(ISSN: 0973-7049(P))

The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 21(4): S.I (4),942-957, 2026 www.thebioscan.com

Drug Induce Changes in Sweating and their Impact on the Body Temperature

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DOI: https://doi.org/10.63001/tbs.2026.v21.i04.S.I(4).pp942-957

KEYWORDS

Hypohidrosis, Anhidrosis, Hyperthermia, Sweating, Heat stroke, Anticholinergic drugs, Antihistaminic drugs, Anti-Parkinson drugs.

Article Info

Received: 30/09 /2026

Accepted: 28 /10/2026

Published: 07/11/2026

Abstract

Sweating plays an important role in maintaining the normal body temperature through evaporative heat loss. Some medications can disturb the normal functioning of sweat glands and nervous system, which may cause hypohidrosis or anhidrosis. This review examine drug-induced changes in sweating and their impact on body temperature. It also shows clinical case reports, risk factors, diagnostic methods and management strategies related to drug-induced anhidrosis and hypohidrosis. The available literature indicates that older age, polypharmacy, dehydration, high environmental temperature and excessive physical activity may increase the risk of drug-induced heat-related illness. Early identification of these side effects, proper patient monitoring, adequate fluid intake and avoiding excessive heat exposure can help to prevent serious complications of heat-related illness.

Introduction

Sweat is a watery fluid produced by sweat gland present in our skin. It consists of water and salts which helps to maintain the body's temperature by losing heat through evaporation. When sweat evaporates from skin it removes heat and helps to keep body cool. In situation where a person is unable to sweat properly then the body temperature may increase and this condition is known an anhidrosis. People suffering from anhidrosis have more risk of developing heat-related conditions like heat exhaustion, heat stroke, heat cramp, heat syncope, hyperthermia. Anhidrosis occurs due to irregularities in sweat gland, disruption in nervous system or by use of certain medication. Also, in severe cases the heat stroke can harm important organs of our body like kidney, heart and brain.

Hypohidrosis refers to a condition in which body produce less amount of sweat than normal even while exercise or exposure to hot air. It may result due to neurological

disorder, skin disorder or due to certain medication. Hyperhidrosis is condition in which body produces more sweat than normal. These sweating disorders are clinically important because they can disturb body's ability to maintain a normal temperature. Anhidrosis and hypohidrosis are important because in this conditions body produce less or no sweat due to which body cannot remove the heat properly from body which leads to heat-related problems. When the body does not release heat properly, and excessive heat is produced in body then the body temperature increases abnormally which leads to a condition known as hyperthermia.

Drug induce anhidrosis means the reduce or absence of sweating which is cause due to intake of certain medications. Some drugs affect the normal working of sweat gland or nervous system which are responsible for producing sweat. Certain medicines block the action of muscarinic receptor which is responsible for producing sweat by stimulating sweat gland. Most common drugs responsible for reducing the sweat in body are anticholinergic drugs. The anticholinergic drugs bind to muscarinic receptor and show actions. Heat related adverse reactions are found when body cannot produce the normal sweat and unable to maintain the body's normal temperature. It includes increase in body temperature, reduce sweating, dizziness, headache.

Pharmacovigilance plays an important role in identifying, assessing, understanding and preventing adverse drug reactions. Pharmacovigilance data are collected from reports of adverse effects experienced by patients after consuming medication. These events are reported and recorded in special databases for monitoring drug safety. Databases include FAERS(US FDA adverse events reporting system), Eudravigilance (European database for reporting adverse drug reaction), and Vigibase (Global database maintained by world health organisation). Pharmacovigilance data can also help researchers discover new uses of existing medicines. Disproportionality analysis is the method which is used to identify whether a particular side effect is reported many times with a specific medicine compared to other medicines. it helps researchers to find the possible relationship between medicines and adverse effects.

Literature Review

1. **Tews et al. (2026)**

   The authors review the relationship between medication use and heat related illness in adults. They reviewed 61 primary studies and 41 grey-literature sources. They found

that some medicines increase the chances of heat-related illness particularly in adults which include anticholinergic drugs, diuretics, ACE inhibitors, antipsychotic drugs, angiotensin receptor blockers. The authors also explained that the adults suffer more from heat-related problems.

