20-yard dash sprints on day 1 and on day 5. A confidence interval of (P≤05) was established a prior for the independent Student t-test in order to determine significant statistical difference. R*esults* showed that the experimental group improved speed after PNF stretching. *Conclusion.* PNF stretching training program may improve the speed and can be used with other training programs.
Key words: *speed, runner, PNF stretching.*

Introduction

Speed is a function of time and distance. It can be defined as the ability to produce a specific movement very quickly (1). It is one of the necessary components for successful performance in many sports. Speed is a motor skill that can be enhanced with proper training (2). Strength training and exercises such as plyometric are used to increase explosiveness and over all athletic performance (3). In efforts to reduce injury risk in athletes and increase range of motion (ROM), stretching is also applied in and out of season during training programs (4). The present study utilizes the method of proprioceptive neuromuscular facilitation (PNF) stretching to examine the impact of hamstring flexibility on speed in females. Exploring the additional benefits of PNF stretching is also worthwhile because of the prevalence of issues within the body such as pain, instability, and injuries as a whole. PNF stretching is designed to maximize improvements in flexibility which aid in preventing or recovering from these issues. Speed and flexibility pertain to assisting the vast majority of the population regardless of age, gender, or athletic skill level. Speed and flexibility have largely been studied as separate topics of interest. Although numerous literature review were found on PNF stretching, the effect it has on speed in individuals seems to remain inadequately explored. The importance of speed is investigated for various ways to measure it, as well as develop improvement. Some of the different popular hamstring stretching techniques and the benefits yielded by performing them, such as decreased back pain and increased functionality, are discussed. Thus the importance of flexibility for optimal performance is emphasized. According to Darden and Coker (1996), speed is an important focus for coaches when training athletes to respond quickly to external stimuli (3). Most sports require a fast reaction time, such as sprinting, swimming, wrestling, and football. Olmo and Castilla (2005) measured strength in individuals to specifically examine explosiveness in sporting activities. Male and female subjects consisting of 41 high-intensity long-distance runners and 65 high-intensity sprinters were tested by isokinetic knee flexion and extension exercises. Dominant limbs were tested during 3 repetitions at 60°/sec speed and 15 repetitions at 300°/sec. Researchers found that RPI (Relative Power Index) for hamstrings was superior to quads. RPI was also found higher in sprinters versus long-distance runners (5).

The hamstring musculature plays an important role in running, but unfortunately hamstring injuries are common in athletics and have a rather high recurrence rate (6). Sole, Milosavljevic, Sullivan, and Nicholson (2008) explored the hamstring muscle group function through a neuromuscular approach. EMG studies were conducted to specifically examine core muscle patterns during gate analyses. Researchers found that stability loss in joints distal and proximal to the hamstrings (lumbo-pelvic articulations and the knee) increased risk for hamstring injury. Decreased strength and/or flexibility were also explained as a possible cause for hamstring injury. In conclusion, the authors noted that the most significant information regarding the risk of hamstring injury was connected to joint instability surrounding this musculature (7). Maintaining full ROM is an essential part of athletic fitness and sport performance. Consistent stretching is important because flexibility is lost rather quickly with inactivity (4). The different stretching techniques used during rehabilitation are ballistic, static, PNF, myofascial, and neural tissue stretching. PNF exercises are stretching techniques used to increase both passive and active ROM. According to Sharman (2006), PNF stretching is deemed by literature as the most effective means for increasing ROM, particularly active PNF stretching. Contract-relax, hold-relax, and slow reversal-hold-relax are the 3 different types of PNF stretching. These techniques incorporate a combination of isometric or isotonic muscle contractions accompanied by relaxation to improve flexibility (8). PNF exercises exploit inhibitory reflexes in the body to increase relaxation of the muscles which, in turn, permits a greater stretch magnitude. The technique and pattern of these stretching exercises are efficient in how they allow muscles to perform actions similar to the movements found in many sports (9). Contract-relax (CR) were the specific method of PNF stretching used in the present study because of its act in warming up the muscles while increasing ROM. This method is performed first by passive stretching to the point of limitation, and then applying resistance while the individual is instructed to push by contracting throughout the ROM until the original position is assumed (1). Decoster, Scanlon, Horn, and Cleland (2004) conducted a study where a comparison was made between the flexibility effectiveness of standing versus supine hamstring static stretching (10). Additional research on hamstring flexibility was conducted by O'Sullivan, Murray, and Sainsbury (2009). The study was designed to observe short-term effects on hamstring flexibility from warm-up, static, and dynamic stretching on previously injured and uninjured subjects. 18 athletes with specific previous hamstring injuries participated, along with 18 similarly matched volunteers, but without the specific previous injury history, acting as a control group. Flexibility was examined over 2 days with 10 days max between tests, using a goniometer during passive knee extension. Baseline measurements were taken and 15 seconds of rest was required before post-stretching measurements. Results revealed that there were no significant differences between groups. Hamstring flexibility increased after warm-up and static stretching, but decreased after dynamic stretching (11). Kofotolis and Kellis (2006) researched PNF stretching effects on core endurance, functional performance, and flexibility in females suffering from CLBP (chronic low back pain). Eighty-six women were organized according to three random groups consisting of combination of isotonic exercises (COI), rhythmic stabilization training (RST), and control programs. COI is a form of PNF exercise focusing on controlled purposeful movements, where as RST is described as a PNF technique by isometric exercises where the instructor does not break the contraction. For 4 weeks the subjects were trained 5 times a week under their program, working on core stability and strength improvement. Researchers measured lumbar ROM and core muscular endurance before and after training, and 4 and 8 weeks following. Severity of back pain and inability were also recorded. Results revealed significant improvement in muscular endurance (9), function ability, and lumbar mobility, as well as a decrease in subjects' back pain from PNF exercises. Johnson and Johnson (2002) also examined the impact of PNF stretching on the body, specifically for lumbar spinal instability. They explain how every piece of PNF stretching plays a role in the all around development of coordinated trunk and extremity control in the body. This is important information regarding the present study at hand, because of the significant role coordinated trunk and extremity control plays in fast and efficient sprinting. The authors reveal that the PNF approach can be used to enhance mobilization of restricted joints and soft tissues,

