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EDITORIAL
A Foreword from the Editor-in-Chief

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In view of advancement of medical and basic science technology, *Journal of Human Physiology*, focus on innovative methods, novel hypothesis in physiology and patho-physiological aspects in human by publishing original articles, case studies, and comprehensive reviews.

The electronic ISSN (Online) for this journal is 2661-3859. So far, three volumes have been published in this journal in different areas of research such as kidney disease, Systemic Lupus Erythematosus, diabetes, physiotherapy and neurological disorders. Here, we briefly describing the significance of articles published recently in volume 3.

The first article of this volume 3 demonstrated the relationship between polymorphism and SLE (systemic lupus erythematosus) of vitamin D metabolic pathway related Gene. The main aim of this paper was to find the any mutation in vitamin D metabolic pathway genes could lead to SLE. Vitamin D is very important to maintain physiological states of organs in human body. A plethora of studies demonstrated that vitamin D regulates not only calcium and phosphorus related metabolism, but also involve in immune response, humoral and cell cycle regulation. SLE is a specific autoimmune disease that damages tissues and organs and is influenced by many factors including genetics and environment. Among these, the vitamin D an important gene involves in metabolic pathways is key molecule influencing SLE. This review paper highlighted the mechanism of genetic polymorphism of vitamin D in association with SLE development.

The second article of this volume 3 published novel concept of whiplash injuries rehabilitation. Whiplash is a neck injury due to forceful, rapid back-and-forth movement of the neck, like the cracking of a whip. The mechanism underlying whiplash injuries is not yet understood and many hypotheses have been given ranging from biomechanical to neurophysiological, focusing on central sensitization, but major disabilities are strictly related to deregulation of somatosensory function. This manuscript used the data based Head Neutral Reference Point (HNRP), to restore valid somatosensory output from cranio-cervical junction that may be useful in the process of central desensitization and rehabilitation process.

A third article of the volume 3 is all about maintaining the health of professional folk dancers in conditions of physical recreation. The health issues related to folk dancer have not been addressed till date. This study is based on sociological survey of the artists of the folk dance ensemble “Joc” following parameters such as eating style, rest regime, physical and mental state, the attitude of respondents to physical activity in fitness clubs, readiness to

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engage in physical recreation to improve their condition, prevent diseases and fitness programs.

The fourth article was published as regular exercise improved the diabetes condition of type II diabetes mellitus elderly patients. The purpose of this study was to assess the aerobics and walking exercise to improve the illness condition of elderly patients suffering with type II diabetes. The outcome suggested that old aerobics and rope skipping could be very effective in improving the clinical symptoms of diabetic patients.

This journal will continue to publish the articles based on novel theme in diverse areas related to human, which could draw attention from wide range of researchers working in the field of human biology.

I would like to thank all readers for their consistent support, and also will welcome you all to publish the latest breakthrough in human research.

Sanjay Kumar, PhD
Editor in Chief
Journal of Human Physiology
ARTICLE

Research Progress on the Relationship between Polymorphism and SLE of Vitamin D Metabolic Pathway Related Gene

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ABSTRACT

Vitamin D is a class of hormones necessary to maintain normal physiological activities of the body. A large number of studies have shown that vitamin D, as a fat-soluble vitamin, is not only related to calcium and phosphorus metabolism, but also closely related to immune regulation, humoral regulation, cell cycle and so on. Systemic Lupus erythema-Tosus (SLE) is a specific autoimmune diffuse connective tissue disease that causes tissue and organ damage under the joint action of multiple factors such as environment and heredity. Among many factors, the vitamin D metabolism pathway gene is particularly important for its influence. Some literature has shown that the genetic polymorphism of vitamin D metabolic pathway genes is correlated with SLE. Therefore, by referring to relevant literature, this paper summarized the progress in the research on the mechanism of genetic polymorphism of vitamin metabolism pathway genes and the development of SLE.

1. Introduction

Recent studies have shown that serum vitamin D deficiency in patients with SLE\(^1\). Gao et al. conducted a study on the relationship between vitamin D and SLE and found that 62.81% of the patients had vitamin D deficiency and 34.71% had severe vitamin D deficiency, indicating that vitamin D deficiency would significantly increase the incidence of SLE\(^1\). Some animal experiments have also shown that moderate vitamin D can reduce the levels of urine protein, impaired joint function and reduce the damage of renal function in lupus rats\(^4\). In the study of genetic level, Luo Xiongyan, Liu Junlin et al. further studied the genetic polymorphism of vitamin D metabolic pathway genes and SLE\(^4\)-\(^5\). In foreign literature, Ozaki, Huang et al also studied the correlation\(^6\)-\(^7\). In this paper, we review the research progress on the genetic polymorphism of vitamin D metabolic pathway related to the pathogenesis and development of SLE.

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2. Research Progress of Systemic Lupus Erythematosus (SLE)

2.1 Pathogenesis

Systemic lupus erythematosus (SLE) is an autoimmune disease that often affects women of childbearing age [8], with a high incidence, multiple system, multiple organs involved, repeated attacks and other characteristics [9-10]. At present, its pathogenesis is not fully understood, mainly including the formation of immune complex which is involved in multiple organ damage, the production of autoantibodies, the over-activation of T cells and B cells and other abnormal regulation of the immune system [11-13].

2.2 Clinical Manifestations

The clinical symptoms of SLE are more complex, mainly including respiratory system damage, kidney damage symptoms, fever, facial erythema, joint pain and so on. In mild cases, only arthralgia or facial rashes are present, while in severe cases, early life-threatening severe thrombocytopenia, neuropsychiatric lupus, progressive lupus nephritis, and alveolar bleeding occur [10,14].

2.3 Common Treatment Methods

The drugs for clinical treatment of SLE mainly include hormones and immunosuppressants, which are known as Stand of Care (SOC). Glucocorticoids are often used in combination with prednisone and metasone. In the acute stage of the onset of SLE, a large amount of glucocorticoids may pull the patient back from the line of life or death, but adverse reactions may occur [15].

3. Single Nucleotide Polymorphism and SNP Detection Techniques

Single nucleotide polymorphism (SNP) refers to the transformation, transposition, insertion and deletion of a specific nucleotide position in the DNA of the genome, and the frequency of at least one allele in the population is not less than 1%. Although the genetic code consists of four bases, an SNP is usually just a biallelic, or dimorphic genetic variation, in which two different bases are present at that location. If the four bases mutate randomly, the transversions in the SNP should be twice as much as the transversions, but the chance of four bases mutating is not equal. In fact, the conversion accounts for a higher proportion in the SNP. Through the application of sequencing and gene mutation research technology, a large number of SNPs have been obtained, and a common database has been established. The development of efficient SNP analysis techniques has expanded the scope of the study from a small number of variants associated with a particular disease to genetic markers corresponding to multiple variation types within multiple genes. SNP analysis techniques are mainly divided into two categories according to their research objects, namely: (1) analysis of unknown SNPs, that is, finding unknown SNPs or determining the relationship between an unknown SNP and a genetic disease; (2) Analysis of known SNPs, i.e. detection of genetic diversity of SNPs in different populations or genetic diagnosis of genetic diseases with known pathogenic genes in clinical practice. In practical application, many methods for detecting unknown SNPs can also be used to detect known SNPs, and methods for detecting known SNPs can also be used to screen unknown SNPs, and then sequencing method can be used to determine the types and locations of SNP mutations after screening. The following introduction of SNP analysis commonly used method, in addition to the mutation mismatch amplification test (MAMA), SNPshotTM GeneScan and allele specific oligonucleotide fragment analysis (ASO) can only detect known mutations, other methods can be used in the analysis of two kinds of SNP detection, the experimenter can according to their own needs and choose to suit the condition of the experiment equipment, simple and efficient, economy or mass detection method [16].

4. Research Progress on Vitamin D Metabolic Pathway

VD occurs in a variety of forms in the body, including 25-hydroxyvitamin D (25-(OH)D) and 1, 25-dihydroxyvitamin D (1,25-(OH)2D) [17]. 25-(OH)D is the active form of VD, and VD is considered to be the most representative biomarker of the overall level of VD in human body [18]; After that, it is formed by hydroxylating 1-α-hydroxylase encoded by CYP27B1 gene in the kidney [19]. 1, 25 - (OH)2D is the active form of VD,1,25-(OH)2D forms 1,24,25-(OH)3 under the action of 24 hydroxylase encoded by CYP24A1 gene in liver, and 25-hydroxylase encoded by CYP24A1 gene is considered to be the most representative biomarker of the overall level of VD in human body [18].

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abnormal expression of vitamin D metabolic pathway genes may affect the level of vitamin D, thus affecting the play of biological efficacy [21].

