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THE ROLE OF EXERCISE IN ALLEVIATING DIABETES SYNDROME ACROSS ALL AGE GROUPS IN KOGI STATE

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Abstract
This research investigates the role of exercise as a mitigating factor in alleviating diabetes syndrome across diverse age groups in Kogi State, Nigeria. Diabetes syndrome poses a significant health challenge globally, and its prevalence is on the rise, particularly in regions undergoing rapid socio-economic transitions. The study aims to explore the impact of regular exercise on diabetes prevention, management, and overall well-being, with a focus on its applicability across various age demographics in the specific context of Kogi State. Key variables examined include the frequency, intensity, and types of exercise undertaken by individuals, as well as their knowledge and awareness of the link between physical activity and diabetes. The research also explores socio-cultural factors that may influence exercise behaviors across age groups in the unique socio-economic landscape of Kogi State. To provide evidence-based suggestions for public health interventions, educational programs, and policy initiatives to promote exercise as a preventive and therapeutic measure for diabetes across all age groups.
Keywords: Exercise, Diabetes syndrome, Management and Age group

Introduction
Diabetes got its name from the ancient Greek word for siphon (a kind of tube) because early physicians noted that people with diabetes tended to be unusually thirsty and to urinate a lot. The "mellitus" part of the term is from the Latin version of the ancient Greek word for honey, used because doctors in centuries past diagnosed the disease by the sweet taste of the patient's urine. Diabetes mellitus is a disease condition commonly known to be treated on continuous basis with regular chemotherapy and dietary modification. It is a disease condition that manifests itself as a syndrome, which virtually affects every system of the body. Diabetes impairs the body's ability to adequately utilize blood glucose for energy and keep the blood-sugar-within the normal range. Diabetes primarily affects the metabolism of carbohydrates and consequently that of fats, proteins, fluids and electrolytes. Glucose, being the major source of fuel is normally carried to the body's cells by the blood but the cells need insulin, which is made by the pancreas (an organ just behind the stomach), to allow glucose to move inside. Without insulin glucose accumulate in the blood and then is dumped into the urine by the kidneys. This sometimes happens because the cells of the pancreas that make insulin (beta cells) are mostly or entirely destroyed by the body's own immune system (Barnett & Todd, 2020).

Diabetes mellitus arising from a group of conditions, all of which results in the body being unable to keep the blood glucose-sugar – within the normal range. Thus, the diabetic patient requires a continuous treatment for life. There are two major classes of diabetes:
(1) Insulin Dependent Diabetes Mellitus (IDDM)-Type 1 diabetes
(2) Non-Insulin Dependent Diabetes Mellitus (NIDDM)-Type 2 diabetes
The first group if diagnosed form a kind of diabetes that usually affects young adults below the age of 40years, though with a few occurring thereafter. Such individuals experience or diminished insulin secretion by the pancreatic B cells in response to glucose. Such affected persons are usually non-obese and they need insulin injections to survive for the rest of their lives. As type 1, it usually starts in childhood or adolescence, thus regarding it as a juvenile – onset diabetes. However, this form of diabetes can begin at any age (Robbins& Carleton, 2019; Anaja et al., 2022; Betteridge, 2017).

The second group - type II diabetes if diagnosed appears more often in obese individuals. In such diabetes, the patient's tissues are not sensitive enough to the insulin hormone, and thus use glucose inefficiently. In other words, the insulin receptors are not working well and therefore they resist the flow of insulin (insulin resistance) thus causing an abnormality in which both glucose and insulin can accumulate in the blood in large amounts. Many experts (Oakley et al 2018; Wood, 2017; Richard, et al., 2016) in diabetes study revealed that type II can occur as a result of changes in hormones besides insulin, due to administration of various drugs and chemical agents.

