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FIZIČKO VEŽBANJE KAO MEHANIZAM UPRAVLJANJA STRESOM

Sažetak: Način reagovanja na potencijalno stresne situacije je individualan i zavisi od dva osnovna faktora. Prvi je način na koji osoba percipira i interpretira situaciju, a drugi faktor se odnosi na stanje samog tela, odnosno organizma. Usled hroničnog stresa, sindroma izgaranja i posttraumatskog stresnog poremećaja često dolazi do nastanka bolesti. Stres može uticati na zdravlje direktno, putem autonomnih i endokrinih reakcija koje izaziva, ali i indirektno, putem promene u zdravstvenom ponašanju koje mogu nastati posle stresa.

Fizičko vežbanje se često preporučuje kao deo programa upravljanja stresom. Dokazano je da se vežbanjem smanjuju hormoni stresa i reaktivnost na stres. Vežbe prilagođene stepenu fizičkih mogućnosti i nivou motivacije osobe, smatraju se odličnim početnim pristupom u upravljanju psihičkim stresom. Fizička aktivnost nije važna samo kao primarna prevencija mnogih hroničnih bolesti, već i kao sekundarna prevencija koja usporava i smanjuje simptome hroničnih bolesti. Osim uticaja na hronične bolesti, fizička aktivnost snažno utiče i na poboljšanje samopouzdanja, društvenih veština, kognitivnog funkcionisanja, smanjuje simptome stresa, što zajedno sa ostalim pozitivnim efektima doprinosi boljem kvalitetu života.

Rezultati postojećih istraživanja pokazuju da fizičko vežbanje može da utiče na kognitivno funkcionisanje tokom čitavog životnog veka, direktno, kroz fiziološke mehanizme i strukturne promene u mozgu, a indirektno kroz uticaj na raspoloženje i smanjenje stresa. Fizičko vežbanje, kroz različite mehanizme, ima snažan uticaj na ispoljavanje nivoa stresa.

Ključne reči: stres, fizička aktivnost, fizičko vežbanje, zdravlje

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Uvod

Poslednjih decenija, savremeni način života podrazumeva izuzetno brz i zahtevan tempo, nedovoljno kretanja, neadekvatnu ishranu i svakodnevni stres. Stres se opisuje kao autonomni nespecifičan odgovor organizma na fizičke, mentalne i konstantne zahteve okoline čoveka [1]. Sa druge strane, osetan je nedostatak vremena ili resursa kojima bi se omogućilo usvajanje mehanizama za efikasno upravljanje stresom i bavljenje fizičkom aktivnošću. Svi ti činioci dovode do narušavanja zdravlja. Skoro svakodnevno osoba doživljava stresna iskustva, manja ili veća, a koja često u pozadini imaju hronični stres. Stoga, stres ne predstavlja samo pretnju ličnom doživljavanju sreće i blagostanja, već predstavlja ozbiljan rizik za zdravlje [2]. Iako je zdravstvena korist umerenog vežbanja, odnosno umerene fizičke aktivnosti, uveliko dokazana, više od 60% odraslih u svetu ne vežba na redovnoj osnovi, a 25% odraslih vodi sedentarni način života [3].

Stres

Stres se može definisati kao narušena homeostaza organizma, preterano emocionalno i fiziološko uzbuđenje koje se doživljava u pretećoj situaciji. „Stres je nespecifičan biološki odgovor (fizički i psihički) na svaki neuobičajeni zahtev koji nadilazi adaptivne sposobnosti organizma“ [4]. Stres se opisuje kao autonomni nespecifičan odgovor organizma na fizičke, mentalne i konstantne zahteve okoline na čoveka [1]. Štetni agensi, stimulusi, koji izazivaju stres, nazivaju se stresori. Stresori su podeljeni u nekoliko kategorija, pa tako razlikujemo psihičke stresore (frustracije, tuga, strah, mobing), fizičke stresore (trauma, buka, ekstremni napor) i socijalne stresore (razvod, gubitak posla, finansijska kriza). Obično se o stresu govori uvek u negativnom kontekstu, ali mora se istaći da postoje dve vrste stresa: eustres i distres. Eustres predstavlja pozitivan stres koji održava organizam u pripravnosti. Eustres karakteriše uzbuđenje, kratkotrajnost, povećanje efikasnosti. Pozitivni stresori, eustresori, mogu biti promena posla, povišica, sklapanje braka, odmor. Distres je negativan stres. Nastaje kada se osoba dugotrajno suočava sa stresom, što rezultuje preopterećenošću. Karakteristike distresa su anksioznost, zabrinutost, smanjena efikasnost, kao i brojne somatske manifestacije u vidu glavobolje, hipertenzije, bolova u grudima. Česti negativni stresori su smrt bliske osobe, razvod, bolest, finansijski problemi [5].