5. Vitamin D Metabolic Pathway Gene Polymorphism and SLE

5.1 CYP2R1 Gene Polymorphism and SLE

CYP2R1 gene is located in human chromosome 11 P15.2, with a span of 15.5 KB and 5 exons [22]. CYP2R1 gene encodes the 25-hydroxylase of vitamin D (CYP2R1), which is present in the liver microsomal cytochrome P450. It is a member of the 2 subfamilies of the P450 family and is composed of 501 amino acids [23]. The main role of CYP2R1 is the 25-position hydroxylation of vitamin D in the liver to produce 25-hydroxyvitamin D(25-(0H)D), which is the main product of the vitamin D metabolic cycle. Genome-wide Association Studies (GWAS) determined that CYP2R1 SNPs were associated with vitamin D levels, and some previous studies also showed a significant association between CYP2R1 variants and 25-(0H)D levels [24-25]. It was also confirmed by Wang et al. that both CYP2R1 and CYP27A1 played a role in the 25-hydroxylation of vitamin D [24], but CYP2R gene plays a dominant role, and CYP27A1 is a secondary factor in the synthesis of 25-(0H)D.

A large number of studies have shown that single nucleotide polymorphisms of CYP2R1 are significantly associated with many diseases. The occurrence of atypical vitamin D deficiency rickets was related to the mutation of CYP2R1 gene. Xu et al. found that CYP2R1 locus rs10766197 was significantly correlated with low serum vitamin D content in Uyghur population [26]. Wang et al. confirmed through comparative studies that CYP2R1 locus rs10766197 was significantly correlated with serum 25-(0H)D level in patients with type II diabetes [27]. At the same time, CYP2R1 gene polymorphism was found to be significantly associated with the susceptibility to type I diabetes, and the low expression of CYP2R1 may be associated with the decreased 25-(0H)D concentration in blood of patients with type I diabetes. The CYP2R1-induced product 25-(0H)D is associated with susceptibility to a variety of cancers, including pancreatic cancer and breast cancer. Sheng et al. found that the high expression of CYP2R1 gene was significantly correlated with the relapse-free survival rate of breast cancer through a large number of studies and analyses [28]. The loci rs10741657, rs2060793 and rs12794714 in CYP2R1 gene are associated with 20% to 30% susceptibility to pancreatic cancer. In GWAS, these SNPs of CYP2R1 were significantly correlated with 25-(0H)D levels.

In addition to being associated with these diseases, a large number of loci of the CYP2R1 gene also indicate an association with 25-(0H)D levels. 25-(0H)D is the main form of vitamin D in the blood. At present, the level of vitamin D in the body is mainly measured by detecting serum 225-(0H)D in clinical practice [29]. Studies have shown that there are widespread problems of insufficient or deficient serum 25-(0H)D levels in patients with SLE [30]. Squance et al. found that the serum level of 25-(0H)D in SLE patients was significantly lower than that in normal healthy people by comparing the serum of 80 patients with SLE and 41 healthy people with normal physical examination [31]. Serum 25-(0H)D level plays an important role in the pathogenesis of SLE, and is related to the pathogenesis of SLE, and can be used as a clinical indicator to judge the severity of SLE disease [36]. Studies have found that low 25-(0H)D level in patients with SLE is associated with high activation of B cells and high expression of IFN-α signal, as well as high anti-dsDNA and immunoglobulin levels [32]. This finding provides evidence that low 25-(0H)D levels may trigger the production of autoantibodies, thereby increasing an individual’s risk of developing autoimmune diseases. On this basis, it can be concluded that CYP2R1 gene further affects SLE by affecting the liver 25 hydroxylation of vitamin D in the vitamin D metabolic pathway, thereby affecting the blood 25-(0H)D level.

5.2 VDBP Gene Polymorphism and SLE

Vitamin D Binding Protein (VDBP) is encoded by the VDBP gene. VDBP is a plasma Protein that can play a variety of roles and is synthesized in a variety of tissues in the body, but mainly in the liver. It was successfully isolated in 1959 and was originally called group-specific component-Gc globulin because of its immunological characteristics [33]. Later, Gc protein and VDBP were found to be the same protein through multiple studies [34]. Genes encoding VDBP GC locates to the long arm of chromosome 4 q11 - q12, at present there are more than 2000 SNPS are found the gene, VDBP with vitamin D has a close connection between VDBP in maintaining serum vitamin D levels, adjust the bioavailability of vitamin D, vitamin D activity and end the response to vitamin D plays and important role [35]. Among them, VDBP plays a very important role in vitamin D pinocytosis, and its gene polymorphism will affect vitamin D level and activity [36]. In addition, studies have shown that VDBP also plays a very important role in the vitamin D metabolic pathway, and its polymorphism is related to the immune response and the ability to bind vitamin D and its derivatives.

There are many studies on the association between sin-
gle nucleotide polymorphism of VDBP gene and disease at home and abroad [37]. VDBP is associated with lung disease, liver disease, obesity, bone tissue disease, diabetes and many other diseases [38-40]. At present, domestic and foreign studies on VDBP encoding genes mostly focus on rs2282679(A/C), rs45889(C/A) and rs7041(T/G), and studies have found that rs2282679(A/C) polymorphism is correlated with vitamin D level [41-43] and SNP rs2282679 is associated with bone metabolic diseases, obesity, heart and lung diseases, etc [38]. Regulla et al. found that VDBP gene polymorphism was correlated with Graves’ disease [44]. Wang Gaoshuai et al. found that the SNP locus rs7041 of VDBP was closely related to obesity [45]. However, at present, the role of VDBP gene polymorphism in the pathogenesis of SLE is still unclear, and there are no large-scale clinical studies and reports on the association between SLE patients and VDBP gene polymorphism, so it still needs to be verified by subsequent experiments.

5.3 CYP27B1 Gene Polymorphism and SLE

CYP27B1 gene is the encoding gene of 1-α-hydroxylase, which exists on the long arm of human chromosome 12 (12q13.1-q13.3). It consists of 9 exons and 8 introns, and is a single-copy gene. Its full length cDNA is 4.8 KB, encoding 508 amino acid polypeptide [46-47], a member of the P450 family of enzymes, encodes 1-α-hydroxylase.

α-hydroxylase catalyzes 25-(OH)D to form 1,25-(OH)2D, a rate-limiting enzyme of D whose main function is to catalyze the hydroxylation and activation of 25-(OH)D in the proximal convoluted tubules and rectus and convert it to its active form 1,25-(OH)2D [48-50]. Panda and Zhang Zengli et al. found that the changes of 1-α-hydroxylase activity were correlated with 1,25-(OH) in plasma and local area. 2D levels were associated with immune system dysfunction, and no active vitamin D was found in animals targeted with the CYP27B1 gene [51-53]. Multiple literature reports, 1,25-(OH)2D has a direct effect on both T and B cells, not only promoting the production of various inflammatory cytokines, but also inducing regulatory T cells to participate in a “off” inflammatory response. On this basis, some studies show that D is mainly involved in SLE by increasing the number of regulatory T cells and producing anti-proliferation effects. Therefore, it can be concluded that CYP27B1 single nucleotide polymorphism is closely related to the occurrence and development of SLE.

5.4 Calcium-phosphorus Regulation of Vitamin D in SLE

Coexistence of vitamin D and vitamin A in cod liver oil, animal tissues and within the human body skin contains cholesterol, A precursor of vitamin D 3 - dehydrogenation after sunlight into vitamin D, vitamin D with biological activity of 1, 25 - (OH) 2 D3 form play A role, the calcium, phosphorus, and children’s bone growth has very important meaning. Studies have reported that the level of 1,25- (OH) 2D3 is positively correlated with bone mineral density in patients with SLE, and the incidence of SLE combined with osteoporosis is 1.4% ~ 68% [54-56], the larger span was due to differences in genetic background, ethnicity, age, and disease activity, and postmenopausal women were at higher risk for lumbar osteoporosis. Children with SLE are also at a higher risk of developing osteoporosis, considering that long-term use of hormones may affect the growth of their normal peak bone mass [57]. The causes of osteoporosis in SLE are very complex, including disease factors, drug influencing factors (glucocorticoid) and renal damage, etc., and defective osteogenic differentiation of mesenchymal stem cells in SLE may also lead to osteoporosis [58-59]. 1,25-(OH) 2D3 can regulate calcium and phosphorus levels in patients with SLE through binding with vitamin D receptor (VDR), maintain mineral stability, thus promoting bone metabolism and bone transformation, and reducing the occurrence of osteoporosis in patients with SLE. Vitamin D can also regulate osteoblasts and osteoclasts.