train musculature for stabilization, facilitate appropriate firing patterns in muscles, and for training over-all efficiency in functional activity performances (13-15). Therefore, information as to the optimal method for changing stiffness to improve running performance is speculative. Muscular power has been discussed as a critical component of speed, and stretching has been thoroughly explored for its different ways to increase mobility, however the correlation between sprinting and flexibility is still speculative. PNF stretching has demonstrated improvement in increasing joint ROM and control, as well as muscular functionality altogether. These techniques are only helpful in improving performance and would seem, for that reason, to aid in improving running speed, however additional studies must be found to support this hypothesis.

Material and Method

Sixteen healthy young male volunteers were tested between the ages of 15-19. All subjects had previously participated in at least one year athletic field. Informed consent papers were signed by all participants prior to any testing procedures. However, no participants had injuries.

The subjects wore shorts in order to allow full ROM capability and were asked to wear the same shoes during separate testing times to further reduce possible variables.

The 16 volunteers were evenly split up into 2 groups so that a control group (8) and an experimental group (8) were each formed. Two separate speed testing days were scheduled 5 days apart.

All 16 subjects were timed individually during two, 20-yard dash sprints on day 1 and on day 5. The control group of 8 participants was left unattended between the days of timed sprints. The experimental group members underwent 3 consecutive days of PNF hamstring stretching. A standard stopwatch was used during the sprints and each performance. A confidence interval of ($p \leq 05$) was established a prior for the independent Student t-test in order to determine significant statistical differences.

PNF training Protocol. Contract-relax (CR) were the only method of PNF stretching used, performing 2 sets of 10 repetitions with each leg. The subjects assumed a supine position while the instructor assisted in passive hip flexion to stretch the hamstrings to the maximal point. During each set the participants were told to announce when the limit of stretch was reached. The passive stretch was held for 5 seconds and participants were then instructed to contract their hamstrings, pushing against the resistance applied by the instructor until the involved limb reached the floor. Immediately after their leg reached the floor, subjects were told to relax and allow passive hip flexion stretching to be performed again. The participants kept track of repetitions while the instructor articulated when to contract and when to relax during each set.

Results

The following tables display data for each of the 16 subjects' average 20 yard dash times in seconds. Table I shows the results of the experimental group, while Table II displays the control groups' data. The columns of "Time difference" reveal the speed change between the 2 different days of tests. The following tables show results from the two-tailed Student's t-test that was used for hypothesis testing. An independent samples t-test was run for repeated measures. Group I represents the control group, while group 2 represents the experimental group. The II graphs following the tables provide a visual representation for comparison of the different speeds for each subject between day 1 and day 5.

Table I. Group Statistics

Groups	N	Mean	Std. Deviation
TRN	8	0.016	0.087
CTL	8	0.001	0.211

Table II. Experimental Group

Subjects	Day 1 (sec) (average of 2 sprints)	Day 5 (sec) (average of 2 sprints)	Time difference
Subject 1	4:16	4:11	0:05
Subject 2	4:22	4:08	0:14
Subject 3	4:16	3:79	0:37
Subject 4	4:55	4:41	0:14
Subject 5	4:11	4:26	- 0:15
Subject 6	4:38	4:65	- 0:27
Subject 7	4:34	4:44	- 0:10
Subject 8	4:08	4:25	- 0:17

Table III. Control Group

Subjects	Day 1 (sec) (average of 2 sprints)	Day 5 (sec) (average of 2 sprints)	Time difference
Subject 1	4:19	4:13	0:06
Subject 2	4:52	4:36	0:16
Subject 3	4:19	4:08	0:11
Subject 4	4:30	4:28	0:02
Subject 5	4:61	4:66	- 0:05
Subject 6	4:69	4:75	- 0:06
Subject 7	3:97	4:05	- 0:08

Table IV. Analysis of t student tow groups

f	sig	t	df	Sig2 tail	Mean diffrence	Std.error diffrence	lower	upper
7.025	0.019	0.186	14	0.855	0.015	0.080	-0.158	0.188
		0.186	9.305	0.857	0.015	0.080	-0.166	0.196