Prema trajanju i učestalosti, stres se može podeliti na: a) Akutni stres – nastaje usled pritiska i zahteva okoline iz bliske prošlosti ili očekivanja u bliskoj budućnosti, a izaziva reakciju „bori se ili beži“, gde se telo dovodi u stanje reakcije ili adaptacije na stresor; b) Epizodični akutni stres – nastaje usled čestog ponavljanja akutnih stresnih epizoda; c) Hronični stres – nastaje usled duže izloženosti stresnim situacijama,

posebno vezano za porodični i poslovni segment života; d) Posttraumatski stresni poremećaj – nastaje kada stresor perzistira unutar organizma godinama, sa čestim ponavljanjem traumatskih događaja [6].

Mehanizmi nastanka stresa

Razumevanje regiona mozga koji su povezani sa fiziološkim odgovorima na stres je važan poduhvat, a sve veći broj istraživanja sada počinje da povezuje neuronske aktivnosti tokom izlaganja stresoru sa fiziološkim reakcijama koje usled toga nastaju. U nekoliko poslednjih decenija, naučnim istraživanjima je objašnjen fiziološki mehanizam nastanka stresa i njegov uticaj na zdravlje. Prema tim studijama, stres dovodi do aktivacije simpatičkog nervnog sistema i osovine hipotalamus – hipofiza – nadbubrežna žlezda, usled čega dolazi do zapaljenskih procesa koji su u korelaciji sa smanjenjem imuniteta i mnogim hroničnim oboljenjima [2].

Od percepcije stresnog događaja do reakcije na njih u nervnom sistemu prolazi se kroz pet nivoa: 1. Ulaz i interpretacija senzornih informacija (asocijativna i prefrontalna oblast korteksa, hipokampus), 2. emocije koje nastaju na osnovu procene (prefrontalno-amigdalna aktivnost), 3. otpočinjanje neuroendokrinih odgovora (hipotalamus i paraventrikularna jezgra), 4. povratne informacije iz autonomnih i endokrinih struktura (aminergična jezgra moždanog stabla) i 5. autonomni i endokrini odgovor (hipofiza i nadbubrežna žlezda).

Fiziološke odgovore na stres u najvećoj meri regulišu simpatičko-adrenalno-medularna i hipotalamičko-hipofizna-adrenalno-kortikalna osovina. Usled dejstva stresora dolazi do odašiljanja simpatičkih impulsa od hipotalamusa ka različitim organima, kao i otpuštanja adrenalina i noradrenalina u krvotok. Pri jakom stresu organizam je preplavljen ovim hormonima koji pojačavaju efekte simpatikusa, a putem povratne sprege sa hipotalamusom povećava se izlučivanje adrenokortikotropnog hormona. Adrenokortikotropni hormon stimuliše koru nadbubrežne žlezde, zbog čega dolazi do pojačanog lučenja kortizola. Kortizol omogućava organizmu dodatne količine energije kroz povećanje koncentracije aminokiselina u krvi, izlučivanje masnih kiselina i stvaranje glukoze. Međutim, trajno povišen nivo kortizola može dovesti do smanjenog korišćenja glukoze, nagomilavanja masnoća, smanjenja sposobnosti pamćenja i oštećenja imunoloških funkcija organizma. Uz kortizol se izlučuje i β -endorfin, čija je uloga u pripremi organizma za potencijalni bol. Takođe, kao reakcija na stres dolazi do promene nivoa tiroidnog stimulisanog hormona, najčešće do njegovog smanjenja. Svi ovi mehanizmi pokreću niz drugih reakcija u organizmu [7].