2. **Hospers et al. (2024)**

The authors conducted a study on how prescription and over-the-counter medicines affect body temperature during heat exposure. The researchers examined 35 studies involving 353 participants and also studied 27 different medicines. They found that medicines with strong anticholinergic effect increase the body's internal temperature and reduce sweating which cause difficulty in cool down body naturally. The authors also found that the non-selective beta blockers and some anti-parkinsons medications may disturb the body's normal cooling process.

3. **Gamboa et al. (2023)**

The authors studied the reported cases of heat stroke and heat exhaustion related to medicine use. The researchers collected adverse drug reaction reports. They found 469 cases of heat stroke and heat exhaustion. The study also identified the importance of monitoring heat-related problems caused by medicines, particularly the patient who is taking several medicines together. The researchers also found that the medicines that showed possible safety signal for heat-related illness are belonging to nervous system drug group, and some medicines disturbs the body's normal temperature-regulating mechanism by decreasing sweating.

4. **Liu et al.**

The author conducted a pharmacovigilance study with the help of FDA Adverse Event Reporting System (FAERS) database to identify which medicines cause anhidrosis or hypohidrosis. The researchers examined adverse drug reaction reports which are collected between January 2004 and December 2021. From the report they found 540 reports are related to 192 suspected medicines. From these 39 medicines shows safety signals. The researchers study found that those medicines which affect the nervous

system are commonly reported like epilepsy, depression, and mental health conditions. Topiramate had highest number of reports with 115 cases.

5. **Montastruc and Durrieu (2022)**
The authors analysed drug-associated hypohidrosis and anhidrosis using the World Health Organizations pharmacovigilance database. The study focusses on identifying which medicines cause reduced or absence of sweating as a side effect. The researchers examined that medicines-related to sweating problems need proper attention during medication safety monitoring. This study explained the pharmacovigilance database which helps to identify the rear and severe side effects of medicines during routine clinical practice.

Table 1. Research Gap Analysis

Sr. No	Title of Study	Research Focus	Conclusion by Author	Research Gap Analysis
1.	Recognizing and mitigating the effects of medication on heat-related illness in older adults: A scoping review (Tews et al. 2026)	Reviewed 61 primary studies and 41 grey-literature source to investigate the relationship between medication use and heat-related illness.	Some medicines including anticholinergic, diuretics, ACE inhibitors, and antipsychotics may increase the risk of heat-related illness.	Further studies are required to understand how age, use of multiple medicines and high environmental temperatures together affect the body.
2.	The effect of prescription over-the-counter medications on core temperature in adults during heat stress: A systematic review and meta-	Examined 35 studies involving 353 participants to understand how prescription and OTC medicines affect body temperature during heat exposure.	Medicines with strong anticholinergic effects can reduce sweating and interfere with body's natural heat regulation process	Limited studies including woman, older adults and people with long term health problem. More clinical studies are required.

	analysis (Hospers et al. 2024)			
3.	Analysis of heat stroke and heat exhaustion cases in EudraVigilance pharmacovigilance database (Gamboa et al. 2023)	Analysed adverse drug reaction reports to identify medicines associated with heats troke and heat exhaustion	Identified 469 reports of heat stroke and heat exhaustion associated with medication use. Certain medicines may interfere with temperature regulation by reducing sweating.	Further research is required to identify high-risk medicines and understand the relationship between medication induced sweating and heat related illness.
4.	Pharmacovigilance-based drug repurposing: searching for putative drugs with hypohidrosis or anhidrosis adverse events for use against hyperhidrosis (Lie et al. 2023)	Use the FDA Adverse Event Reporting System database to identify medicines related to anhidrosis and hypohidrosis	Identified 540 reports including 192 suspected medicines, with 39 medicines showing potential safety signals. Topiramate had highest number of reports	More research is needed to understand how the medicines affect body temperature balance and increase the risk of heat related conditions
5.	Drug-induced hypohidrosis and anhidrosis: analysis of WHO pharmacovigilance database 2000-2020 (Montastruc and Durrieu 2022)	Analysed drug related to hypohidrosis and anhidrosis using WHO pharmacovigilance database	Highlighted the importance of pharmacovigilance databases in identifying medicines associated with reduced or absent sweating	Further research is needed to establish the clinical significance of reported sweating abnormalities and improve their identification, monitoring and prevention.