5.5 VDR Gene Polymorphism and SLE

VDR is a nuclear receptor of 50 kDa, belonging to the second class of the steroid receptor family, similar to retinoic acid receptor and thyrotropin [60]. 1, 25 - (OH) 2D binds to the nuclear VDR genome and determines genomic responses by regulating the transcription of certain genes [61]. VDR is synthesized by a gene located at position 12q13.1 on chromosome 12, known as VDR gene [57]. The gene is basically composed of 9 exons distributed in the 5’ promoter and the 3’ regulatory region. In the latter region, a long 3 ‘untranslated region, known as the 3’ untranslated region, is involved in the regulation of gene expression, in particular by regulating the stability of messenger RNA. VDR gene showed some polymorphisms in the promoter region between exons 2 and 9 in the 3’ translation region, especially in the promoter region around exons 1, F and C [61]. Polymorphism BSMI located in intron 8 and adenine - guanine replacement results (A-G) [62]. Apai and Taqi polymorphisms were distributed in this region of the 3’ gene. Polymorphic APAI is defined as thymine substitution (T-G) in intron 8, while polymorphic TAQI is defined as cytosine-thymine substitution (C-T), resulting in codon exchange (ATC→ATT), but maintaining the same isoleucine amino acid [63]. Functional correlations of these polymorphisms were associated
Foki polymorphism is caused by the substitution of cytosine-thymine (C-T) at the junction of intron 1 and exon 2, resulting in an additional start codon (ACG→ATG), three codons close to the transcription start site. This polymorphism can be considered as an independent genetic marker because it does not appear to be in linkage imbalance with other VDR gene polymorphisms. An occurrence variant of Foki, defined as a mutation in F (Atg codon) resulting in complete production of VDR protein (427 amino acids) [65], and the mutation Foki, defined as F (codon GCA), starts translating at a different site to produce a slightly shorter VDR protein containing three fewer amino acids (424 amino acids). In vitro studies have shown that short proteins seem to have higher transcriptional activity than long proteins [66]. This may increase the function of VDR and thus alter the role of vitamin D in different cells and tissues. The effect of Foki polymorphism on the transcriptional activity of immunospecific transcription factors in lymphocyte proliferation and immunocell protein synthesis suggests that Foki polymorphism is involved in immune regulation and immunoregulatory polymorphism [67].

In vitamin D transport and metabolism pathway, the SNP of VDR gene is associated with the susceptibility to severe respiratory syncytial virus infection, tuberculosis, asthma, systemic lupus erythematosus, colorectal tumor, melanoma, periodontitis, renal cell tumor, gout, multiple sclerosis, AIDS, Parkinson's disease and other diseases [66-70]. A large number of researchers have conducted experiments on the relationship between BSmi polymorphism of VDR gene and SLE. In 2000, a study of 58 Japanese patients with SLE demonstrated a higher incidence of B/B genotypes compared with healthy controls (15.5 vs. 5.7%,p<0.0001). In addition, a higher frequency of genotype B/B was found in nephrotic syndrome (61.5% vs. 35.7%,p<0.0034) in nephrotic patients [67]. In 2002, Chinese authors studied 47 patients with systemic lupus erythematosus and 90 healthy controls and found a higher B allele frequency in patients with systemic lupus erythematosus (39.4% vs. 8.3%,OR=0.74, P <0.0001) [71]. A study of 101 Thai and 60 Iranian patients in 2006 and 2010, respectively, found no association between BSmi polymorphisms and SLE or clinical and laboratory manifestations of the disease. In 2002, a study assessed FOKI polymorphisms in 52 patients with SLE and 90 healthy controls and found no significant differences in allele and genotype frequencies [72]. In 2010, a meta-analysis was published that found no significant Foki polymorphism. However, due to the small number of studies included, these results should be interpreted with caution, and they apply only to European and Asian ethnic groups [73].

6. Conclusions

At present, a large number of studies have explored the relationship between vitamin D deficiency and the occurrence and development of SLE disease, but most of the studies on its mechanism remain at the cellular level, and a few involve genetic level. However, with the deepening of the research on SLE, it is not difficult to find that genetic polymorphism of genes plays a non-negligible role in the occurrence and development of SLE. As an important pathway of vitamin D production, vitamin D metabolic pathway has a direct impact on vitamin D level, which further affects the occurrence and development of some diseases, especially autoimmune diseases (such as SLE). To sum up, in view of the vitamin D in SLE properties of calcium phosphate, immunity adjustment, system and SLE and VDR gene polymorphism, the correlation of atherosclerosis, improve the level of 1, 25 -(OH) 2 d3 to improve SLE patients with osteoporosis, disease activity, atherosclerosis, cardiovascular disease and clinical symptoms may play a role, but the kinds of vitamin D supplements, dose and treatment remains to be more large-scale clinical trials research further defined. It remains to be further investigated whether vitamin D and VDR can reduce or even replace hormone and immunosuppressive therapy, and whether adequate vitamin D supplementation can prevent the occurrence of SLE [74].
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ARTICLE

New Concept of Whiplash Injuries Rehabilitation

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ABSTRACT

Whiplash injuries are a global health problem and a significant financial burden for both health care systems, and insurance providers. The diverse symptomatology after whiplash injury both in the somatic, emotional and behavioral sphere prompted separation of the Whiplash Associated Disorders (WAD) as a separate category of diseases. The exact mechanism of whiplash injury is still under debate and theories explaining pathogenesis of WAD are very diverse ranging from purely biomechanical to neurophysiological, emphasizing central sensitization but the core disability seems to be strictly connected to somatosensory dysfunction. As a result, the optimal algorithm of rehabilitation has not been established and data published in the current literature on effectiveness of such algorithms are inconsistent. Based on the presented here of Head Neutral Reference Point (HNRP), the objective of central desensitization is to restore valid somatosensory output from Cranio - cervical Junction (CCJ). This new concept of rehabilitation after whiplash presented here is based on clinical observations and is supported by initial results.

1. Introduction

The term “whiplash” was used for the first time by Har- old Crowe in 1928, during the San Francisco Orthopaedic Congress when he presented eight cases of cervical injury resulting from traffic accidents [1].

Dynamic technological development and increase of road traffic, resulted in tremendous increase in numbers of vehicle collisions, which became a huge socio-medical problem. The most recent report of the US National Highway Traffic Safety Administration published in 2010 shows 3.9 million traffic injuries with damages to 24 million vehicles in the US in that year. The total, direct economic costs associated with these accidents were astronomic and reached $242 billion. Together with the indirect costs, like long-term disability, legal costs, rehabilitation costs, etc., total costs of these accidents reached a staggering $836 billion. By comparison, the costs of direct, immediate medical treatments of all victims of car accidents, excluding fatal accidents, in 2010 were estimated at $23.4 [2,3].

In the USA whiplash injuries account for around 83% of all traffic injuries, resulting in a total yearly incidence of between 235 - 300 / 100,000. The total cost of treating only whiplash injuries including medical care, disability, sickness absence is estimated at 3.9 billion USD annually, while including procedural and compensation costs up to 29 billion USD, due to their extent, complex symptomatology hindering treatment and a tendency to leave the long-term effects of injury are a significant socio-medical

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Due to wide variety of symptoms presented by the whiplash victims, a working group, called The Québec Task Force introduced in 1995 the term “Whiplash Associated Disorders” (WAD) to describe a set of somatic, emotional and behavioral symptoms resulting from a cervical spine injury during road collision [1].

The onset of symptoms may be delayed up to 12-15 hours. The most common complaints are similar regardless of the time of the onset and include: neck pain, often also in the thoracic and even in the lumbar region, upper limb paraesthesia, headache, dizziness and other balance disorders, visual disturbance (double vision, accommodation disorder), auditory sensation (tinnitus), swallowing disorder, hoarseness, nausea, vomiting, and impaired concentration. Usually a physical examination reveals “only” limitation of the range of motion in the cervical segment, raised muscle tone, numerous tender points. Much less often neurological deficits are detected, and almost always nothing more than diminished cervical lordosis in radiological findings is registered.

The mechanism of the injury is much more complicated than the flexion - extension as the term “whiplash” would suggest. Many theories attempted to define the pathophysiology of the WAD, among them purely biomechanical (injury of the anterior ligament complex and facet joint compression), hydrodynamic (displacement of the cerebrospinal fluid) and neurophysiological (central sensitisation) ones, but none is regarded to adequately describe the pathophysiology of the WAD [5,6,7].

Despite many attempts to develop an optimal algorithm for rehabilitation and in-depth analyses indicating progressive muscle disorders suggesting that activation of deep cervical muscles should be a part of the rehabilitation process, there is still lack of consensus on the optimal rehabilitation approach to whiplash injuries. This is evidenced by conclusion of the Cochrane meta-analysis prepared by Verhagen et al. regarding treatment of whiplash injuries, where it was enigmatically stated: “the trend is observed, that active therapy probably has an advantage over passive management, but none of the methods has a clear advantage over another” [9].

