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MANAGEMENT OF PLATELETS LEVEL WITH THE HELP OF PHYSICAL EXERCISES

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Abstract: Platelet management with physical exercise requires a cautious approach. Regular, moderate-intensity workouts can enhance platelet function by improving blood flow and reducing clotting risk. However, strenuous exercise can transiently lower platelet count, potentially increasing bleeding risk. Monitoring platelet levels is crucial, especially in those with underlying conditions. Maintaining hydration, balancing aerobic and strength training, and avoiding vigorous activity during low platelet counts are essential. Consult a healthcare expert for a personalized exercise regimen that prioritizes platelet health while promoting overall fitness**.**

Index Terms **– Platelets count, Stress reduction, relaxation techniques, blood cell.**

I. INTRODUCTION

Platelets, or thrombocytes, are small, colorless cell fragments in our blood that form clots and stop or prevent bleeding. Platelets are made in our bone marrow, the sponge-like tissue inside our bones. Bone marrow contains stem cells that develop into red blood cells, white blood cells, and platelets. Platelets were recognized as a distinct blood element in the late 19th century; the seminal work by bizzozero in 1882 demonstrated that platelets (and not white blood cells) were responsible for formation of "white" clots at the sites of vascular injury in guinea pig microvessels in vivo [BIZZOZERO J. , 1882]Platelets play an important role in the vessel. Following their formation from megakaryocytes, platelets exist in circulation for 5–7 days and primarily function as regulators of hemostasis and thrombosis. Following vascular insult or injury, platelets become activated in the blood resulting in adhesion to the exposed extracellular matrix underlying the endothelium, formation of a platelet plug, and finally formation and consolidation of a thrombus consisting of both a core and shell. This research paper on management of platelets with physical exercises regular physical training reduces CV death and rehospitalization in patients affected by coronary artery diseases (CAD) [*EUR. HEART J,2021, SHARMA S. ET AL,2021]*.

II. MAIN FUNCTIONS OF PLATELETS IN THE HUMAN BODY

1. **Hemostasis**: Platelets are essential for preventing excessive bleeding when a blood vessel is damaged. When a blood vessel is injured, platelets quickly adhere to the site of injury and form a temporary plug. This initial plug prevents further blood loss until more permanent clotting mechanisms can take over.[J.N. Thon, 2010]
2. **Coagulation**: Platelets release chemical signals that activate the coagulation (clotting) cascade. This cascade involves a series of enzymatic reactions that ultimately lead to the formation of a stable blood clot. Fibrin, a protein, forms a mesh that traps blood cells to create a more durable clot.
3. **Vasoconstriction**: Platelets release substances that cause the blood vessels to constrict or narrow at the site of injury. This constriction helps reduce blood flow to the injured area, further limiting blood loss.
4. **Inflammation and Immunity**: Platelets contain proteins and molecules that are involved in the body's immune response and inflammatory processes. They can release cytokines and chemokines, which help regulate immune responses and inflammation.[Sharda A., 2018]
5. **Wound Healing**: Platelets also contain growth factors that play a role in tissue repair and regeneration. They stimulate the healing of damaged tissues and blood vessels.[Kapoor S. et al, 2019]
6. **Maintenance of Vascular Integrity**: Platelets help maintain the integrity of the blood vessel walls by releasing factors that promote repair and regeneration of damaged endothelial cells, which line the inner surface of blood vessels.

Platelets are vital for maintaining the balance between bleeding and clotting in the human body. Their ability to form clots at the site of vascular injuries is essential for preventing excessive bleeding and promoting wound healing. Problems with platelet function can lead to bleeding disorders or clotting disorders, emphasizing the importance of their role in the body. They secrete chemicals that attract neutrophils and monocytes to sites of inflammation. They internalize and destroy bacteria and particulate debris in the bloodstream. They secrete growth factors that stimulate mitosis in fibroblasts and smooth muscle and thus help to maintain and repair blood vessels.

III. PHYSIOLOGY OF PLATELETS PRODUCTION

Platelets are the second most abundant cell type in blood and play an essential role in the immune response by orchestrating blood coagulation during wound healing [Dibben G. et all, 2021]Because of their short life span of under 10 d, it is critical for the body to be able to constantly replenish platelets in the blood stream, and low platelet counts are indeed associated with a slew of pathologies with major health and economic consequences

The baseline platelet count, which refers to the normal range of platelets in the bloodstream, is typically between 150,000 and 450,000 platelets per microliter of blood. Several factors can influence an individual's baseline platelet count, causing it to fall within or outside this normal range.

Here are some of the key factors that can affect baseline platelet counts:

Age: Platelet counts can vary with age. In general, infants and young children tend to have slightly higher platelet counts than adults. Platelet counts may decrease as a person gets older.

Genetics: Genetic factors can influence baseline platelet counts. Some individuals may have a naturally higher or lower platelet count due to their genetic makeup.

Gender: There can be slight differences in baseline platelet counts between males and females. Women often have slightly higher platelet counts than men.

