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A comparative study of effect of exercise on physiological and biochemical blood parameters in Indian and the Indian origin Mauritian population

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Abstract
Numerous reports have emerged regarding fatalities following gym exercises, notably observed within both the Indian and Indian-origin Mauritian populations. Within these regions, there is a prevailing sentiment attributing the current state of affairs to excessive exercise.

Keywords: Physiological parameters, biochemical parameters, Blood Parameters, exercise

Introduction
Numerous reports have emerged regarding fatalities following gym exercises, notably observed in Indian and population. Reports of fatalities following exercise in Mauritius have surfaced, prompting concerns and inquiries into the underlying causes and contributing factors to such incidents. Within these regions, there is a prevailing sentiment attributing the current state of affairs to excessive exercise.

The term "exercise" denotes structured, repetitive, and intentional physical activity aimed at enhancing or maintaining one or more aspects of physical fitness [1]. Exercise physiology has emerged as a significant area of study, propelled by pioneering work within cardiovascular rehabilitation centers that have underscored exercise's therapeutic potential in aiding the recovery of cardiac and other patients [2]. The relationship between physical activity and disease susceptibility is well-documented, with sedentary lifestyles often predisposing individuals to various health risks [3]. Empirical evidence from the fields of physical education, exercise physiology, and medicine robustly supports the scientific validity of exercise interventions [4]. Research indicates that interventions incorporating physical exercise have effectively reduced both systolic and diastolic blood pressure levels in hypertensive adults [5]. Similar benefits have been observed in adolescents [6-8]. Given the potential persistence of blood pressure patterns from adolescence into adulthood, early intervention through exercise is crucial [9]. Regular engagement in mild physical activities, following a structured exercise regimen, can lead to significant reductions in systolic blood pressure, yielding antihypertensive effects [10]. Although the precise mechanisms underlying blood pressure reduction remain incompletely understood, evidence suggests associations with sodium depletion, decreased blood volume, and prolonged exercise-induced sweating [11]. Exercise complements sodium restriction and diuretic therapy in managing moderate hypertension [12].

Caspersen *et al*. (1985) delineated physical activity as voluntary musculoskeletal motion with variable energy expenditure, directly correlated with physical fitness [5]. They distinguished exercise as systematic, voluntary muscle contraction with varying energy expenditure levels, aiming to preserve or enhance physical fitness [6]. In terms of health outcomes, exercise intensity, frequency, and duration should surpass resting metabolic energy expenditure levels [8]. Recent research underscores the health benefits of activities like standing, which engage major muscle groups, particularly in the core and lower body [7].

Edward M. and colleagues proposed standardized definitions aligned with the International System of Units (SI) to describe muscle function and exercise-induced physiological responses [8]. Exercise, characterized by muscle activity, perturbs homeostasis and encompasses concentric, eccentric, or isometric muscle contractions [9]. It's widely acknowledged that exercise initially elevates blood clotting propensity, attributed to increased platelet count mobilized by catecholamine secretion [9]. However, long-term exercise fosters a balanced increase in clotting tendency and fibrinolytic activity, mitigating the risk of blood clot formation [10]. Hypertension etiology varies with age, with younger individuals often exhibiting elevated cardiac output, while older individuals commonly present with heightened peripheral vascular resistance and arterial stiffness [11-12]. Consequently, the applicability of current exercise guidelines for hypertension management in older populations remains uncertain.

Is there a difference in the various physiological and biochemical markers before and after exercise? Whether it's only in native Indian population or in people who have migrated to other parts of the world is the question of the hour. So this study puts in a sincere effort to find the answers to the question.

Materials and Methods

The study involved a cohort comprising 30 volunteers from Mauritius and an equal number of age- and morphometrically-matched counterparts. Specifically, the participants were male students aged between 18 and 22 years. Rigorous screening procedures were employed to ascertain normal baseline health measurements. Subsequently, the volunteers were directed to engage in physical activity for a period of 30 minutes, and comprehensive data were collected thereafter.

Faculties of a Medical College, Mauritius were involved for this study. They did the study in Indian origin Mauritian population and the study in the Indian counterpart was done in SMS Jaipur and Dr. SS Tantia Medical College, Hospital and Research Centre.