Indeed, it has not been shown that any of the methods proposed thus far have definitely better outcome. The new concept attempts to link the pathomechanics and really bothersome symptomatology of whiplash injury with the post-traumatic loss of the sense of the Head Neutral Reference Point (HNRP). The HNRP is not the same as Head Neck Center of Gravity (HNCG) described in details by Dempster (1955) as “the point located 8 mm anterior to the basion on the inferior surface of the base of occipit or within the bone 24±5 mm from the crest of the dorsum sellae. On the surface of the head a point is located 10 mm anterior to the supratragic notch above the head of the mandible is directly lateral” [9].

The HNRP has a much broader, functional meaning and describes position of the head which, apart from visual and vestibular control, the somatosensory system allows keeping with minimal effort. The cornerstone of this somatosensory system are mechanoreceptors, located mostly in the muscle spindles, which provide the nervous system with information about the muscle’s length and velocity of contraction, thus contributing to the individual’s ability to discern joint movement and a sense of head’s position. There is strong evidence that impairment of this system leads to a chronic neck pain, postural sway, poor position sense and dizziness [10].

Human muscle spindles in the suboccipital area are extremely rich in mechanoreceptors, (part of Cranio-cervical Junction, CCJ) but these mechanoreceptors are also found in ligaments, joint capsules, fascia and even in dura where, besides conveying purely mechanical information, they may regulate cranial blood vessels, as it was shown in animal studies [11,12].

It is widely accepted that mechanoreceptor impulses from the occiput to C3 have a direct impact on vestibular nuclear complex (VNC) - a reflex centre that coordinates vision and neck movements. This same mechanoreceptor input also converges on the central cervical nucleus (CCN), which is a pathway to the cerebellum integrating vestibular, ocular and proprioceptive information. Simplistically speaking, the mechanoreceptor input from the upper cervical region helps to coordinate vision, balance, movement of the neck and postural control. Disruption of normal afferent/ efferent stream after whiplash injuries produce more harm to the upper cervical region than to the lower one, because the upper region contains more muscle spindles and has more complicated connections to the visual and vestibular systems, and receives feedback from it. Malmström et al. have shown how powerful is mechanoreceptor system of the CCJ because even subjects with bilateral vestibulopathy did not differ significantly from controls in their ability to reproduce different target positions [13].

Thus, the mechanoreceptor system of upper cervical spine can be viewed as independent Head Position Control System (HPCS). Through afferent pathways it relays to the central nervous system the least necessary afferent stimulation, and with minimal energy expenditure of well-balanced muscles the head is kept around HNRP. In clinical practice, achieving the correction of the habitual defective malposition of the head enables the patient to
breathe freely and swallow without pain and any effort.

The HNRP pattern is defined by 2 lines:

1) a vertical line passes through the center of the sternal jugular notch, the center of the chin (gnation), nasion and the center of the glabella;

2) an horizontal line passes from the nasal chondro-osseous junction to the supratragic notch.

The malalignment of these lines from the vertical reference line in the frontal plane (usually in the side-bending and rotation direction) and from the horizontal reference line in the sagittal plane (usually in the extension direction) is a measure of true HPCS dysfunction.

The loss of HNRP after whiplash injury results not only in defective stimulation from position receptors to muscles which produce abnormal head position, but can be responsible for disturbance of brain perfusion and “dark cloud” of behavioral symptoms (catastrophic attitude, kinesiophobia, dysphoric mood) which jeopardise rehabilitation results. Restoring of HNRP may be of fundamental importance for the rehabilitation process.

2. Methodology

Successful evaluation of the patient begins as usual with a detailed history-taking process. Subjects with a loss of HNRP report typical symptoms of dizziness, tinnitus, visual disturbances (diplopia, accommodation disorders), impaired vocal function due to irritation of laryngeal recurrent nerve (muscle imbalance results elevated hyoid bone and narrowed passage conflicting the nerve), dysphagia, hoarseness, nausea, impaired concentration and nonradicular pattern paraesthesia.

Inspection indicates significant malalignment of vertical and horizontal line from reference lines mentioned above. (Figure 1 & 2)

Figure 1. Frontal view with malalignment of vertical line in side bending.

Figure 2. Lateral view with malalignment of horizontal line in extension pattern

Soft tissue palpation reveals muscle tone disbalance - raised tone of suboccipital mm. (SOM), sternocleidomas-toid m. (SCM) and suprahypoid mm. (SHM) with hypoactive longus colli m. and longus capitis m. (LCoM, LCaM).

Then follows analysis of CCJ mobility and ligaments integrity.

Test for alar ligaments - during passive rotation of the head (e.g. to the left) countermovement of C2 spinus process can be felt by the thumb placed on its right aspect - if no consecutive movement of C2 spinal process during the first 15 deg. of rotation occurs it may indicate alar ligaments injury.

Sharp purser test - passive compression of C2 spinous process with a thumb with consecutive resisted short active flexion of the upper cervical spine, when “click” or loss of support under the thumb is felt the transverse liga-ment of C1 may be compromised.

Passive translation test for C0/C1 segment - manual assessment by the three-finger grip (mandibular angle, C1 transverse process, mastoid) - translational passive move-ments - C0 / C1 is normally combined with lateral flexion. If no connection between translation and side-bending - disfunction C0/C1 is likely.

Passive rotation test for C0/C1 segment - two - finger grip (occiput, C1) - extension test with an unilateral side-bending and rotation - normally occiput can easily approximate C1.

Special consideration is given to detection of compensatory mobility malfunctions.

Open mouth test - in normal conditions two - fingers wide opening occurs without co-existent compensatory movements and no painful protrusion of the mandible is noted (physiologically up to 30 mm). (Figure 3).
Figures 3, 4, and 5: Open mouth test with properly made correction of HNRP.

Subjects after whiplash present extension in the upper cervical segment, side-bending or elevation/compression to one side during mouth opening test. During active rotation of the neck malalignment usually increases significantly. (Figures 4 & 5)

Figure 3. Open mouth test with properly made correction of HNRP

Apart from significant limitations of the range of motion in the cervical segment active neck movements dis-

close wrong pattern of rotation, side-bending and flexion/extension usually with engagement of whole torso or upper limb.

Re-education of HNRP

Phase I - self-correction

Information and reassurance for the patient are crucial. It is worthy of time to start with the explanation of the treatment objective, prognosis and above all to invite the patient to be equally responsible for the final outcome as an active “co-producer”.

Mirror therapy - active self-correction of reference line following 3 points marked on the skin assisted by therapist.

Mouth opening (two fingers wide) with active correction of horizontal lateral line assisted by therapist (repeated until no pain, resistance or compensation occurs).

Phase II - self-correction and active movement

Active rotation of the neck - the main objective is to keep corrected position of 3 reference points marked on the face and rotation is continued within comfortable range without triggering any suboccipital tension.

Phase III - self-correction, active movement, resistance

Active rotation of the neck - the main objective is to keep corrected position of 3 reference points and rotation is continued within comfortable range then followed by gentle resistance but without triggering any suboccipital tension.

Resisted mouth opening with assisted control of SCM attachments (conscious lowering of SCM hypertonus) by activation of suprahyoid muscles (repeated until no pain, resistance or compensation occurs). Recommendation for further home therapy 2-3 minutes twice a day.

Resisted mouth opening with rotation and self-correction. (Figure 6)

Figure 6. Open mouth test with rotation and self-correction in vertical line
After successfully accomplishing the tasks in open chain some closed-chain tasks can be introduced e.g. active gentle pressure bregma point against wall with correction of the position of the shoulder blade in all fours supported position as an activation of LCoM and LCaM mm.

Above mentioned training sessions (ca. 45 min each) are applied usually twice a week in acute or subacute phase of WAD, then the appointments are spread to once weekly, twice monthly, once monthly until resuming full function. During each session manual intervention (mobilisation, manipulation, soft tissue release) is performed when needed.

An objective test to validate the progress of HNRP re-education is very simple - eyes closed, active head rotation and return to zero position evaluated by therapist, repetition five times both sides before beginning each new session. Patient gathers 1 point for single restoration of the target position correctly. Obtaining 10 points ends the therapy.

3. Material and Method

In the period between 01/2018 and 09/2020 totally 112 patients were qualified to rehabilitation program and were treated according to the rules described above, in the clinic Arenamed, Warsaw, Poland.

Serious neurological deficits, fractures/dislocations or operative treatment were the only excluding criteria. Two experienced physiotherapist and manual therapists took care of the patients, which were enrolled to the therapy in order of submissions. The patients were treated twice a week (8 sessions) and the follow up visit was made after two months. Most of them continued further therapy and the mean period of therapy reached 19.25 weeks (13.12 sessions) but the longest period of therapy reached even 68 weeks to resume full function.

End points: the beginning of therapy (Visit 0,V0), after 2 months of therapy (Visit 1,V1).