Discussion

The present research study results demonstrate that statistically significant speed improvement after PNF stretching did not occur. Four out of 8 subjects from the experimental group showed increases in speed after the 3 consecutive days of stretching. However, 4 out of 8 subjects from the control group also showed improvements in speed without the PNF stretching. According to the two-tailed Student's t-test, t value was less than t value. Analysis reveals that there was not a significant difference within the group. Previous literature reviewed during the project did not parallel the study, thus comparing methods and results was not available. Variables such as footwear, days in between tests, testing times, and stretching times remained relatively consistent to eliminate additional variables. However, the limitation of the small sample size, as well as the numerous uncontrolled variables, may have significantly impacted the results, decreasing the reliability of the research study. If the study should be replicated, the following limitations and variables are factors researchers may want to consider. Variables such as the participants' comfort levels, muscle soreness or fatigue from PNF exercises, diet, and rest were not controlled, which may have slightly affected the results. Possible lack of consistent, maximal effort from the subjects is an uncontrollable variable that could have played a major role in the timed outcomes. Perhaps for more reliable results, male and female subjects should have both been selected, and the intensity and frequency of exercise engaged in during the week in between tests should have been monitored. Additionally, the limitation of only 3 days of PNF stretching in between days 1 and 5 of timed sprints may not have been enough to gain reliable and adequate

flexibility. If PNF stretching had been conducted for 3-5 different sessions during 2 or 3 weeks in between tests, significant increase in flexibility may have occurred, with a causal increase in speed. But the most problematic variable seemed to be the timing system during the sprints. Only one instructor ran the stop watch and recorded the information. During 2 different sprinting sessions the stop watch malfunctioned and the subjects had to re-run for a third sprint. Failure to appropriately see when the participants' feet crossed the marker to start the sprint may have caused slightly inaccurate and inconsistent speed times. If the study should be repeated, a more accurate system for timing sprints is advised for collecting more precise data results.

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Study regarding the benefits of using physical exercise in the treatment of non-insulin dependent diabetes

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Abstract. The World Health Organization estimated in 1994 the existence of a total of 12 million diabetics. It signaled an alarming increase in prevalence worldwide, especially for non-insulin dependent diabetes, with a record of 194 million cases in 2003 and estimates a total of 350 million in 2030. This study aims to highlight the benefits of using therapeutic exercise in maintaining or improving the clinical status of patients diagnosed with non-insulin dependent diabetes. *Material and Method*. The study was conducted on a number of 157 patients aged between 40 and 50 years and diagnosed with non-insulin dependent diabetes, balanced by restricted diet and oral hypoglycemic agents. The exercise programs were conducted according to the principles of progressivity and individualization initially showed a moderate intensity which was gradually increased and exhausting or high intensity exercises were avoided. The evaluation of metabolic balance (glycemia, cholesterolemia and triglyceridemia) was done in dynamic and included three tests: initial (T_0), intermediate (after 3 months) (T_1) and final (at 6 months) (T_2). Results. The adaptive modifications occur slowly and respond to the adjustments of the physical exercise. Disturbances of the glucose metabolism associated with the lipid one significantly improve between tests demonstrating not only the installation of adaptive process imposed by a graduated and directed exercise program, but also the correct choice of kinetic means with long-term benefits on patients' lives. *Conclusions*. The association of kinetic means to the classical treatment of diabetes determines an optimal biochemical rebalancing that allows the functional and the psychosomatic adaptation of the body to the effort, which represent a prevention activity in appearance of vascular and neurological complications.
Key words: *diabetes, physical effort, biochemical tests*.

Introduction

Diabetes is considered one of the diseases with mass spreading that raises the outstanding social problems. Patients are hospitalized frequently in the hospital, on average 30-45 days per year, which represents a big financial effort both for the society as well as for the patients, often leading even to retirement, sometimes with the removal of social life at a relatively young age.

The World Health Organization estimated in 1994 the existence of a total of 12 million diabetics. It signaled an alarming increase in prevalence worldwide, especially for non-insulin dependent diabetes, with a record of 194 million cases in 2003 and estimates a total of 350 million in 2030 (1). The treatment of endocrine and metabolic disorders is complex and requires close interdisciplinary collaboration between the physician, physical therapist, psychologist and the social worker.

Physical exercise associated with restrictive diet and drug therapy has beneficial effects on the body and through individualized exercise programs decrease the risk of secondary diseases of diabetic illness (stroke) or related disorders (obesity of sedentary adults) (2).

The main objective of any treatment is to maintain clinical and biochemical parameters as close to normal in order to achieve secondary prevention. (3,4).

In this study, we plan to highlight the benefits of using therapeutic exercise in maintaining or improving the clinical status of patients diagnosed with non-insulin dependent diabetes.

The classic strategy of recommending physical effort depends on the regularity of the performed physical activity, the length of time and intensity of the exercise. Physical effort protocol should be prescribed individually with the main goal to achieve a certain level of training.

Material and Method

The study was initially organized on a number of 159 patients aged between 40 and 50 years and

diagnosed with non-insulin dependent diabetes kept under control by restricted diet and oral agents; they were hospitalized for evaluation of endocrine-metabolic status on an average duration for 5 days. In order to not include in the patients with high-risk this study, the subjects were assessed by: complete physical examination with emphasis on the cardiovascular system, peripheral nervous system and cutaneous modifications, ocular fundus exam; cardiopulmonary radioscopy, abdominal ultrasound, complete laboratory examination of biochemical parameters.