Ethnicity: Platelet counts can also vary by ethnicity. Some ethnic groups may have different baseline platelet count ranges.

Medications: Certain medications, such as chemotherapy drugs, antibiotics, and anticonvulsants, can affect platelet production or lead to platelet destruction, potentially causing a decrease in platelet count.

Medical Conditions: Various medical conditions can impact baseline platelet counts. For example:

- **Bone Marrow Disorders:** Conditions like leukemia, myelodysplastic syndrome, and aplastic anemia can affect platelet production.
- **Autoimmune Disorders:** Conditions like immune thrombocytopenia (ITP) can result in low platelet counts due to the immune system mistakenly attacking platelets.
- **Infections:** Certain infections, like HIV, hepatitis C, or sepsis, can lead to decreased platelet counts.
- **Liver Disease:** Liver diseases can impair the production of thrombopoietin, which is necessary for platelet production.
- **Hematologic Disorders:** Disorders affecting other blood components, such as red or white blood cells, can indirectly affect platelet counts.

Diet and Nutrition: Nutritional deficiencies, particularly deficiencies in vitamin B12 and folate, can impact platelet production.

Pregnancy: Platelet counts can decrease during pregnancy, which is known as gestational thrombocytopenia. This is usually mild and does not require treatment.

Lifestyle Factors: Factors such as smoking, excessive alcohol consumption, and certain environmental exposures can affect platelet counts.

Stress and Exercise: Acute stress and intense physical activity can temporarily increase platelet counts due to the body's response to these stressors.

IV. MISBALANCE IN PLATELETS

Platelets have a typical diameter of ~2–3 μm. Platelets circulate in a discoid form and their average lifespan in humans is ~10 days. However, following activation, they undergo dramatic changes in shape and ultrastructure; the membranes become ruffled with cytoplasmic projections and the granules are centralized and discharged. Normal human platelet count is ~150,000–400,000/μl.

Sometime due to some cause's platelets count may be misbalanced. These conditions are described as: -

1.Thrombocythemia
2.Thrombocytopenia

4.1 Thrombocythemia

Thrombocythemia is a disease in which your bone marrow makes too many platelets. Platelets are blood cell fragments that help with blood clotting. Having too many platelets makes it hard for your blood to clot normally. This can cause too much clotting, or not enough clotting. Primary thrombocythemia is more common in people ages 50 to 70, but it can occur at any age. It is more common in women than in men. A high platelet count is 400,000(400×10^9 /L) or above

Sign of thrombocythemia: -

- Confusion or changes in speech
- Migraines
- Seizures
- Upper body discomfort in one or both arms, your back, neck, jaw or abdomen
- Shortness of breath and nausea (feeling sick to your stomach)
- Weakness
- Chest pain
- Pregnancy complication

4.2 Thrombocytopenia

This condition can range from mild to severe, depending on its underlying cause. Some people with thrombocytopenia may not experience any symptoms; for more severe cases, uncontrollable bleeding can result in death. A person with thrombocytopenia will have a platelet count **below 150,000/μl.**

Thrombocytopenia may make it difficult for the body to stop bleeding following an injury. Bleeding can occur inside the body, beneath the skin, or at the surface of the skin. Bleeding causes the main symptoms of

thrombocytopenia. Symptoms can appear suddenly or over time. Mild thrombocytopenia often has no symptoms. Many times, it is found during a routine blood test.

Signs of thrombocytopenia may include: -

- Bleeding that lasts a long time, even from small injuries
- Petechiae, which are small, flat red spots under the skin caused by blood leaking from blood vessels
- Purpura, which is bleeding in your skin that can cause red, purple, or brownish- yellow spots
- Nosebleeds or bleeding from your gums

Blood in your urine or stool, which can appear as red blood or as a dark.

4.3 Diagnosis of misbalance in Platelets

To diagnose thrombocythemia or thrombocytosis, your provider will ask about your medical and family history. They will ask about your symptoms and do a physical exam to look for signs of blood clots or bleeding.

Your provider may also order one or more of the tests below.

- **Complete blood count (CBC):** A complete blood count (CBC) measures the levels of red blood cells, white blood cells, and platelets in your blood.
- **Blood smear:** For this test, some of your blood is put on a slide. A microscope is used to look at your platelets and other blood cells.
- **Bone marrow tests:** These tests check whether your bone marrow is healthy.
- **Genetic testing:** This test checks for mutations, or changes, in genes that control how your body makes platelets

V. PHYSICAL EXERCISES FOR MANAGEMENT OF PLATLET COUNT

Regular habitual exercise reduces CVD incidence by improving hemostatic profile both at rest and during exertion. On the contrary, strenuous exercise without training may also lead to sudden cardiac death and venous thromboembolism in subjects with or without underlying vascular disease [Sharma S., 2015, Thrall G., 2005, Hilberg T., 2021].

Moderate-intensity exercise exerts inhibitory effects on platelets, while strenuous exercise stimulates platelet aggregation and activation [Kestin A.S. et al,1993]. While 20-min cycling at 70–80% of the maximal heart rate causes a significant increase in platelet aggregation to agonists, a 12-week regular exercise training blunts platelet hyperreactivity in response to acute exercise in healthy subjects [Wang J.S. et al, 1997].