Outcome measure: Numeric Rating Scale (NRS, 0-10) and Neck Disability Index (NDI, 0-50).

Rehabilitation process was performed by two therapists, but the patient assigned to a given therapist was treated by him from the beginning to the end of the study.

Mean values change of NRS, NDI were compared between V0 and V1 endpoints. Percentages of patients achieving clinical response in NRS and NDI were determined according to the Minimal Important Difference (MID) with cut-off points 3/10 for NRS and 10/50 for NDI.

All calculations and graphs were performed in IBM SPSS Statistics.

4. Results

Presented analysis covers retrospective material for single-center, open study. All the patients accomplished 8 sessions of therapy and all of them were checked-up after finishing of therapy (2 months from V0). There were no serious complications during therapy, some post-procedure soreness after manual therapy occurred and lasted several hours but were generally well tolerated.

The demographic data are presented in Table 1.

<table>
<thead>
<tr>
<th>Demographic data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of patients, n</td>
<td>112</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>79 (70.5)</td>
</tr>
<tr>
<td>Age, years, mean ± SD (range)</td>
<td>46.17±11.4 (21-74)</td>
</tr>
<tr>
<td>Duration of complaints, weeks, range</td>
<td>3-600</td>
</tr>
<tr>
<td>Duration of complaints, weeks, mean ± SD (range)</td>
<td>89.24±113.92 (3-600)</td>
</tr>
<tr>
<td>WAD phase, n (%):</td>
<td></td>
</tr>
<tr>
<td>Acute phase patients</td>
<td>30 (26.8)</td>
</tr>
<tr>
<td>Subacute phase patients</td>
<td>40 (35.7)</td>
</tr>
<tr>
<td>Chronic phase patients</td>
<td>42 (37.5)</td>
</tr>
</tbody>
</table>

Mean NRS at the beginning of therapy was 3.61 (SD=1.55) and after accomplishing therapy 2.14 (SD=1.08). (Figure 7)

Mean NDI at the beginning of therapy was 21.25 (SD=8.28) and after accomplishing therapy 12.31 (SD=5.93). (Figure 8)
Mean NRS and NDI values before and after therapy are presented in Figure 9 and 10. Only 21.4% of patients achieved MID (at least 3 points difference) for NRS, but MID (at least 10 points difference) in NDI achieved 41.9% of patients. Presented data should be treated as preliminary and with caution because there is no information about additional e.g. pharmacological or psychological consecutive care. There is also a lack of information and comparison study about various initial treatments which were implemented before admission for rehabilitation process.

Considering outcomes and prognosis of WAD the Québec Task Force (1995), assumed that whiplash injuries have mostly good prognosis, because 87% of patients after 6 months and 97% after 12 months declare the end of the period of insurance benefits due to incapacity for work [1]. Completely different data are provided by Barnsley et al. (1994), where 14 to 42% of patients develop chronic complaints (lasting over 6 months), and 10% remain with chronic, persistent pain [14]. In more recent studies, the percentage of chronic pain developed after whiplash trauma varies widely between 2 and 58%, but the most common range is 20-40% [15,16].

It means that there is much to discover in the area of optimal rehabilitation care after whiplash injuries. Nevertheless, some facts seem to support the theory of HNRP restoration as an effective tool of WAD care. One of the most popular theories considering whiplash pathomechanics emphasizes eccentric contraction of the neck muscles during inertial movement and assumes a rapid defensive contraction of muscles causing their micro damages and overcorrection of muscle spindles with a looped increased muscle tone [17].

Persistent excessive muscle tension in a patient’s specific pattern may lead to malalignment of HNRP.

We know for sure that immobilization in the orthopaedic collar, beyond absolute necessity, delays recovery and does not reduce pain, and may also strengthen kinesiophobia [18].

Regardless of the dominant mechanism of trauma, the eventful and possibly chronic course of WAD is indeed a

5. Discussion

The population treated was mostly female, middle aged but very inhomogeneous considering duration of complaints (3-600 weeks). Both mean values of NRS and NDI were reduced after treatment with much better dynamics in acute and subacute than chronic cases. Nevertheless no improvement in NRS was noted by 29 patients (25.8%) albeit real worsening of outcomes was found only in 2 cases (1.8%). Three of cases reported worsening of outcomes in NDI (2.7%). Many more patients achieved MID in NDI (41.9%) than in NRS (21.4%). It may suggest that patients are doing better functionally after therapy but the encoded pain especially in the chronic cases need some more time to resolve and to be really noticed by patient.

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We know for sure that immobilization in the orthopaedic collar, beyond absolute necessity, delays recovery and does not reduce pain, and may also strengthen kinesiophobia [18].

Regardless of the dominant mechanism of trauma, the eventful and possibly chronic course of WAD is indeed a
dysfunctional processing of the pain signal at the level of the spinal cord and upper cerebral centres with peripheral and central sensitization. It was confirmed by numerous experiments showing changes in cerebral regional blood distribution in functional MRI, increased sensitivity to both mechanical and thermal stimuli of patients with WAD similar to those encountered, among others in fibromyalgia and algodystrophy [19,20,21,22].

Unproper balanced CCJ can profoundly change perfusion of the brain when the theory of mechanoreceptors impact on intracranial vascular tonus is still potent. Neglecting of HNRP may be the causative that the results of WAD treatment donated by many authors regardless of the method, are still unsatisfactory for both the acute and chronic phase. Especially in cases of moderate to severe initial symptoms, many patients in these groups experience central pain sensitization and its chronicification. Rehabilitation and manual therapy only slightly modify the symptoms in these patients (reduction by 2 points per 10 in NRS which is very similar to our data - 1.47), so efforts are aimed at broadening the spectrum of specialists involved in the care of a patient with WAD by psychologists, psychiatrists, specialists in pain management, occupational therapists, etc.

It has been shown that cerebral hypoperfusion in the parietal-occipital border zone can be responsible for visual disturbances (blurring the contours of objects, accommodation disorders) and certain behavioral disorders in the form of difficulties in the formulation of thoughts, distraction or, on the contrary, the inability to divert attention from one imposed thought, which patients with chronic WAD often complain about [23,24].

Patients with WAD present extensive zones of increased pain sensitivity, covering areas of the body that could in no way have had any injury as a result. It also causes specific characterological changes in these patients very often with an increased level of anxiety, catastrophising, kinesiophobia, withdrawal or sometimes aggression and claim attitude, which makes cooperation with a physician or a physiotherapist very difficult. Kinesiophobia in the chronic phase may be responsible for paravertebral muscle atrophy and fat infiltration observed in MRI - especially in the deep layer [25,26,27,28]

We know that as a result of whiplash injury, tensions between the superficial and deep muscles of the neck are disorganized. The predominance of SCM tension (confirmed by EMG) and inhibition of the LCoM function causes a change in the curvature of the cervical segment, significant limitation of the range of motion and protraction of the head, which promotes shortening of the middle layer (scalene muscles) and inhibits even more multifidus and LCoM. This, of course, also affects the incorrect timing of neck muscles cooperating with shoulder girdle movements, which means that with repetitive movements of the upper limbs, the pain is intensified [29,30].

On this basis, the concept of “waking up” of the LCoM with the simultaneous relaxation of the SCM was created by specific, precise exercises that selectively activate deep layer muscles without simultaneously involving superficial muscles.

Another supporting HNRP restoration paradigm can be study of Bunketorp et al. who proved that tailor-made therapy, individualized and supervised by a physiotherapist, is a more effective method of muscle re-education after whiplash injuries than instructing home exercises alone, no matter how precise they are [31].

There are even reports that the improvement between muscle balance between LCoM and SCM through precise flexion exercises at the CCJ transition zone lead to a reversal of the fat infiltration process [32,33].

Further intensive research is needed to develop a coherent and scientifically proven optimal strategy for the treatment of acute whiplash injuries, preventing the transition to a chronic form.

6. Conclusions

1) The concept of the HNRP is strongly related to the sensorimotor control of the CCJ.

2) Recovery of the HNRP may facilitate the reprogramming of the dysfunctional sensorimotor control of the CCJ after whiplash injuries and seems to be useful in the process of central desensitisation and individualized rehabilitation.

3) Based on the preliminary clinical experience, the method of HNRP recovering seems to be effective, however, it requires confirmation on a larger number of participants in a study with a control group and a sufficiently long observation period.

References


ARTICLE
Maintaining the Health of Professional Folk Dancers in Conditions of Physical Recreation

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ABSTRACT
Research on the health issues of folk dancers has not been sufficiently developed. A sociological survey of the artists of the National Academic Ensemble of Folk Dance “Joc” from Moldova on the problems of a healthy lifestyle, diet, rest regime, physical and mental state, the attitude of respondents to physical activity in fitness clubs, readiness to engage in physical recreation to improve their condition, prevention diseases, allowed to determine the types of physical recreation and fitness programs recommended for dancers.