Through this evaluation 2 patients were eliminated from this research, as they had retinopathy and the rest of 157 subjects were grouped in 2 lots (87 women with a mean age of 47 years and 6 months and 70 men with a mean age of 49 years and 2 months). Subjects have given their consent to participate in this physical therapy program.

The kinetic means (physical activity, relaxation and breathing exercises, practicing a sport that pleased the patient) contribute to the improvement of somatic symptoms, giving self-confidence and a good feeling. All these are important conditions for an appropriate family and socio-professional reintegration (5).

Physical exercise programs have been carried out respecting the progressive and individualized principles; initially presents a moderate intensity which was gradually increased and is necessary to avoid the exhausting effort or high intensity. It is recommended that a program aimed at reducing postprandial hyperglycemia and discourages physical activity during the peak action of insulin or after receiving sulfonylurea's drugs. Particular attention should be given to prevention of hypoglycemia during exercise thus it is recommended the ingestion of 10 to 20 grams after of the carbohydrates (particularly in the form of juice). [6].

The program included a complex physical therapy exercises in open or closed kinetic series, with or without aids (kinesiology bands) for a duration of 25-30 minutes, the walking belt and ergometer bike, at intervals of 5-10 minutes with differentiated pauses according to availability of each patient and ended up with relaxation, breathing and recovery exercises (legwork, jogging). It is recommended that patients should continue the aerobic physical activity at home (walks to distances of one kilometer with gradually increasing the distance and duration and reducing rest periods) (7)

The rating of the metabolic balance (glycemia, cholesterol level and triglyceridemia) was done in dynamic and included three tests: initial (T_0), intermediate (after 3 months) (T_1) and final (at 6 months) (T_2). Recorded values have been compared to the literature values. It was considered that the initial testing provided reference data for further testing and to determine the basic programs (structure, association, iteration, dosage) adapted to each patient, therefore allowing them to be carried out and lead to the appearance of a stress factor.

Results

The results obtained from the evaluation of the studied parameters confirm the data from the literature namely, the improvement of metabolic balance by improving the average of glycemic index (according to the correlation index in Figure 1).

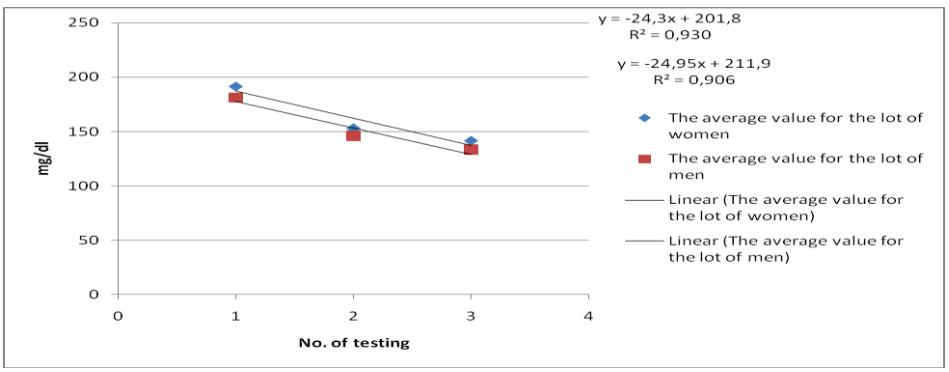

Figure 1. The correlation between the average values of glycemia (initial, intermediate and final test)

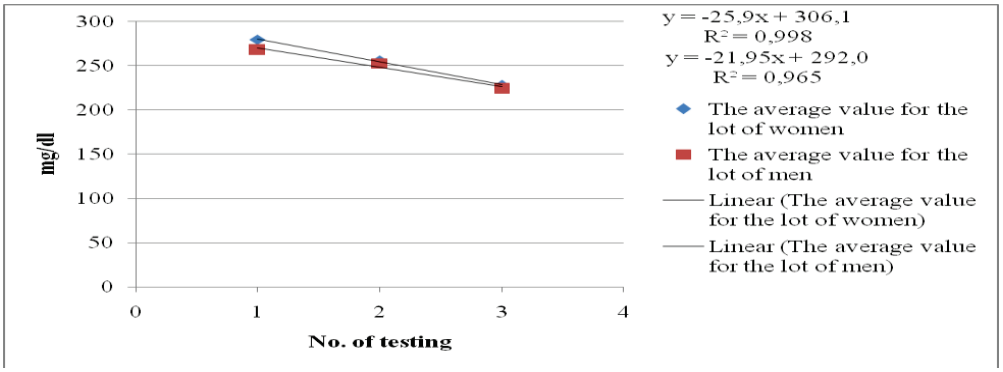

Figure 2. The correlation between the average values of cholesterolemia (initial, intermediate and final test)

The average glycemia values showed a significant decrease in T_1 and T_2 in both groups as follows: for women group T_1 152.8 mg/dl respectively, T_2 141.7 mg/dl compared with T_0 whose average value was 191.6 mg/dl and for men group T_1 showed an average value of 145.6 mg/dl and T_2 of 132.8 mg/dl compared with 181.4 mg/dl average value recorded at initial test (T_0).