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General Signs and Symptoms of Insulin Dependent Diabetes Mellitus (IDDM)-Type 1 Diabetes and Non-Insulin Dependent Diabetes Mellitus (NIDDM)

Available research findings have clearly indicated that diabetes primarily affect the metabolism of carbohydrates and consequently that of fats, proteins, fluids and electrolytes, and all these when affected changes the body's metabolic activity. Clinical investigation has shown that when these abnormalities occur, symptoms associated with these abnormalities typically appear abruptly especially in IDDM victims and they include excessive frequent urination (polyuria), insatiable hunger, and unquenchable thirst. Unexplained weight loss is also common, blurred vision, nausea and vomiting, total body weakness, drowsiness, irritability, extreme fatigue, and an abnormal rise in blood glucose concentration (hypergylcemia); presence of sugar in urine (glycosuria), excessive ketone compounds in the body ketosis), a decrease in blood pH below normal level (acidosis) presence of Coma if not treated early, and eventually the victim may die due to the presence of acids namely acetoacetic acid and B Hydroxybuteric acid (ketoacidosis) in the blood beyond normal limit (Betteridge, 2017; Sa'ad, 2021).

The complexity of diabetes mellitus could be labelled beyond human expectation and understanding. The complications may include hypertension, cardiac failure, retin-opathy, leading to blindness, chronic pulmonary obstruction, reduced resistance to infection, and several heart related diseases (Anaja et al., 2022). Symptoms of Non-Insulin Dependent Diabetes Mellitus (NIDDM) may include any or all found in IDDM. However, other symptoms found in NIDDM may include tingling or numbness in the lower legs, feet, or hands; frequent and recurring skin, gum, or bladder infection; and cuts or bruises that are slow to heal. The onset of NIDDM is usually after age 30 and steadily increases with advancing age (Venkateswarlu, 2016)

Causes of Diabetes

This disease called diabetes (either IDDM or NIDDM) could be hereditary at any stage in a family tree (Marja-Riitta, 2017). In fact, diabetes is a non-communicable disease and that the risk of it increases with rising systolic blood pressure. Experts in diabetic study revealed that genes alone are not enough to cause diabetes suggesting that other risk factors must have contributed in the development of such disease. These factors may include environmental conditions such as cold climate, lack of breast-feeding, certain viruses, certain food causes blood glucose to rise, history of obesity, high blood pressure, cholesterol, gestational diabetes are among the factors leading to the cause of diabetes with increasing age. (Perry et al, 2022,)

Adoption of westernized lifestyle by people in developing countries in reference to affluent diet intake (high fat diet) and lack of regular exercise performance are among the risk factors causing diabetes and other heart related diseases (Dikko 2020). This strongly suggest that for appropriate diabetes control, prevention strategies must be employed.

Consequences of Diabetes

The consequences of this insidious nature of diabetes include:

i. Gross medical bills: Diabetes is among the most expensive disease and with the current inflamationary trend when medical bills have become very expensive and out of the reach of common man, the condition of its rapid scale explosion may be beyond containment (Camtu, 2022, Marja-Riitta, 2017).
ii. Declining productivity: Every individual dream and hope is to live a healthy and productive life. To be more useful and resourceful depends upon how fit you are. For a diabetic subject, current revelation shows that such individuals appeared to be less productive due to man hours lost, sick leave, off duty, frequent hospital visitation for medical check, accumulated health bills especially as treatment lasts for life. All these can cripple one's level of productivity.
iii. Decrease life expectancy: Any disease that requires continuous medication for life is usually a life-threatening disease. Diabetes is not an exception. Similarly, a disease that exposed one to daily injections, which in addition to pain, exposes the victim to the danger of infection. The resultant of these grievous nature of the disease can lead to sudden death. Before death occur series of unexplained manifestation may take place including feelings of upset, depression, frustration and disappointment with the way one's life is heading. Generally, stress is going to get in the victims way and distract his or her from the job in hand while he or she is trying to focus and relaxed about how to make life more useful. Where many more are unaware of the disease or untreated or if discontinue medication the end result could be dying silently from the disease without

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knowing. Thus, life satisfaction is prematurely terminated. Therefore, appropriate and most effective chemotherapy and therapeutic modalities must be employed in the control and prevention of diabetes.

Prevention Strategies

Diabetes as a metabolic disorder, usually requires some preventive measures including dietary restrictions in addition to chemotherapy (Sherman & Albright, 2022; Manson, et al, 2021; Kriska et al, 2022; Sa'ad, 2021; Marja-Riitta, 2017). In addition, subjects with diabetes were advice to include regular exercises, weight reduction, cessation of smoking, reduced salt intake, and reduced alcohol consumption, (Kriska et al., 2022).