Keywords: Folk-dancers, Health, Physical recreation

1. Introduction
Preservation, maintenance, dissemination of cultural heritage is, as it is known, one of the most important goals of cultural policy. Among the central tasks arising from this - relying on this heritage, to create conditions for the development of the cultural potential of the nation, while simultaneously integrating national culture into the world cultural process.

One of the areas, in which the process of interaction of the national cultural heritage with modernity is clearly manifested, is the sphere of artistic culture. The most important place, among other components of this space, is occupied by everything that is associated with the national choreographic culture and, in particular, with folk dance. It represents undoubtedly a fundamentally significant component of the cultural heritage of Moldova, without which it is impossible to understand and present the entire wealth of national cultural traditions. It should be noted that this component is not only the folk dance itself as a material unit, but also its social existence, its social and functional load, its symbolic meanings and interpretations.

Comprehension of practical and theoretical issues of modern folk dance and those disciplines where dance is closely related to art is one of the most pressing problems, which is expressed in the absence of a clearly expressed semantic content of the requirements for the artistic and aesthetic side of the artists’ performance [1]. Along with this, the problem of health of dancers (performers) is also among the current problems. And although the age of professional dancers is short-lived, the negative consequences of this profession are manifested even in the process of their vigorous activity [2].

Thus, the relevance of this study is due to the need for a scientific understanding of the health-saving aspects of folk dance.

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In the specialized literature available to us, a scientifically grounded approach to solving the problem of dancers’ health in conditions of physical recreation and determining the appropriate means has not been revealed.

2. Methodology

The purpose of our research was to identify the means of physical recreation that contribute to the maintenance of the health of professional folk dancers.

The set up goal was resolved using the following research methods: theoretical analysis and generalization of specialized literature data, analysis of the rehearsal process of folk dancers, pedagogical observations, sociological survey, mathematical processing and interpretation of statistical data.

The research was carried out at the bases of the State University of Physical Education and Sports of the Republic of Moldova and the National Academic Ensemble of Folk Dance “Joc”.

To determine the main and secondary factors, one way or another, contributing to the development of diseases in dancers, a survey of the artists of the National Academic Ensemble of Folk Dance “Joc” was conducted.

The questionnaire included 34 questions, within which 5 additional questions were asked. The questions given identified the following issues:
- lifestyle;
- food style;
- rest mode;
- the level of employment;
- physical and mental condition;
- the presence of diseases;
- the attitude of respondents to physical activity in fitness clubs;
- willingness to engage in physical recreation to improve their condition and prevent diseases.

The sociological survey was conducted in order to determine the optimal fitness programs for the prevention of diseases of professional dancers.

3. Results and Discussion

The survey involved 30 respondents aged 16-45 years. Of these, 15 are men and 15 are women. The questions of the questionnaire at the age of 16-18 years old were answered by 3 men and 3 women, at the age of 19-29 years – 7 men and 6 women, at the age of 30-45 years – 5 men and 6 women. Thus, in percentage terms, the presented ages were (Figure 1): adolescence – 20%, where 50% were men and 50% – women; youth age – 43.33%, of which 53.85% are men and 46.15% are women; mature age – 36.67% – men – 45.45%, women – 54.55%.

Analyzing the answers of the respondents, it can be noted that among the dancers who maintain an improper diet (frequent snacks, fast food, sugary carbonated drinks, eating food that does not contain a sufficient amount of protein, complex carbohydrates, vitamins and microelements) make up 86.67% (Figure 2). This can be compared with the percentage of dancers who prefer passive rest – 83.33%. As you can see, the data for these items are almost identical, which indicates their interdependence. At the same time, among the dancers who prefer passive rest, near the TV and at the computer spend: 3-5 hours – 47.6%; less than 5 hours – 52.4% of respondents.

It should be noted that most of the respondents (75%) spend 5-7 hours on sleep, while 18.33% sleep 4-5 hours or have insomnia, and only 6.67% get enough sleep, in 7-9 hours (Figure 3).

Although the profession of dancers reveals a lot of physical activity, which implies the absence of bad habits, still 9.7% of respondents does not exclude smoking, of which 6.37% are men, 3.33% are women.

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The survey revealed 86.67% of respondents with diseases (osteoarthritis, migraine, varicose veins, arthritis, etc.).

As it was expected, 100% of the dancers surveyed believe that health is important in a person’s life. However, to the question about engaging in physical activity, the distribution of answers is as follows: 3.33% – exercise regularly (exercise, walking), 19.98% – periodically (go to the vacation home during the season, sometimes to the forest and the beach), 70.02% – episodically (extremely rarely) and 6.67% – answered “no” referring to the lack of time, increased fatigue, illness (Figure 4).

**Figure 4. Respondents’ answers to the question about physical exercise**

To the question: “If you were offered a free subscription to a fitness club, would you find time to visit?”, only 63.33% answered “yes”, and from the entire composition of the ensemble these are respondents of adolescence and youth. This suggests that the level of income can influence a person’s choice of a healthy lifestyle. In addition, among the choice of fitness programs, it was noted that for women, activities that have a restorative orientation not only in the physical aspect, but also in the psychological one were more attractive. Men, on the other hand, preferred power exercises, that is, find a “critical” pulse, calculate the optimal pulse and, focusing on it, build a physiological curve classes. To control and regulate a given program, it is recommended to use heart rate monitors, which make it possible to more efficiently program physical activities.

In order to do this, it is recommended to set the limiting heart rate at which unfavourable shifts in dancers begin, both from the cardiovascular system and autonomic reactions, that is, find a “critical” pulse, calculate the optimal pulse and, focusing on it, build a physiological curve classes. To control and regulate a given program, it is recommended to use heart rate monitors, which make it possible to more efficiently program physical activities.

As part of the rehabilitation process, it is proposed to use a program consisting in alternating sub-tolerant, mixed and tolerant load regimes. The method of establishing tolerance to physical activity (on a treadmill or ergometer bicycle) with the identification of a “critical” heart rate and determination of the optimal one, makes it possible to more efficiently program physical activities.

In general, when conducting a sociological study, the set goals have been achieved. It was revealed that such factors as promoting a healthy lifestyle, proper nutrition and fitness activity are of great importance in the fight against diseases.

Analysis of the results of the sociological survey of folk dancers “Joc” made it possible to reveal that along with the so-called “professional” diseases (diseases of the joints and blood vessels of the lower extremities, flat feet, varicose veins), problems of the psycho-emotional state (depression, aggression), dancers acquire this or another illness due to an improper lifestyle, which implies insufficient sleep, improper regimen and nutrition itself, there is no change in physical activity (physical culture and recreational activities).

In order to be able to extend their professional career, professional dancers must include in their daily routine physical and recreational activities aimed at relieving psychological stress, stretching muscles and joints, strengthening large muscle groups, using breathing practices, concentration, centering and relaxation practices.

From this point of view, we have identified the types of physical recreation for all folk dancers: Health Walking, Running, Swimming, Rowing, Cycling, Rollerblading, Outdoor Games; as well as fitness programs recommended for women: Pilates, Callanetics, Stretching, Yoga, and Bodybuilding recommended for men.

### 4. Folk Dancers Recommendations for Physical Exercise

When using strength exercises, light weights with multiple repetitions are recommended, in order to avoid unnecessary stress on the joints and ligaments.

As part of the rehabilitation process, it is proposed to use a program consisting in alternating sub-tolerant, mixed and tolerant load regimes. The method of establishing tolerance to physical activity (on a treadmill or ergometer bicycle) with the identification of a “critical” heart rate and determination of the optimal one, makes it possible to more efficiently program physical activities.

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A general approach to the aerobic physical activity (walking, running, cycling, swimming, playing, etc.) is to exercise it in the fresh air. However, in some cases, you can exercise not only in the fresh air, but also in a room that is equipped with cardiovascular equipment.

### 5. Conclusions

As a result of studying specialized literature in the field of physical recreation, health-improving training, we have noted that research on the problems of maintaining health in people whose profession involves significant physical activity (athletes, ballet dancers, pop and folk dancers) have not been sufficiently developed. Basically, they are
of an informational nature, which does not allow determining the details of the correctional and health-improving method.

The sociological survey of the artists of the folk dance ensemble “Joc” on the problems of a healthy lifestyle, eating style, rest regime, physical and mental state, the attitude of respondents to physical activity in fitness clubs, readiness to engage in physical recreation to improve their condition, prevent diseases, allowed to determine types of physical recreation and fitness programs recommended for dancers.