Reakcije organizma na stres

Način reagovanja potencijalno stresne situacije je individualan i zavisi od dva osnovna faktora. Prvi je način na koji osoba percipira i interpretira situaciju, a drugi faktor se odnosi na stanje samog tela, odnosno organizma [8]. Selye (1975) je ukazao da kao reakcija na stresor dolazi do razvoja opšteg adaptacionog sindroma. On je istakao da, bez obzira na intenzitet stresora, organizam razvija jedan nespecifičan odgovor, usled kog dolazi do povećanja aktivnosti kore nadbubrežne žlezde, smanjenja timusa, slezine, limfnih čvorova i drugih limfnih struktura. Opšti adaptacioni sindrom podrazumeva tri faze: fazu alarma, fazu otpora i fazu iscrpljenosti. Faza alarma traje od nekoliko sati do nekoliko dana i tada dolazi do povećanja aktivnosti nadbubrežne žlezde, kardiovaskularne i respiratorne funkcije. Nakon toga sledi faza otpora, u kojoj je stresni stimulus relativno konstantan, ali se otpornost organizma na druge stresore smanjuje. U fazu iscrpljenosti se ulazi nakon produženog dejstva stresora ili ukoliko je on prejak i ponovljen. Tada se smanjuje kapacitet neuroendokrinog sistema za lučenje hormona, koji štite organizam od stresa, usled čega dolazi do razvoja bolesti, čak i smrti. Kao posledica pada nivoa kortizola izostaje inhibicioni odgovor simpatičkog nervnog sistema, što dovodi do nastanka hroničnog stresa, sindroma izgaranja ("burn-out") i posttraumatskog stresnog poremećaja [4].

Šupe i sar. (2011) reakcije na stres svrstavaju u fiziološko/fizičke i psihičke reakcije.

Fizičke i fiziološke reakcije na stres su: tahikardija, aritmija, porast krvnog pritiska, ubrzano disanje, pojačano znojenje, opstipacija ili dijareja, pojačana napetost mišića, glavobolja, vazokonstrikcija površinskih krvnih sudova, povećan nivo glukoze i holesterola u krvi, povećana propustljivost krvno-moždane barijere, smanjena reakcija na bolne nadražaje, smanjenje ili gubitak seksualne funkcije, izmenjen imunološki odgovor sa pojačanom zapaljenskom reakcijom.

Psihičke reakcije na stres mogu biti kognitivne (poremećaj pažnje, pamćenja, koncentracije, promene sposobnosti rasuđivanja i kritičkog mišljenja), emocionalne (strah, tuga, potištenost, agresija, ljutnja, depresija, preosetljivost, razdražljivost, osećaj bespomoćnosti i beznada, bezvrednosti, nerazumevanja, gubitak apetita, prejedanje, gubitak seksualne želje, nesigurnost, povlačenje) i bihejvioralne (zanemarivanje odgovornosti, gubitak motivacije za poslom, zanemarivanje lične higijene, zavisnički oblici ponašanja, fizička neaktivnost, sedentarnost) [6].

Uticaj stresa na zdravlje

Usled hroničnog stresa, sindroma izgaranja i posttraumatskog stresnog poremećaja često dolazi do nastanka bolesti. Stres može uticati na zdravlje direktno, putem autonomnih i endokrinih reakcija koje izaziva, ali i indirektno, putem promena u

zdravstvenom ponašanju koje mogu nastati kao posledica stresa. U uslovima dugotrajnog stresa dolazi do alostatskog opterećenja – najjednostavnije rečeno prekomernog trošenja fizioloških sistema. Pri tome dolazi do promene u raspodeli dominacije unutar autonomnog nervnog sistema, tj. pojačanog rada simpatičkog u odnosu na parasimpatički nervni sistem, što je usko povezano sa nastankom brojnih mentalnih poremećaja, hipertenzije, koronarne bolesti srca, dijabetesom [9].

Uticaj hroničnog stresa na razvoj oboljenja gastrointestinalnog trakta dokazan je kod sindroma iritabilnih creva, peptičnog ulkusa, ulceroznog kolitisa. Takođe, 40% veći rizik od nastanka čira na želucu imaju osobe sa negativnim zdravstvenim ponašanjem izazvanim stresom (neredovna ishrana, upotreba duvana i alkohola, neredovan san).

U imunom sistemu usled stresa dolazi do disregulacije proinflamatornih citokina, što dovodi do smanjenja imuniteta, prolongiranog zarastanja rana, smanjenog odgovora antitela, reaktivacije latentnih virusa, veće osetljivosti na virusne infekcije.