The integrated meditative yoga module for high risk pregnant women developed by a team consisting of two senior yoga faculties of the Yoga research foundation (VYASA) and an obstetrician with knowledge of yoga, was used [Table 1]. This one-hour daily practice started with a prayer followed by a short session (3-5 minutes) of theory that was aimed at giving an understanding of the holistic approach of yoga. The practices were aimed at achieving a state of deep alertful rest at physical and mental level that may promote rapid adaptation to physiological or emotional challenges. The module consisted of a few preparatory loosening body movements and breathing practices, safe asanas in supine position, deep relaxation with guided imagery, pranayama and meditation using visualization and sound resonance [Table 1].

Practices	Duration
Hasta āyama śvasanam (hands in and out breathing)	2 min
Hastavistāra śvasanam (hands stretch breathing)	2 mins
Gulphavistāra śvasanam (ankles stretch breathing with wall support)	1 min
Kaṭiparivartana śvsanam (side twist breathing)	2 min
Deep relaxation	10 mins
Uttānapādāsana śvasanam (leg raise breathing)	2 min
Setubandhāsana śvasanam (hip raise breathing)	2 min
Pādasañcālanam (cycling in supine pose)	2 min
Supta udarākarṣaṇasana śvasanam (supine abdominal stretch breathing)	2 min
Vyāghrāsana śvasanam (tiger stretch breathing)	2 min
Deep relaxation	5 mins
Gulphagūraṇam (ankle rotation)	2 mins
Jānuphalakākarṣaṇam (kneecap contraction)	2 min
Relaxation techniques	
Deep relaxation	10 mins
Pranayama	
Nāḍīśuddhi pranayam (alternate nostrils breathing)	2 mins
Deep relaxation in matsyakrīḍāsana (lateral shavasana)	10 mins
Meditation techniques	
Jyotitrāṭaka (eye exercises)	2 mins
MIRT (mind imagery technique), guided visualization, final relaxation	30 mins

Table 1

Yoga interventions
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The control group received standard care plus prenatal exercises offered by the hospital. Walking for half an hour morning and evening was the standard exercise prescribed routinely. Standard care offered to both groups included:

After exercise, several studies found increased plasma levels of β-thromboglobulin [Surui H. et al, 1987] and platelet factor 4 [Knudsen J.B. et al, 1982]. As both β-thromboglobulin and platelet factor 4 represent very sensitive marker of platelet activation, these findings represent strong evidence that exercise activates platelets, although a small number of studies reported unchanged [Cadroy Y. et al, 2002] or decreased [Aldemir H., 2005] levels of β-thromboglobulin after exercise.

1) Naukasana -
. This pose helps in increasing the strength of your body.
If you do this yoga practice regularly, then your body starts getting stiff and your immunity power increases.
Naukasana is a Stress Remover Pose and you should practice this pose for at least 30 seconds.
2) Hal asana –
This pose is very helpful in weight loss and mental strength increase.
The best thing is that practicing for the long term increases your immunity.
If your platelets are low then this pose helps in increasing them.
Hal asana makes the circulation of blood in your body flow in the reverse direction, you should do this pose for at least 60 seconds.
3) Tad asana –
Tad asana is a straight pose that is known to increase height and strength.
Doing Tad asana increases your body's Flexibility and Blood Circulation.
It also works as a Booster for your Immunity.
In Tadasana, we stretch our complete body as above, you should do this pose for at least 70 seconds.
4) Kagasana –
Kagasana is a medium-level pose. This pose is quite easy to do.

This pose helps in reducing the weight of your Lower Body Fat, Hip, Thigh, etc.
It increases the flexibility of your body. By practicing it in the long term, the RBC, WBC, and platelets of your blood are all maintained.
In this pose, you squeeze your lower abdomen inwards, you should do this pose for at least 20 to 30 seconds.

5) Malasana -

Malasana is a medium-level yoga practice. This is a setting pose that is a panacea for your knee and thigh.
You can practice this pose regularly.
By doing this pose, you can fix your external disease as well as your internal disease.
It is an immunity booster and maintains blood circulation and helps in fixing internal diseases.
In this pose, we stretch our knee from the elbow, you should do this pose for at least 40 seconds
Available evidence suggests that the platelet count increases after short-term exercise, with favorable effects on platelet aggregation and activation, in both men and women.[El-Sayed MS, 2004]
Yoga is known to induce beneficial effects on the physiological, biochemical, psychological, and cognitive functions, with a significant influence on blood coagulation and other metabolic processes. Chohan *et al*.[Chohan IS, 1984]
The reason for this benign physiological thrombocytopenia, although not clear, appears to be relative due to the increased plasma volume resulting from hemodilution. [McCrae KR, 2010] Increased platelet consumption by the physiological hypercoagulability or decreased platelet production [Silver RM et al, 1999] seem to be the other contributory factors

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