Women's cholesterolemia showed an average value (T_0) of 279.6 mg/dl, which decreased significantly to 255.7 mg/dl for T_1 and respectively to 227.8 mg/dl for T_2; the men lot registered an average value (T_0) of 267.7 mg/dl and the intermediate tests (T_1) decreased to 252.9 mg/dl and final (T2) to 223.8 mg /dl (according to the correlation index in figure 2).

Graphical representation of the linear correlation index of the averages of triglyceridemia for each group indicate a moderate decrease at T_1 and a pronounced decrease at T_2 compared with T_0, assumed a control values (Figure 3). Thus, for the women T_1 values averaged 232.5 mg/dl and T_2 of 208.2 mg/dl compared with initial average value of 256.3 mg/dl. For the men, it is showed a lower value in all the evaluations, namely 227.1 mg/dl at T_1 and 203.4 mg/dl at T_2 compared with the initial average of 245.3 mg/dl.

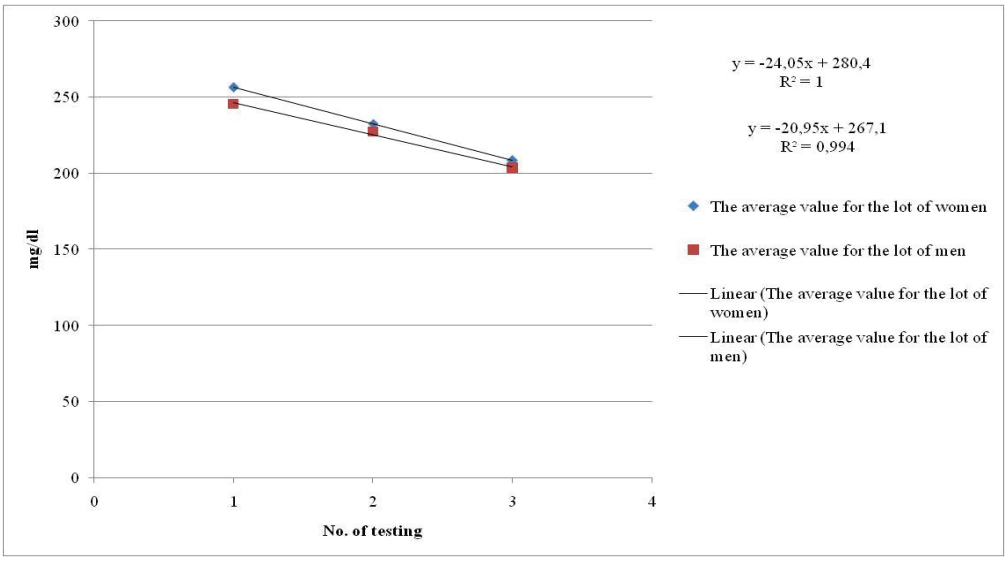

Figure 3. The correlation between the average values of triglyceridemia (initial, intermediate and final test)

The adaptive modifications occur slowly and respond to the adjustments of the physical exercise, both women and men. Disturbances of the glucose metabolism associated with the lipid one improves significantly between tests demonstrating not only the installation of adaptive process imposed by a graduated and directed exercise program, but also the correct choice of kinetic means with long-term benefits on patients' lives.

Conclusions

For patients with non-insulin dependent the association of physical exercise with diet restrictive and drug therapy is a correct option in the complex treatment evidenced by improving of biochemical indicators and by improving "the well-being" state with a positive impact on the social life of the patients.

Diabetics have a low tolerance to the effort due to associated endocrine and metabolic disorders and to physiological phenomena imposed by physical activity. In this context, the individualizing and grading effort is necessary according to the principle of progressivity and the availability of the patient.

The association of kinetic means to the classical treatment of diabetes determines an optimal biochemical rebalancing that allows the functional and the psychosomatic adaptation of the body to the effort, which represent a prevention activity in appearance of vascular and neurological complications.

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The analgesic effect and improvement of motor deficit using a rehabilitation program with high intensity laser included, after operated lumbar disc hernia with paretic radiculopathy

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Abstract. There are plenty of physical agents with are used in physical therapies in different combinations, but they are separated by the proposed objectives and their proved therapeutic effects.The latest research and clinical experiences show also multiplied therapeutic effect using high intensity laser in several pathologies including low-back pain. A study performed on a group of 51 patients from November 2012 to December 2013 after operated lumbar disc hernia with parethic radiculopathy, using a complex rehabilitation program wich included high intensity laser, demonstrates analgesic effect and improvements of motor deficit.
Key words: *low back pain, analgesia, laser therapy, exercise.*