Usled oslobađanja kateholamina pod dejstvom stresora dolazi do povećanja broja otkucaja srca, minutnog volumena i vazokonstrikcije perifernih arterija, što uzrokuje hipertenziju. Pod dejstvom simpatikusa dolazi do aktivacije i taloženja trombocita, vaskularne hipertrofije i hronično povišenog krvnog pritiska. Ukoliko ove promene perzistiraju, mogu dovesti do hipertrofije leve srčane komore i povećanog formiranja plakova, usled čega može doći do infarkta miokarda, arteroskleroze i moždanog udara.

Stres je povezan sa povećanim psihijatrijskim morbiditetom, kao i povećanim rizikom od pojave recidiva kod brojnih psihijatrijskih poremećaja. Dokazano je da produžena proizvodnja proinflamatornih citokina, koja se javlja usled stresa, uzrokuje depresiju [10].

Upravljanje stresom

Postoji veliki broj tehnika za upravljanje stresom (sa različitim nivoima empirijske podrške) – psihoterapija, masaža, meditacija, joga, različite tehnike relaksacije koje uključuju autogeni trening, progresivno opuštanje mišića, tehniku dijafragmalnog disanja.

Fizičko vežbanje se često preporučuje kao deo programa upravljanja stresom. Dokazano je da se vežbanjem smanjuju hormoni stresa i reaktivnost na stres. Vežbe prilagođene stepenu fizičkih mogućnosti i nivou motivacije osobe smatraju se odličnim početnim pristupom u upravljanju psihičkim stresom. Dovoljno je početi sa umerenom fizičkom aktivnošću, npr. hodanjem, 15–20 minuta, tri puta nedeljno. Samo jedan tretman vežbanja od 20 minuta može smanjiti nivo akutnog stresa, dok je kod osoba sa hroničnim stresom za poboljšanje potrebno 10 ili više nedelja [10].

Fizička aktivnost

Fizička aktivnost predstavlja svaki vid pokreta tela koji povećava energetske potrošnje iznad potrošnje u mirovanju, a može se sprovoditi u različitim oblicima i intenzitetima [11]. Samim tim, fizička aktivnost podrazumeva i svakodnevne aktivnosti poput hodanja, penjanja uz stepenice, rada u kući [12].

Pouzdana procena fizičke aktivnosti u slobodnom životnom okruženju je i dalje polje diskusije istraživača. Ovakva procena uključuje upotrebu brojnih uređaja, uključujući direktnu i indirektnu kalorimetriju, praćenje fizioloških markera, mehanički i elektronski monitoring, senzore pokreta i direktno posmatranje. Ograničenja ovako dobijenih podataka postaju evidentna kada se uzme u obzir da ovakva ispitivanja variraju u validnosti, pouzdanosti, stepenu nametljivosti, ceni, administraciji i namenskoj upotrebi. Ograničenjima doprinose i raznovrsnost aktivnosti kojima su ispitanici bili podvrgnuti i varijabilnost među samim ispitanicima [3].

Fizička aktivnost nije važna samo kao primarna prevencija mnogih hroničnih bolesti, već i kao sekundarna prevencija koja usporava i smanjuje simptome hroničnih bolesti. Osim uticaja na hronične bolesti, fizička aktivnost povoljno utiče i na poboljšanje samopouzdanja, društvenih veština, kognitivnog funkcionisanja, smanjuje simptome stresa, što zajedno sa ostalim pozitivnim efektima doprinosi boljem kvalitetu života [13].

Efekti fizičkog vežbanja

Fizičko vežbanje podrazumeva plansku i svrsishodnu fizičku aktivnost, čiji je primarni cilj očuvanje i unapređenje zdravlja i fizičke kondicije.

Rezultati postojećih istraživanja pokazuju da fizičko vežbanje može da utiče na kognitivno funkcionisanje tokom čitavog životnog veka, direktno, kroz fiziološke mehanizme i strukturne promene u mozgu, a indirektno kroz uticaj na raspoloženje i smanjenje stresa. Međutim, istraživanja pokazuju da efekti fizičkog vežbanja zavise od intenziteta fizičke aktivnosti – dok umereni intenzitet fizičke aktivnosti pozitivno utiče na kognitivno funkcionisanje, vežbe visokog intenziteta pokazuju suprotan efekat. Takođe, istraživanja sugerišu da efekat fizičkih vežbi na kognitivno funkcionisanje zavisi od vrste fizičke aktivnosti koja se praktikuje. Sve u svemu, fizičke vežbe mogu proizvesti pozitivne efekte u kontekstu različitih kognitivnih procesa, ali istraživanja još uvek ne nude jasan mehanizam ovog uticaja. Takođe, nema jasnih odgovora na pitanja u kojoj meri se efekti različitih fizičkih aktivnosti razlikuju i da li su ti efekti specifični za određene kognitivne procese ili se neki od njih mogu generalizovati na celokupno kognitivno funkcionisanje [14].