Adoption dietary restriction including inexcessive carbohydrates food intake (all starchy foods), but replaced by moderate, carbohydrate, protein fat foods limited can significantly improve and prevent any progression of the disease. At the sametime adequate chemotherapeutic strategies must be employed (Cantu, 2022). Control weight projection, avoid any stimulant like cigarette smoking and alcohol consumption can be of importance as a prevention strategy.

Role of Exercise in the Management of Diabetes

Currently, physical activity is regarded as a non-pharmacological agent for decreasing the rate of diabetic disease (Williams, 2021; USDHHS, 2022). For this to be true, a number of diabetes patients were placed on regular exercise (Cantu 2022; Wareham, 2021) consisted of three bouts of one-minute maximal exercise on bicycle ergometer with two minutes rest between each work period. This took a number of appropriately sixteen weeks, to three times per week at moderate rate of VO_2 max (45 to 50% VO_2 max) significantly yielded a good improvement in the disease (Dulac et al., 2022). When critically these diabetic patients were observed through repeated, short bouts of exercise markedly increased plasma catecholamine concentrations with a progressive increase in growth hormone concentration. It was also observed a delayed response of cortisol and particularly insulin. This result affirms that exercise has an insulin-like effect on the body hence the need for the body to delay the production of insulin in exercising individuals (Sa'ad, 2021).

Experts in diabetes approach (Waren, 2022; Marja-Riita, 2017), stated that exercise reduces the triglycerides and low-density lipoprotein (LDL) in the blood which care lead to better control of the disease. This can be stated in a clear-cut way that exercise tend to increase the receptivity of muscle fibers to insulin and stimulating the muscles through exercise can increase the amount of glucose to be picked up significantly. Consequently, the same-amount of insulin will cause increased amount of glucose to be transferred from the blood stream to the working muscles. This could be the reason why it can be said that regular participation in exercise have an insulin like effect (Marja Riita, 2017), on the body hence the need for the body to delay the production of insulin in exercising subjects.

There is overwhelming evidence that inadequate physical activity and obesity may be adduced as two major factors that influence the development of non-insulin dependent diabetes mellitus (NIDDM. Obesity especially upper-body or abdominal (android) obesity, is associated with insulin resistance, that is, a decreased number of insulin receptors. It was based on this that regular exercise of moderate to vigorous endurance exercise was suggested so that the receptors can be stimulated, and this can increase the receptivity by muscles to insulin. Similar, abdominal fat is lost, the insulin resistance is reduced, and blood glucose levels often return to normal.

There is convincing support for the role of regular physical activity in the prevention of NIDDM (Robbin & Carleton, 2019; Manson & Spelsberg, 2022). Experts in exercise prescription have mentioned that certain training methods if well compliance can be of importance in the reduction of diabetes, especially, the NIDDM. These training methods may include long interval training for a period of 12 weeks at the rate of 1 hour daily, three times a week (Venkateswarlu, 2020; Sa'ad & Venkateswarlu, 2021). Such training can decline fasting blood sugar level due to the dominance in the utility of carbohydrate substrate as source of energy during training. Similarly, it has been supported that continuous and intermittent exercise for a period of 30 minutes of each for a period of 12 weeks showed a decline in plasma glucose. When these training methods are employed, the increase receptivity by muscles to insulin will be enhanced and blood glucose normal level can be obtained (Sills & Cerny, 2020; Duda, 2022).

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Exercise has been identified as a potent stimulus for skeletal muscle glucose uptake, the increase in glucose uptake by contracting skeletal muscle being greater than that elicited by maximal insulin stimulation (Young, 2022; Sherman & Albright, 2022). The increase in glucose uptake arises from both an increase in glucose delivery to contracting muscle due to elevated skeletal muscle blood flow, and an increase in glucose extraction. This increased glucose extraction by contracting muscle is as a result of enhanced membrane glucose transport and activation of the glycolytic and oxidative pathways responsible for glucose disposal. However, one should note that both intensity and duration of exercise can influence the magnitude of the increase in blood glucose uptake (Sherman &Albright, 2020). Lifestyle factor-such as exercise, weight-low, or improved diet have been identified as most responsible for the impressive results in tackling diabetes disease. Though chemotherapy can be applied. This suggest that the optimal combination of therapy for diabetics should consist of three possible complexes, namely, diet, insulin and sport. Therefore, lifestyle modification of both diet and exercise in the treatment of NIDDM must be emphasized. The primary goals of the diabetic diet for NIDDM patients are to lower blood glucose and lipids, blood pressure, and body weight when necessary. For these reasons, NIDDM patients should follow a healthy and varied diet, with an emphasis on controlling saturated fats (Manson & Spelsberg, 2022).