References

ARTICLE

Improvement of Regular Exercise on Diabetes Condition of Type II Diabetes Mellitus Elderly Patients

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Improvement

ABSTRACT

To investigate the effects of 12-week old aerobics and brisk walking exercise on type II diabetes in elderly patients with illness condition, at the same time, after intervention 12 months later, the subsequent movement of patients in the intervention group were followed up, in order to provide a simple and effective, scientific and reasonable exercise prescription for elderly patients. Subjects were selected according to the standard, the sex ratio of 1:1 from 28 over the age of 60 elderly patients with type II diabetes (male and female 14 each), and divided them into intervention group and control group, the control group lived a normal life (without regularity, fitness behavior during the experimental period), the intervention group did aerobics plus walking exercise intervention, two groups of patients were assessed indexes of diabetes before and after the intervention. After 12-week exercise intervention, blood glucose and cholesterol of intervention group decreased significantly, the illness condition of them had improved effectively, while the control group had no obvious change before and after the experiment, after intervention 12 months later, over 85% elderly patients of the intervention group had been in good behavior habits of fitness. Aerobics and walking exercise can improve the illness condition of elderly patients with type II diabetes to a certain extent, think that the old aerobics and rope skipping is a kind of effective and simple fitness behavior, should be targeted according to the condition of patients and health promotion.

1. Introduction

With the acceleration of population aging process, diabetes has been widely prevalent in the world. According to the WHO, the number of diabetic patients increased from 125 million in 1995 to 171 million in 2000, and it is predicted that the number will reach 366 million in 2030 [1]. Currently, China has 113.9 million diabetics. Due to the significant decline in the level of physical activity in the elderly population, the incidence rate is increasing year by year, and the trend is gradually becoming younger and younger. Account for 80 to 90 percent of the total number of diabetes patients belongs to Type II diabetes (T2DM) patients, the vast majority of which occur in adults. Diabetes mellitus is characterized by a long course of disease, complex treatment methods, numerous complications and serious health hazards, which seriously has affected the quality of life of patients greatly [2]. Elevated blood
glucose is the main basis for the diagnosis of diabetes mellitus, and its core index is HbA1c. The occurrence, development and recurrence of T2DM mellitus are highly related to emotion, living environment, obesity, lack of exercise, diet and heredity. The etiology of T2DM is unknown. Heredity is a major factor, but a more important factor is living environment.

A large number of studies have proved that regular exercise has a positive effect on the prevention and improvement of T2DM [3]. Long-term aerobic exercise as an effective means of T2DM intervention has been widely recognized [4-5]. Experts have believed that such a high prevalence of diabetes and such a rapid growth rate are mainly caused by the improvement of material levels and lifestyle changes, especially with the excessive intake of foods such as high fat, high sugar and high salt and lack of physical activity. In this study, the combination of geriatric aerobics and brisk walking exercise was used to conduct exercise intervention for the elderly patients with T2DM, in order to effectively improve the condition of the patients and improve the quality of life.

2. Materials and Methods

2.1 Subjects

The method of recruitment was adopted among the elderly in the urban community, and the unqualified elderly were eliminated. Finally, 28 elderly (T2DM) patients were selected. Inclusion criteria: (1) Urban community residents, aged 60-80, who are required to have no fitness habits. (2) Fasting blood glucose is stable in the range of 7.0-16.7 mmol/L, and the course of disease is 5-10 years. (3) have certain listening, speaking, reading and writing ability; (4) dietary control (such as low salt, low fat and low sugar diet) or oral hypoglycemic drugs; (5) No serious diabetes complications, no liver, kidney and other organ function damage, blood pressure is less than 180-105 mmHg, ECG examination is normal; (6) Can adhere to 12 weeks of moderate intensity fitness exercise, volunteer to participate in the intervention experiment project. According to the inclusion criteria, a total of 28 elderly patients with T2DM were enrolled, including 14 males and 14 females. The subjects were randomly divided into intervention group and control group. A medical examination should be performed before exercise to rule out contraindications. To ensure that their physical health status can complete the experiment, screening exercise intervention objects. Understand the living habits, daily diet, medication and exercise habits of the subjects. Explain the purpose of the study, the duration of the study, the content of the study, the matters needing attention for exercise and the requirements for patients’ cooperation to the study subjects, and obtain their informed consent and signature.

2.2 Main Test Indexes and Instruments

Main test indexes: Main evaluation indexes of diabetes mellitus: blood glucose, serum triglyceride, serum total cholesterol, serum low density lipoprotein, serum high density lipoprotein, glycosylated hemoglobin, etc. Professional testing equipment: Blood glucose was determined by glucose oxidase (GOD) method, TC, TG, HDL-C and LDL-C were determined by Beckman matching reagent, and the automatic biochemical analyzer of Beckman CX4CE was performed.

2.3 Implementation Method of Exercise Prescription

According to the test results, the disease status and physical function status of the intervention objects were mastered, and individualized exercise prescription was given in combination with the personal lifestyle to implement the exercise intervention program. (1) Sports: geriatric aerobics and brisk walking; (2) Exercise intensity: warm-up activities for 10 minutes are conducted first, followed by self-made aerobics for about 25 minutes. During exercise, the subjects’ heart rate is maintained between 110 times /min and 130 times /min. During exercise, the subjects’ heart rate changes are monitored regularly, and the intensity can be controlled according to their physical conditions during brisk walking. (3) Exercise time: exercise for about 1 hour and 20 minutes each time, namely 10 minutes of warm-up activities, 30 minutes of geriatric aerobics exercises, 20 minutes of brisk walking after 10 minutes of rest, and the finishing activities for the last 10 minutes. (4) Exercise frequency: three times a week. Actually speaking on Monday, Wednesday and Friday, one hour after breakfast. The intervention experiment lasted for 12 weeks in total. (5) Exercise location: it is located in a rented activity room of nearly 200 square meters to ensure the safety and effectiveness of subjects’ exercise. In addition, according to the research results of Zhou Yurong et al., patients in group A suffered from 7.0 mmol/L ≤FPG <10.0 mmol/L, patients in group B 10.0 mmol/L ≤FPG <14.0 mmol/L, and group A reached the peak of insulin 2 hours later. The peak of insulin in group B was 3 h postprandial [3]. According to the American Physical Fitness Association’s recommendation of “not exercising during insulin peak”, this study decided to start intensive exercise 1 hour after breakfast to avoid hypoglycemia.

2.4 Statistical Methods

SPSS23.0 software package and Microsoft Excel2003
software were used for statistical processing. The significance test of mean ± standard deviation was used as Independent-Sample t test, and the numerical variables were expressed as M±SD. The analysis methods included repeated measurement analysis of variance and simple effect analysis. The significant level was P<0.05, and the very significant level was P<0.01.

3. Results

The results have shown that exercise intervention stimulated the decrease of blood glucose, blood lipid, cholesterol and other indexes in the elderly urban patients with T2DM mellitus to varying degrees, and played a positive role in improving the condition of the elderly patients.

3.1 Changes of Blood Glucose Before, at Week 4 and at Week 12 in the Two Groups

A 2×3 repeated measure ANOVA was performed on the blood glucose of the patients. Intergroup factors were groups, i.e., the intervention group and the control group; intra-group factors were time, i.e., before intervention, the fourth week of the experiment, and the twelfth week of the experiment; interaction was group × time. The results showed that the group main effect was significant (F value (1,26) =4.89, P<0.05), the group main effect was significant (F value (2,52) =12.38, P<0.001), the interaction between the two was significant (F value (2,52) =11.09, P<0.001). Further simple effect analysis showed that no significant difference was found between the experimental group and the control group (P>0.05) when tested before and after the fourth week of the experiment, but after the twelfth week, the intervention group (M±SD) blood glucose index was significantly lower than the control group (F value (1,26) =21.03, P<0.001; With the passage of test time, the blood glucose of the intervention group was gradually decreased, and the difference was very significant (P<0.001). In contrast, blood glucose in the control group did not change over time (P>0.05) (Table 1).

Table 1. Changes of blood glucose, triglyceride, cholesterol, high density lipoprotein and low density lipoprotein in two groups at different test time (M±SD)

3.2 Changes of Triglyceride before, at week 4 and at week 12 in the Two Groups

A 2×3 repeated measure ANOVA for triglycerides showed that the main effect and interaction between group and test time were not significant (P>0.05) (see Table 1). The experiment results show that the intervention group of triglyceride levels at the time of intervention in the 4th week fell slightly, but with the experiment before there is no significant difference (P>0.05), perhaps because not enough exercise, shorter reasons of intervention, and to intervene in 12 weeks, before and after the experiment compared with significant difference (P<0.05), the deeper reason remains to be further explored. There was no significant difference in the control group before and after intervention (P>0.05).