Dokazano je da redovne fizičke vežbe imaju pozitivne efekte u kognitivnim, emocionalnim i motoričkim domenima, uporedo sa smanjenjem stresa i redukcijom

negativnih uticaja. Takođe, imaju preventivnu ulogu u anksioznim i depresivnim stanjima i ollašavaju psihološko blagostanje i adolescenata i odraslih [15].

Milani i Lavie (2009), u studiji sprovedenoj kod pacijenata sa koronarnom arterijskom bolešću, navode stres kao nezavisan faktor rizika smrti, a vežbanje može efikasno smanjiti njegovu prevalencu. Ističu da vežbanje smanjuje smrtnost kod ovih pacijenata, što je posredovano blagotvornim efektom fizičkih vežbi na stres [16].

Kim i McKenzie (2014) u zaključku istraživanja sprovedenog na grupi studenata navode da fizičko vežbanje doprinosi efikasnom suočavanju sa problemima, dok poboljšano suočavanje sa stresom utiče na regulaciju zdravstvenog ponašanja blagostanja, što dovodi do opšteg blagostanja [17].

Cilj istraživanja sprovedenog u Srbiji bio je da se ispituje značaj fizičkog vežbanja i mehanizma za upravljanje stresom u kontekstu indikatora mentalnog zdravlja u uslovima socijalne izolacije tokom zaključavanja izazvanog pandemijom COVID-19. Uzorak se nalazio od 680 odraslih (66% žena), čija je prosečna starost 35,91 godina. Rezultati su ukazali na značajnu vezu između fizičkog vežbanja i smanjenog odgovora na stres [18].

Fizičko vežbanje, kroz različite mehanizme, ima snažan uticaj na ispoljavanje nivoa stresa. Biološki mehanizam se odnosi na regulaciju lučenja hormona kortizola i adrenalina i poboljšanje funkcije autonomnog nervnog sistema. Oslobađanjem endorfina dolazi do poboljšanja raspoloženja i smanjenja anksioznosti [19]. I na kraju, socijalni efekat ogleda se u jačanju društvenih veza, posebno kroz organizovane grupne aktivnosti, jer dovodi do povećanja socijalne interakcije, čime se stvara snažna mreža podrške i dodatno redukuje stres [20].

U istraživanju sprovedenom u Sjedinjenim Američkim Državama 2013. godine, 70% muškaraca i 56% žena navodi da vežba minimum jednom nedeljno. Kao jedan od razloga za ovako nizak stepen bavljenja nekom vrstom fizičkog vežbanja žene ističu društvene obaveze i izazove sa kojima se svakodnevno susreću, kao i veći osećaj stresa. Čak 43% žena, u poređenju sa 34% muškaraca, izjavilo je da je izbegavalo vežbanje zbog stresa. Međutim, uprkos tome, pozitivne efekte vežbanja prijavilo je više žena, 57%, u poređenju sa 48% muškaraca [21].

Zaključak

Fizička aktivnost kroz različite aspekte utiče na redukciju stresa. Iako različite faze života nose sa sobom različite izazove i stresore, fizička aktivnost je univerzalna strategija za poboljšanje fizičkog i mentalnog zdravlja [22]. S obzirom na to da su u zaključcima brojnih istraživanja istaknute polne i individualne razlike, poželjno je definisati jasan pristup planiranja i sprovođenja fizičkih aktivnosti. Pri tome, treba imati u vidu i nedostatak vremena, motivacije i ekonomskih ograničenja koji umnog-

me utiču na procenat bavljenja nekom vrstom fizičkog vežbanja, zbog čega je važno razviti pristup koji će otkloniti ove barijere.

S obzirom na to da je u pitanju pregledni rad, dozvola Etičkog odbora nije potrebna. Sukob interesa ne postoji.