Introduction

Most of the wave lengths of the electromagnetic spectrum are used as physical therapeutic modalities in different types of pathologies, rheumatology, traumatology, neurology, neurosurgery, vascular surgery, oncology etc (1).
For example, the visible spectrum, used in fototherapy (laser therapy) are in the middle of the electromagnetic spectrum, conventionaly. The microwave diathermy and infrared lamp have both,lower wavelenghs then the visible spectrum.In the other hand,the ultraviolet therapy uses a higher wavelengh then the visible spectrum.
The therapeutic physical modalities can be classified depending on various forms of energy: electromagnetic energy (shortwave diathermy, microwave diathermy, infrared lamps, ultraviolet therapy, low frequency electromagnetic field, low power laser, high intensity laser), electrical energy (electrical stimulating currents, biofeed-back, iontophoresis, electrical stiumulating currents, biofeed-back, iontophoresis)
Thermal energy (thermotherapy, cryotherapy), sound energy (ultrasound, extracorporeal shockwave therapy), mechanical energy (intermittent compression, traction, massage, whirlpool therapy) (Figure I) (1).
Some of these therapies has been studied and used for over 60 years. Low frequency electromagnetic field is used for therapy since the IInd World War. The first studies started in 1902 regarding the biological effects of the electromagnetic fields.
In Romania we have studies on it's therapeutically benefits since 1960 with magnetodiaflux, a device that produced low frequency electromagnetic field. It is a noninvasive therapy and the biological effects are mainly influencing the endocrine system, the neurovegetative system, the muscular system and the bone. A combination of different physical agents using different wavelengths are often used in medical rehabilitation. (1- 5).
This study used a peticular combination of physical therapies made from high intensity laser, low frequency electromagnetic field, galvanic bath, electrical stimulating currents, whirlpool bath, kinetotherapy, associated with massage, in this specific succession. The purpose was to measure the terapeuthical effects after operated lumbar disc hernia with paretic radiculopathy.

This motor deficit and low back pain are often a secondary sechelas after lumbar disc hernia surgery, and that affects the functionality of the lumbar column, of the inferior limb (the locomotion function and the balance of the body) and the quality of life.

Finding a more efficient rehabilitation program using new and old noninvasive therapies, is a very important purpose for the improvement of the quality of life of this kind of patients and reducing the disability (2, 3, 6).

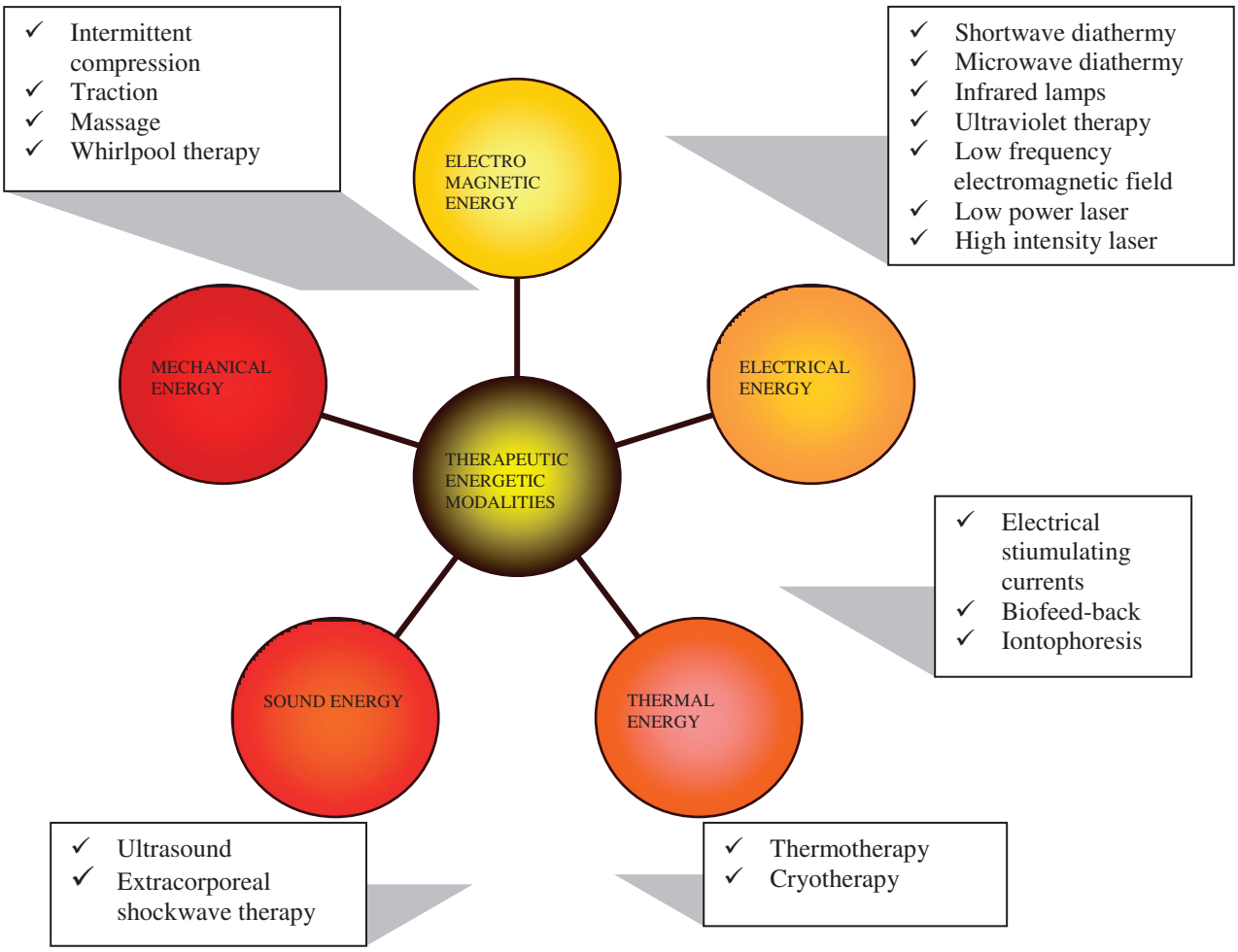

Figure 1. Classification of the physical therapeutic modalities (10, modified)