3.3 Cholesterol Changes in the Two Groups at Different Test Time

A 2×3 repeated measure ANOVA for cholesterol showed significant group main effect (F value (1,26) =8.93, P<0.01), significant intra-group main effect (F value (2,52) =48.92, P<0.001), significant interaction between the two (F value (2,52) =56.05, P<0.001). Further simple effect analysis showed that there were significant differences between the intervention groups before, in the 4th week, and in the 12th week (P<0.001). Cholesterol levels

<table>
<thead>
<tr>
<th>index</th>
<th>group</th>
<th>Before the experiment</th>
<th>The fourth week</th>
<th>The twelfth week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose</td>
<td>intervention group(n=14)</td>
<td>8.54±1.98</td>
<td>8.20±1.64</td>
<td>6.86±1.04**</td>
</tr>
<tr>
<td></td>
<td>Control group(n=14)</td>
<td>9.21±1.87</td>
<td>9.10±1.53</td>
<td>9.13±1.53</td>
</tr>
<tr>
<td></td>
<td>intervention group(n=14)</td>
<td>2.44±1.08</td>
<td>2.36±.94</td>
<td>2.01±.72*</td>
</tr>
<tr>
<td></td>
<td>Control group(n=14)</td>
<td>2.28±1.10</td>
<td>2.34±1.14</td>
<td>2.31±1.18</td>
</tr>
<tr>
<td></td>
<td>intervention group(n=14)</td>
<td>6.52±.47</td>
<td>6.01±.49</td>
<td>4.80±.69**</td>
</tr>
<tr>
<td></td>
<td>Control group(n=14)</td>
<td>6.38±.80</td>
<td>6.46±.72</td>
<td>6.32±.76</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>intervention group(n=14)</td>
<td>2.09±.61</td>
<td>2.01±.49</td>
<td>2.05±.24</td>
</tr>
<tr>
<td></td>
<td>Control group(n=14)</td>
<td>1.98±.68</td>
<td>1.96±.62</td>
<td>1.90±.68</td>
</tr>
<tr>
<td>High density lipoprotein</td>
<td>intervention group(n=14)</td>
<td>3.32±.85</td>
<td>2.95±.76</td>
<td>2.18±.75**</td>
</tr>
<tr>
<td></td>
<td>Control group(n=14)</td>
<td>3.30±.68</td>
<td>3.04±.67</td>
<td>3.07±.68</td>
</tr>
</tbody>
</table>

Notes: the experimental data of this study, * indicates significant difference P<0.05; ** indicates significant difference (P<0.01)
in the intervention group were significantly lower than those in the control group in the 12th week (F (1,26) = 8.32, P<0.001). As the test time went on, the cholesterol of the intervention group was gradually decreased, and the difference was significant (P<0.001). In contrast, cholesterol in the control group did not change over time (P>0.05) (Table 1).

3.4 HDL Changes in the Two Groups at Different Test Time

However, a 2×3 repeated measure analysis of variance on HDL showed that the group main effect, the intra-group main effect and their interaction were not significant, P>0.05 (Table 1). The reason remains to be further studied.

3.5 Changes of LDL in Two Groups at Different Test Time

A 2×3 repeated measure analysis of variance for low-density lipoprotein showed that the group main effect was not significant (F value (1,26) = 3.35, P>0.05), the group main effect was significant (F value (2,52) = 17.30, P<0.001), the interaction between the two was significant (F value (2,52) = 18.57, P<0.001). Further simple effect analysis found that the intervention group showed a downward trend in the indicators before, in the 4th week, and in the 12th week, and all reached very significant differences (P<0.001). At the twelfth week of the experiment, low density lipoprotein index of the intervention group (M±SE) was significantly lower than that of the control group, F value (1,26) = 16.22, P<0.001; However, the control group did not show a decreasing trend over time (P>0.05) (Table 1).

4. Analysis and Discussion

T2DM is a chronic disease that cannot be cured totally with medicine. Once diagnosed, it is necessary to take drugs or inject insulin for long-term blood sugar control. Not only to the patient’s body damage, but also more heavy psychological pressure. However, after regular physical exercise, the blood sugar of patients decreases and their condition improves. Such favorable results can greatly enhance the confidence of patients to overcome the disease and improve their sense of self-efficacy. Meng En (2014) pointed out that T2DM patients should keep fit 4-5 times a week, with 30-120 min of exercise for at least 30 min of effective intensity for each exercise, and the best effect would be achieved 1 hour after meal [4]. Now exercise therapy has been proved to be a scientific and effective treatment for T2DM diabetes. Patients with appropriate intensity aerobic exercise can effectively reduce weight, improve the organism of insulin sensitivity, promote the body metabolism, improve the function of the respiratory and circulatory system, enhanced physique, vital capacity increases, the prevention of diabetes complications, and can also cultivate life interest, edify sentiment, reduce stress, improve the quality of life [5].

When a person is convinced that he or she is capable of performing a certain activity and gains a certain amount of income, he or she will develop a high sense of self-efficacy and take the initiative to carry out the activity, in order to achieve effective control of the development of disease, improve the quality of life. Research in related fields at home and abroad also shows that in the course of treatment of various chronic diseases, patients’ self-management ability can be enhanced by enhancing their confidence and self-efficacy, patients actively engage in an activity when they see that the behavior is beneficial to the body and the disease. The experimental results are in good agreement with those of collar [6] et al. More than 12 weeks of moderate intensity aerobic exercise has been proven to be effective in improving glucose metabolism. However, other studies [7] have shown that younger age diabetics under the age of 55 are more sensitive to exercise, and aerobic exercise is less effective in lowering blood sugar in older age patients. Wang Zhengrong [8] believes that nearly 90 percent of diabetic patients have a significant drop in fasting blood glucose after one year of exercise intervention, suggesting that as long as people develop good fitness and exercise habits and exercise more than three times a week or every day, it would have a better effect. The control group had no significant changes in blood glucose and other indicators before and after the experiment, which showed that without regular aerobic exercise intervention, only control of Diet and medication, lack of better effect on the decline of Blood Glucose and other indicators of diabetes, [9] the research of Tao lingling and others has similar results. Exercise intervention therapy is as important in the treatment of Type II diabetes as Diet Control and drug therapy, exercise therapy plays an irreplaceable role in clinical practice, which should be paid more attention to by the medical field and patients [10].

Duan Yanping (2012) believes that the subject can actively adhere to at least three times a week or engage in moderate intensity fitness behavior every day for more than 12 months, and to some extent has formed good habits and lifestyle of regular fitness behavior [10]. When the elderly have participated in fitness activities, their physical and mental self-perception is very important, that is to say, the so-called self-efficacy. The theory of self-efficacy refers to an individual’s expectation of whether he or she...
has the ability to implement a certain behavior, which is people’s cognition and evaluation of their own behavioral ability. High levels of “self-efficacy” occur when people believe they are capable of performing an activity, and self-efficacy is at the heart of the self-regulatory system. According to this theory, human behavior is affected by external reinforcement and self-reinforcement, but no matter which reinforcement affects behavior through affecting self-efficacy. Therefore, in the process of exercise, when the old master certain exercise skills, after a period of time after fitness law, to see their physical and mental status changes, will generate more intense internal training motivation, fitness behavior internalizes for own life habits and way of life, to form a long-term mechanism for fitness, regular exercise and self-efficacy form benign interaction each other, promote each other. Regular exercise has a good effect on regulating the endocrine cycle of the elderly, improving physical function, reducing loneliness and depression, making the elderly feel comfortable, increasing communication, enhancing the awareness and ability of social participation, and thus effectively improving the quality of life of the elderly “ [11]. At the end of the campaign experiment after 12 months, has carried on the track to intervention group respectively, there are 12 people in the middle of the 14 people have still insisted to do elderly in setting-up exercise and brisk walking exercise, regular exercise behavior accounted for 85.7%, some old people in addition to do these movements, walks fast and physical exercise, tai chi or other projects to exercise time also increased a lot during the experiment, basically exercise every day, time in 1-2 hours, more than clinical recommendations weekly exercise time, fully demonstrated the exercise intervention experiments good follow-up effect, It has also shown that the music aerobics created by old people in addition to do these movements, walks fast and physical exercise, tai chi or other projects to exercise, these two exercises are simple and easy to do, scientific and effective, and also play an important role in promoting the elderly T2DM patients’ adherence to fitness behavior[12].

4. Conclusions

Applying 12 weeks’ old-age geriatric aerobics and brisk walking intervention to the elderly patients with T2DM can effectively stimulate the patients’ body, make their blood sugar, blood lipid, cholesterol and other indicators decline to varying degrees, and play a positive role in improving the condition of the elderly patients. Therefore, the research conclusion has shown that under the premise of clinical treatment, applying regular and scientific exercise intervention to elderly patients with T2DM has a very good adjuvant treatment effect on improving their condition, and can effectively improve their quality of life, so it is recommended to promote it vigorously.

References

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