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PHYSICAL EXERCISE AS A STRESS MANAGEMENT MECHANISM

Abstract: The way of reacting to potentially stressful situations is individual and depends on two basic factors. The first is the way a person perceives and interprets the situation, and the second factor relates to the state of the body itself, or the organism. Chronic stress, burnout syndrome and post-traumatic stress disorder often lead to the development of diseases. Stress can affect health directly, through the autonomic and endocrine reactions it causes, but also indirectly, through changes in health behavior that can occur due to stress.

Physical exercise is often recommended as part of a stress management program. It has been proven that exercise reduces stress hormones and stress reactivity. Exercises adapted to the degree of physical capabilities and the levels of motivation of the person are considered an excellent initial approach to managing psychological stress. Physical activity is important not only as a primary prevention of many chronic diseases, but also as a secondary prevention that slows down and reduces the symptoms of chronic diseases. In addition to its impact on chronic diseases, physical activity also has a beneficial effect on improving self-confidence, social skills, cognitive functioning, and reducing symptoms of stress, which, together with other positive effects, contributes to a better quality of life.

The results of existing research show that physical exercise can affect cognitive functioning throughout the lifespan directly, through physiological mechanisms and structural changes in the brain, and indirectly through its impact on mood and stress reduction. Physical exercise, through various mechanisms, has a strong impact on the manifestation of stress levels.

Keywords: stress, physical activity, physical exercise, health

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Introduction

In recent decades, the modern way of life has implied an extremely demanding and fast pace, insufficient physical activity, inadequate nutrition, and daily stress. Stress is described as an autonomous non-specific response of the body to physical, mental, and constant environmental demands placed on a person [1]. On the other hand, there is a significant lack of time and resources which would enable the adoption of mechanisms for effectively managing stress and engaging in physical activity. All of these factors lead to the deterioration of health. Almost on a daily basis, a person experiences minor or major stressful event, which often has chronic stress as its underlying cause. Therefore, stress not only threatens personal experience of happiness and well-being, but it also represents a serious health risk [2]. Although the health benefits of moderate exercise, i.e., moderate physical activity, are well established, more than 60% of adults globally do not exercise regularly, and 25% lead a sedentary lifestyle [3].

Stress

Stress can be defined as a disruption of the body's homeostasis, excessive emotional and physiological arousal that is experienced in a threatening situation. "Stress is a non-specific biological response (both physical and mental) to any unusual demand that exceeds the adaptive capacity of the body" [4]. Stress is described as an autonomous non-specific response of the body to physical, mental, and constant environmental demands [1].

Harmful agents, also called stimuli, which cause stress, are called stressors. Stressors are categorized into several types: psychological (frustration, sadness, fears, bullying), physical (trauma, noise, extreme effort), and social (divorce, job loss, financial crisis). Stress is often viewed negatively, but it is important to note the two existing types: eustress and distress. Eustress represents positive stress, which keeps the body alert. It is characterized by excitement, short duration, and increased efficiency. Positive stressors, or eustressors, may include job changes, promotions, marriage, or vacations. Distress is negative stress, which results from prolonged stress exposure, leading to overload. Distress features include anxiety, worry, reduced efficiency, and various somatic symptoms such as headaches, hypertension, and chest pain. Common distress sources are the death of a loved one, divorce, illness, and financial difficulties [5].

Based on its duration and frequency, stress can be classified as:

a) Acute stress – arises from recent environmental pressures of future expectations, and triggers a "fight or flight" response, which brings the body to either a reactive or adaptive state towards the stressor;

- b) Episodic acute stress – caused by frequent recurrence of acute stress episodes;
- c) Chronic stress – results from prolonged exposure to stressful situations, especially in family or work life;
- d) Post-traumatic stress disorder– occurs when a stressor persists within the body for years, with repeated traumatic events [6].

Mechanisms of Stress Development

Understanding brain regions involved in physiological responses to stress is an important endeavor, as a growing number of studies link neuronal activity during exposure to stressors with resulting physiological reactions. In the recent few decades, scientific research has explained the physiological mechanisms of stress and its impact on health. Stress activates the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis, triggering inflammatory processes that correlate with weakened immunity and various chronic diseases [2]. From the perception of a stressor to the response in the nervous system, the following five levels are involved in the following order:

- Input and interpretation of sensory information (associative and prefrontal cortex, hippocampus);

- Emotional evaluation (prefrontal-amygdala activity);

- Initiation of neuroendocrine responses (hypothalamus and paraventricular nuclei);

- Feedback from autonomic and endocrine systems (aminergic nuclei of the brainstem);

- Autonomic and endocrine response (pituitary gland and adrenal glands).