The high intensity laser therapy is a new noninvasive therapy and the biological effect are mainly influencing the muscular system, the peripheral nervous system, the circulatory system and the conjunctive tissue and the skin. The effects are analgesic, biostimulaton, antiphlogistic, antioedematous, increasing the local circulation and the intracellular activities of many enzimes, improve glucose utilization and oxygen circulation (5-9). The low frequency electromagnetic field is a noninvasive therapy and the biological effects are mainly influencing the nervous system, the muscular system and the bone. The effects are analgetic, anti-inflammatory, balance the free radicals and enzymes, and stimulates tissue repair processes (2-3).

The galvanic bath is used for effects of increasing the nerves and muscles excitability and persistent, superficial and deep vasodilation of the extremity of the limb, associated with water effects (36-36, 5ºC) (2, 3). The electro stimulation with exponential pulses is used for decreasing muscle atrophy (2,3).
The whirpool bath for lower limb has benefits in the improvements of blood supply with the oxygen for muscles, for the improvements of blood circulations, antioedematous and relaxing effect.
In the last two decades, there is little evidence in the medical literature, like placebo double blinded studies to evaluate the physical modalities effects in therapy.

Material and Method

From January to December 2013 we selected 51 patients after operated lumbar hernia associated with parethic radiculopathy, wich was evaluated and treated in the Rehabilitation Departament and Laboratory of Neuromotory Rehabilitation, Colentina Hospital, Bucharest.
1281 patients had been evaluated by our department in this period. Inclusion criteria: age between 20-65 (average age 48) no major organ illnesses, no pregnancy, no menstruation, skin type I, II, III or IV according to Fitzpatrick photo typing scale (skin dark brown and skin black was excluded), a period of minimum 6 weeks month after surgery for lumbar hernia, pain syndrome with the following characteristics: acute, localized to low back, nociceptive type of pain, with paretic radiculopathy (10).
Based on the medical experience the medical team chose a special application for this particular pathology for each therapy. The group of patients followed an individualized medical prescription with 10 sessions of a single application of each therapy per day.
For high intensity laser it was used a ceh devise: BTL-6000 High Intensity Laser, 12w, 1064 nm.
The device has a laser unit, a footswitch control and a handpiece witch is precisely applied on treatment area in two phases, at every session, phase I – Analgesia and phase II - Biostimulation. The localization was at the low back, avoiding the cicatriceal postoperatory area. For the phase I-Analgesia, the application was made by usig continuous circular movements (figure 2).
The device was manual set to the program L-7125 with power 10w, frecqency 25 Hz, dose of 10J/cm^2, wave leight 1064 nm, area to be treated 25 cm^2, for 1min and 40 seconds. After the finish of application, the device was manual set for the phase II-Biostimulation. In that case, the application was made by using continuous movements (figure 3). The device manual settings was to the program L-7126, with power 6 w, dose of 100J/cm^2, wave leight 1064 nm, area to be treated 25 cm^2, for 6 min and 56 seconds.
For low intensity magnetic field, it was used a ceh device, BTL-5000 Magneto therapy, in two simultaneous applications, lumbar and longitudinal on the affected lower limb (Figure 4).

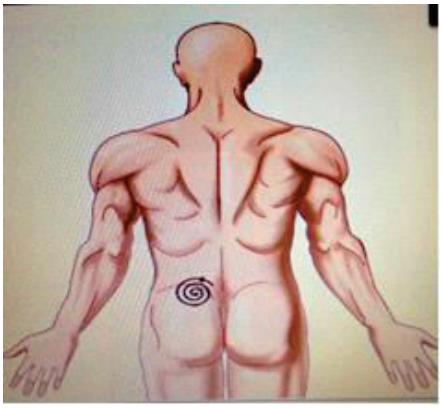

Figure 2. Application of laser therapy In phase I – Analgesia

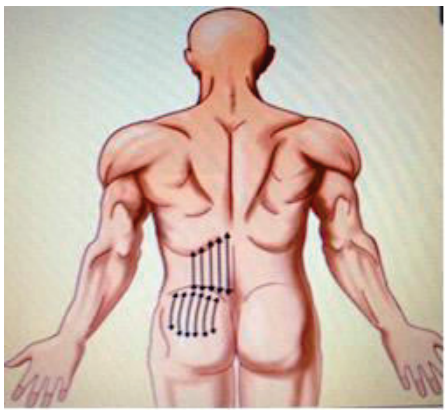

Figure 3. Application of laser therapy in phase II-Bio stimulation

The lumbar application was made with lumbar solenoid, and the device was set to the program called *lumbosacral syndrome* with series of magnetic pulses, rectangular (protracted) pulses, number of period=3, no modulation, the intensity of the magnetic field by 38,0mT/10, for 30 minutes. The longitudinal application on the lower limb was made with four magnets, and the device was set to the program called *nerve paralysis* with series of magnetic pulses, rectangular(protracted) pulses, number of period=16, no modulation, the