Data collection encompassed anthropometric parameters, including age, height, weight, and body surface area. Additionally, physiological parameters such as cardiac rhythm, arterial pressure, breathing rate, hemorrhage duration, coagulation duration, white blood cell count, platelet count, C-reactive protein levels, ferritin levels, and d-dimer levels were meticulously measured.

Results

Table 1: Demographic Data

Parameters Indian population	Mean	SD±	Parameters Indian origin Mauritian population	Mean	SD±
Age (years)	31.38	2.48	Age (years)	33.06	2.14
Height (cms)	167.42	7.46	Height (cms)	168.98	6.47
Weight (kgs)	71.60	5.68	Weight (kgs)	73.74	4.46

Table 2: Heart rate before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	81.36	4.57	Before Exercise	88.28	6.82
After Exercise	112.37	8.34	After Exercise	120.28	10.92

Table 3: Change in Respiratory Rate before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	15.38	1.38	Before Exercise	16.28	2.33
After Exercise	22.34	1.44	After Exercise	25.28	3.44

Table 4: Change in Systolic BP before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	115.47	4.58	Before Exercise	127.22	5.93
After Exercise	142.31	8.27	After Exercise	151.28	10.72

Table 5: Change in Diastolic BP before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	83.47	2.12	Before Exercise	87.22	2.39
After Exercise	89.31	1.29	After Exercise	91.28	2.82

Table 6: Changes in bleeding time before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	1.76	0.1	Before Exercise	1.78	0.21
After Exercise	1.51	0.11	After Exercise	1.56	0.23

Table 7: Changes in Clotting time before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	3.49	0.21	Before Exercise	3.62	0.24
After Exercise	3.34	0.16	After Exercise	3.22	0.19

Table 8: Changes in WBC Count in lakhs before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	7610.2	214.68	Before Exercise	6800.65	374.78
After Exercise	8497.67	176.97	After Exercise	7900.4	553.86

Table 9: Changes in Platelet Count before and after exercise

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	2.17	0.12	Before Exercise	2.29	0.19
After Exercise	2.31	0.19	After Exercise	2.54	0.17

Table 10: C - reactive protein (mg/dl)

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	0.48	0.03	Before Exercise	0.92	0.02
After Exercise	2.65	0.65	After Exercise	4.76	1.11

Table 11: D – Dimer (μ/mL)

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	0.29	0.02	Before Exercise	0.34	0.03
After Exercise	0.49	0.07	After Exercise	0.54	0.09

Table 12: Serum Ferritin (ng/mL)

Indian population	Mean	SD±	Indian origin Mauritian population	Mean	SD±
Before Exercise	204.93	20.32	Before Exercise	256.89	10.84
After Exercise	358.35	37.84	After Exercise	405.72	12.94

Discussion

There was a clear cut distinction between the pre and post exercise values and also such marked variation was observed in Indian origin Mauritian population. The deviation of the dietary habits and surrounding geographical variations might have to do with this.

The rationale behind investigating the effects of physical activity on blood clotting and biochemical parameters in healthy individuals is well-founded. Previous studies have highlighted that over 25% of new myocardial infarctions and 14% of sudden cardiac fatalities stem from sporadic bouts of intense physical exertion. With the growing adoption of exercise therapy, many myocardial infarction survivors have undergone such interventions in recent times. Primary focus in medicine always centers on disease prevention and treatment, irrespective of its manifestation. Effectively preventing and managing these conditions hinges upon understanding their etiology and identifying contributing factors. Consequently, contemporary medical research has broadened its scope to encompass various scientific domains.

Medical science has made substantial strides in enhancing health and combating diseases. Notably, eminent physicians have maintained a keen interest in human anatomy, physiology, and biochemistry, recognizing the profound impact of human activities on well-being. Prior to the establishment of empirical evidence-based guidelines, many observers advocated exercise over rest for maintaining and restoring health.

A study was conducted to assess whether physical activity and training heighten the risk of thromboembolism and acute phase biochemical markers. Findings revealed a marginal increase in thrombocytic activity and acute phase biochemical markers, concomitant with a beneficial rise in fibrinolytic activity.

Conclusion

The outcomes of the study offer valuable insights that can be leveraged to promote individual health by bolstering foundational well-being and maximizing performance during future physical activities. Tailored, structured, and recommended exercise regimens are poised to induce favorable physiological responses, thereby augmenting the functional capacity of every bodily system.

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