Physiological stress responses are mainly regulated by the sympatho-adrenal-medullary system and the hypothalamic-pituitary-adrenal cortical axis. Due to the effects of the stressors, the hypothalamus sends sympathetic impulses to various organs and releases adrenaline and noradrenaline into the bloodstream. During intense stress, the body is flooded with these hormones, amplifying sympathetic effects and increasing secretion of adrenocorticotrophic hormone via feedback with the hypothalamus. Adrenocorticotrophic hormone stimulates the adrenal cortex to produce cortisol. Cortisol provides extra energy by increasing amino acids in the blood, releasing fatty acids, and generating glucose. However, prolonged high cortisol levels can reduce glucose utilization, increase fat accumulation, impair memory, and weaken the body's immune function. B-endorphin is also released to prepare the body for potential pain. Stress also alters thyroid-stimulating hormone levels, usually reducing them. All of these mechanisms trigger further bodily responses [7].

Body's Response to Stress

The response to a potentially stressful situation is individual and depends on two main factors. The first factor regards the person's perception and interpretation of the situation, and the second one regards the state of the body itself [8].

Selye (1975) noted that stressors lead to the development of the general adaptation syndrome. He noted that regardless of stressor intensity, the body develops one unspecific response, during which cortex activity is being increased and thymus, spleen, lymph nodes, and other lymphatic structures are being reduced. The general adaptation syndrome consists of three phases:

Alarm phase, which lasts from few hours to a few days, and brings increased adrenal, cardiovascular, and respiratory activity;

Resistance phase, in which the stressor stays relatively present, but resistance to other stressors decreases;

Exhaustion phase, which means prolonged or repeated exposure to a strong stressor reduces the neuroendocrine system's capacity, potentially leading to disease or death. Decreased cortisol levels impair the inhibitory response of the sympathetic nervous system, resulting in chronic stress, burnout, or post-traumatic stress disorder [4].

Šupe et al. (2011) categorized stress responses into physiological/physical and psychological:

Physical/physiological reactions consist of: tachycardia, arrhythmia, high blood pressure, rapid breathing, sweating, constipation/diarrhea, muscle tension, headaches, vasoconstriction, elevated glucose and cholesterol, weakened blood-brain barrier, reduced pain sensitivity, sexual dysfunction, altered immune response.

Psychological reactions can include:

Cognitive reactions: attention, memory, concentration issues, altered reasoning and judgment;

Emotional reactions: fear, sadness, depression, aggression, hypersensitivity, irritability, helplessness, hopelessness, appetite changes, sexual desire changes, insecurity, and social withdrawal;

Behavioral reactions: neglect of responsibilities/hygiene, loss of motivation, addictive behaviors, physical inactivity, and sedentary lifestyle [6].

Impact of Stress on Health

Chronic stress, burnout, and post-traumatic stress disorder frequently lead to disease. Stress affects health directly via autonomic and endocrine responses and indirectly through health behavior changes. Long-term stress causes allosteric load,

or simply put, overuse of physiological systems. This causes a shift in the dominance in the autonomic nervous system toward sympathetic over parasympathetic activity, contributing to mental disorders, hypertension, coronary heart disease, and diabetes [9].

Chronic stress is linked to gastrointestinal disorders (irritable bowel disease, peptic ulcer, ulcerative colitis). Furthermore, there is a 40% increased risk of ulcers in individuals with stress-induced poor habits (e.g., irregular diet, smoking, alcohol, poor sleep). Stress causes immune dysregulation, reducing wound healing, antibody response, and increasing susceptibility to infections.

Due to the stress induced catecholamine release, the heart rate, cardiac output, and peripheral vasoconstriction increase, causing hypertension. Sympathetic activation leads to platelet aggregation, vascular hypertrophy, and left ventricular hypertrophy, potentially resulting in a heart attack, atherosclerosis, or a stroke. Stress is associated with increased psychiatric morbidity, as well as with an increased relapse risk in many psychiatric disorders. It has been proven that prolonged cytokine production due to stress causes depression [10].