Exercise can significantly affect insulin and blood glucose levels based on the fact that during exercise, to maintain a constant blood glucose level, the blood concentration of insulin drops to counter the insulin-like effect of muscle contraction. Thus, the working muscle can take-in glucose even though little insulin is present. Another hormone from the pancreas, glucagon, stimulates the liver to release glucose to provide fuel for the muscles (Gudat et al, 2022; Leison et al, 2017). To attain and maintain constant blood glucose level, the pancreas secretes two hormones, insulin and glucagon. During rest, when blood glucose levels rise after a meal, insulin is secreted to help move the glucose into the body cells. One noticeable thing is that receptors on the body cells require that insulin be present before glucose can enter. Whereas when blood glucose levels drop, glucagon is secreted to increase blood glucose levels by stimulating, the breakdown of liver glycogen (i.e, stored carbohydrate). However, during exercise, blood insulin levels drop, while blood glucagon levels increase. These changes take place to counterbalance the insulin-like effect of muscle contraction. As the muscles contract during exercise, they do not require much insulin to transport glucose into the working cells. The intensity of exercise is a determining factor for the increase in the uptake of glucose by the muscles. In some cases, if the intensity is high, the glucose uptake increase may be from 7 to 20-fold in the first 30 to 40 minutes in the exercise. (Nieman, 2017; Hayward, 2018). Because of the increase level of insulin receptors sensitivity present during exercise can last for a long period of time even after some days but with significant impact of intensity and duration of exercise programme.

Conclusion

The growing incidence of diabetes these days is giving much concern to medical and allied health professionals. It is really a silent killer and for this reason, appropriate medical attention must be given to diabetes individuals. To improve their health, fitness and productivity in worksite, critical prevention and management in lowering blood sugar, keeping weight normal, diet modification and regular exercise seems to increase the productivity of some of the body's important cells. So long as diabetic atheletes understand the interactions among diet, exertion, and insulin and are aware of their unique reactions to exercise, they can safely engage in almost any sport or physical activity. Therefore, participation in sports during childhood may enhance receptivity by muscles to insulin utilization and to attain tighter control of their blood glucose.

Suggestions

To ensure the safety, well-being, and academic participation of learners living with diabetes, educational stakeholders—including school administrators, policymakers, health educators, and physical education instructors—should adopt the following evidence-based guidelines when developing school health and physical activity policies:

1. Schools should ensure that students diagnosed with diabetes and medically cleared for physical activity engage in exercise programs of moderate intensity lasting approximately 20–45 minutes per session. Emphasis should be placed on low-intensity activities (about 50% VO_2 max), as these are as effective as high-intensity exercise in improving insulin sensitivity, provided the total energy expenditure is comparable. School policies should therefore promote safe, moderate, and well-supervised physical activities.

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2. Educational institutions should support and facilitate regular blood glucose monitoring before, during, and after physical activity. Clear protocols should be established to allow learners to test and manage blood glucose levels during school hours without stigma or disruption to learning.
3. Schools should collaborate with healthcare providers and families to encourage adherence to comprehensive diabetes management plans. These include appropriate diet modification, weight management, insulin administration, prescribed medications, and regular physical activity. Policy frameworks should support coordinated care to maintain optimal blood glucose control among students.
4. Given that certain long-term complications of diabetes may be aggravated by strenuous activity, school physical education policies should discourage vigorous or exhaustive exercise for learners with diabetes, particularly those with known or suspected cardiovascular complications. Alternative, lower-risk activities should be provided.
5. School schedules and physical education timetables should consider the timing of insulin administration. Exercise should not coincide with peak insulin action, such as within one hour after a short-acting insulin injection. Policies should allow flexibility for insulin dose adjustment or additional nutritional intake, as advised by healthcare professionals. Furthermore, insulin injections should not be administered at body sites that will be heavily engaged in physical activity (e.g., thighs prior to running or cycling).

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