intensity of the magnetic field by 261,0mT/10, for 30 minutes .
For galvanic bath it was used a German device (produced by Trautwein) with four cells, ascendant, with progressive intensity until the pleasant tingling sensation, for 30 minutes (Figure 5).
For electro stimulation it was used a ceh devise: BTL-5000 Electrotherapy (produced by BTL), with exponential monofasic pulses,using bipolar technique, located on tibias anterior muscle or triceps sural muscle, in order of type of radiculopathy (Figure 6, eg. on tibias anterior muscle localization). The parameters was individualized using intensity/time curve (2, 3).
The program continues with relaxing and analgesic massage on the lumbar area and tonic massage on affected gamba. The kinethotherapy session consists of program Williams, phase 1 and 2, in progression for increase the lumbar mobility, associated with affected muscle tonisation using strength exercises.
For whirlpool bath, it was used a German device, Trautwein-Hydroxeur Pedi-Jet (produced by Trautwein), for 15 minutes (Figure 7).

Figure 4. Low intensity magnetic field device (produced by BTL)

Figure 5. Galvaniv bath with 4 cells (produced by Trautwein)

Figure 6. Electro stimulation on tibias anterior muscle

Figure 7. Hydroxeur Pedi-Jet (produced by Trautwein)

All the patients had medicamentary treatment with an anti-inflammatory drug (Celecoxibum, produced by Pfizer, in dose of 200 mgx2/day) and a neurotropic drug, Ala-Nerv (produced by GelfipharmaInternational), 18,4 g/day.
We registered a group of parameters that can illustrate the evolution of pain (analgesic effect) and the improvements of the motor deficit at the first patient's evaluation and at the final patient's evaluation after 10 daily session of therapy: the intensity of pain using the Visual Analogical Scale VAS (0=absence, 10=worst pain), the intensity of functional disability using Oswestry Low Back Pain Disability Questionnaire (notification in average obtained after 10 section of questions about how the low back or leg pain is affecting the patients ability to manage in everyday life), for each the deficit in joint range of motion in degrees (ROM), presence/absence of local contracture of the muscle par vertebral of the lumbar column (notification 0=absence, 1=presence, 2=intense), muscle testing for tibias

anterior muscle/triceps sural muscle, measured with manual strength testing (0= visible or noticeable contraction in a specific muscle, 1=when muscle contraction is noted but no movement occurs, 2=when the muscle can contract but cannot move the body part fully against gravity, 3=when the muscle can contract but cannot move the body part fully against gravity, 4=the muscle is able to contract and provide some resistance, 5=this means the muscle is functioning normally and is able to maintain its position even when maximum resistance is applied) (2011), presence/absence of sleep disturbances caused by pain (same notifications as for contracture), change in better way of quality of life (same notifications as for contracture).

Results

After this complex rehabilitation program we obtained the following results in average values as it is show in Table I. The sensation of pain improved in average with 51.38%, but2 patients still had a very little reduction in pain. The range of motion for the lumbar column improved in average with 53.12% and all the patients registered reduction of the deficit. The contracture improved in average with 42.85% and just 3 patiens maintain the same contracture after 10 therapeutic session. The improvement of functional disability with 56.86% is well correlated with sleep disturbances, improved in average with 50%, and with the improvement of the quality of life that is 56.25%, allowing the patient to continue his normal life.

Table I. Results of the rehabilitation program

Parameters	Initial	Final	Improved
VAS	7,2	3,5	51,38 %
ROM	32 º	15 º	53,12%
Contracture	1,4	0,8	42,85%
Muscle strenght	2,1	3,9	41,42%
Sleep Disturb	0,8	0,4	50,00%
Quality of life	1,6	0,7	56,25%
Oswestry Low Back Pain Disability Questionaire	51% Severe disability	22% Moderate disability	56,86 %

VAS - Visual Analogic Scale; ROM- joint range of motion

Discussion

Evaluating the analgetic effect is one of the most difficult task to be proved for a therapeutic effect of physical therapies (9). The studies are using between 3 and 7 parameters beside the VAS to evaluate this effect. We chosed 5 parameters, including the quality of life, the Oswestry Low Back Pain Disability Questionaire (12) and the VAS. For evaluating the functionary deficit we chosed 4 parametres (ROM of lumbar column, contracture par vertebral, muscle strength for tibias anterior muscle /triceps sural muscle and the Oswestry Low Back Pain Disability Questionaire)

Conclusions

The analgesic effect of the complex program wich included the high intensity laser after operated lumbar disc hernia with paretic radiculopathy in daily sessions is demonstrated by the evolution of all registered parameters, including the disability improvement (6).

The significant improvement of the contracture of par vertebral muscles suggested that the mechanism of miorelaxation cannot be only an indirect one, produced by interrupting the vicious circle (pain-contracture-pain), but also can be a direct effect of the muscle fibers biostimulation by the hight intensity laser (5, 8, 13).
The good improvements of both parameters, the quality of life and the disability measured with the Oswestry Low Back Pain Disability Questionnaire, can be explained through the fact that the lumbar analgesic effect is associated with improvements of motor deficit (8, 12).

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