Stress Management

There are many stress management techniques (with varying levels of empirical support), including psychotherapy, massage, meditation, yoga, and relaxation techniques such as autogenic training, progressive muscle relaxation, and diaphragmatic breathing. Physical exercise is frequently recommended as part of stress management programs. It reduces stress hormones and stress reactivity. Exercises tailored to physical ability and motivation levels are an excellent starting point for managing psychological stress. Moderate activity like walking for 15–20 minutes three times a week is sufficient. A single 20-minute session can reduce acute stress, while the improvement in a chronic stress patient typically requires a minimum of 10 weeks of regular exercise [10].

Physical Activity

Physical activity includes any body movement which increases energy expenditure above resting levels, while being performed in various forms and intensities [11]. This includes daily activities like walking, stair climbing, and housework [12].

Accurately assessing physical activity in natural settings remains a topic of discussion among researchers. It involves various devices such as both direct and indirect calorimetry, tracking of physiological markers, mechanical/electronic monitoring, motion sensors, and direct observation. However, variability in activity type and individual differences create limitations in data reliability, validity, intrusiveness, cost, and purpose [3].

Physical activity is important not only for primary prevention of many chronic diseases but also for secondary prevention, helping reduce symptoms. It also improves self-confidence, social skills, cognitive functioning, and reduces stress symptoms, contributing to better quality of life [13].

Effects of Physical Exercise

Physical exercise is a planned, purposeful physical activity aimed at maintaining or improving health and fitness.

Existing research shows that exercise can impact cognitive functioning across the lifespan both directly, through physiological mechanisms and brain structure changes, and indirectly, by improving mood and reducing stress. However, effects vary based on intensity—moderate-intensity improves cognition, while high-intensity may have the opposite effect. Effects also vary by type of activity. Overall, physical exercise benefits various cognitive processes, but no clear mechanism has yet been identified. It's also unclear to what extent different activities affect specific versus general cognitive functioning [14].

It has been proven that regular physical exercise has positive effects in cognitive, emotional, and motor domains, along with stress reduction and the mitigation of negative influences. It also plays a preventive role in anxiety and depressive states and facilitates psychological well-being in both adolescents and adults [15].

Milani and Lavie (2009), in a study conducted on patients with coronary artery disease, identify stress as an independent risk factor for mortality, and exercise can effectively reduce its prevalence. They emphasize that exercise reduces mortality in these patients, which is mediated by the beneficial effects of physical exercise on stress [16].

Kim and McKenzie (2014), in the conclusion of a study conducted on a group of students, state that physical exercise contributes to effective problem coping, while improved stress management influences the regulation of health behavior related to well-being, leading to overall wellness [17].

The goal of a study conducted in Serbia was to examine the importance of physical exercise and stress management mechanisms in the context of mental health indicators during social isolation caused by the COVID-19 lockdown. The sample consisted of 680 adults (66% women), with an average age of 35.91 years. The results indicated a significant connection between physical exercise and a reduced stress response [18].

Physical exercise, through various mechanisms, has a strong impact on the manifestation of stress levels. The biological mechanism relates to the regulation of cortisol and adrenaline hormone secretion and the improvement of autonomic nervous system function. The release of endorphins leads to improved mood and reduced anxiety [19]. Finally, the social effect is reflected in the strengthening of social bonds,

especially through organized group activities, as this increases social interaction, creating a strong support network and further reducing stress [20].

In a study conducted in the United States in 2013, 70% of men and 56% of women reported exercising at least once a week. One of the reasons for such a low level of engagement in physical exercise among women includes social obligations and daily challenges, as well as a higher sense of stress. As many as 43% of women, compared to 34% of men, stated that they avoided exercising due to stress. However, despite this, more women reported positive effects from exercising—57%, compared to 48% of men [21].

Conclusion

Physical activity, through various aspects, influences stress reduction. Although different life stages bring various challenges and stressors, physical activity is a universal strategy for improving physical and mental health [22].

Given that many studies have highlighted gender and individual differences, it is advisable to define a clear approach to planning and implementing physical activities. In doing so, it is also important to consider the lack of time, motivation, and economic constraints that significantly affect the rate of participation in physical exercise, making it crucial to develop an approach that eliminates these barriers.

Since it is a review paper, the permission of the ethics committee is not required. There is no conflict of interest.

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