Drugs Associated with Anhidrosis and Hypohidrosis

Anhidrosis and hypohidrosis can occur as an adverse effect due to use of some medications. These medications disturb the activity of nervous system, sweat gland which leads to reduce sweating. Due to reduce or absence of sweat it affects body's ability to regulates its temperature particularly during hot weather. Certain medicines stop sweating while some medicines reduce sweat production. Anticholinergic drugs, carbonic anhydrous inhibitors and some antidepressants are important drug groups responsible for reduced sweating.

Table 2. Classification of drugs associated with reduced sweating

Drug Class	Drugs	Mechanism
Anticholinergic	Atropine, dicycloverine, glycopyrrolate, hyoscyamine, propantheline	Blocks acetylcholine receptor
Antiepileptic	Topiramate, zonisamide, carbamazepine	Blocks carbonic anhydrase enzyme (topiramate, zonisamide) Central anticholinergic effect (carbamazepine)
Antidepressant	Amitriptyline, clomipramine, desipramine, doxepin, imipramine	Blocks muscarinic receptor
Antihistamine	Cyproheptadine, diphenhydramine, promethazine	Blocks muscarinic receptor
Urinary Antispasmodic	Oxybutynin, Tolterodine, solifenacin	Blocks muscarinic receptor
Antipsychotic and antiemetics	Chlorpromazine, clozapine, thioridazine, olanzapine, quetiapine	Blocks muscarinic receptor

Detailed discussion of important drugs

1. Topiramate

   Topiramate is an anticonvulsant drug which is use to treat epilepsy in children. It is used to treat different types of seizures like partial seizures, generalized seizures and also in some difficult-to-control seizures. Topiramate works through various mechanisms to control abnormal electrical activity of brain. It is usually consumed by children with epilepsy without major difficulty, but it may cause some adverse effects. The adverse effects are weight loss, kidney stone, paresthesia, loss of appetite, sleepiness, change in behaviour, increased acidity in blood. Recently hypohidrosis and related symptoms such as hyperthermia has also been reported in approximately 10% (22 out of 173) of treated children as rare side effect. These adverse effects are reversible mostly in children means they may disappear after discontinuation of medicines. Extra care needed during hot weather because decrease in sweating can increase the risk of overheating in children. Adults are taking topiramate to treat conditions like migraine and essential tremor. Due to the use of this drug adults experience heatstroke problem even after taking the drug at lower dose.

2. Zonisamide

   Zonisamide is an antiepileptic agent and also carbonic anhydrase inhibitor, it is generally used along with other medicine to treat partial seizure in adults. Zonisamide can reduce sweat production and may affect sweat glands means sweat-producing cell of this gland which results in hypohidrosis. In children using zonisamide may have higher risk of developing hypohidrosis. The children are having more risk of reduced sweating than the adults. Oligohidrosis has also been reported in a small number of patients taking zonisamide. But in some patients the body temperature increases which may leads to hyperthermia. Most of the cases of hyperthermia are occurred in

children during summers due to hot weather.

3. Oxybutynin

Oxybutynin is a urinary antispasmodic agent which blocks muscarinic receptor. It particularly blocks M3 receptor which is present on eccrine sweat glands. Due to this the stimulation of sweat glands gets reduced and also decrease in sweat production. It is generally used to treat hyperhidrosis in which oxybutynin reduces excessive sweating. Excessive reduction in sweating may disturb the normal body-temperature regulation and increase high chances of overheating. Dry mouth was the most common adverse effect noticed.

4. Amitriptyline

Amitriptyline is a tricyclic antidepressant used to treat depression, neuropathic pain, and migraine. Some antidepressant medication can reduce sweating because of their anticholinergic property. Amitriptyline is the strongest medicine which reduces the sweating. It blocks muscarinic receptor present on sweat gland which helps to control sweat production, due to which hypohidrosis may occurs. Amitriptyline is most commonly used to treat pain caused by nerve damage usually in patient suffering with diabetes. It shows adverse effects like dry mouth, constipation, hypohidrosis, blurred vision and dizziness.

5. Glycopyrrolate

Glycopyrrolate is an anticholinergic agent that blocks the action of acetylcholine, a chemical messenger which is responsible for controlling various body function including saliva production and sweating. It also blocks muscarinic receptor present on sweat glands. Generally, acetylcholine stimulates these receptor and cause sweat production. When glycopyrrolate blocks muscarinic receptor sweat production decreases which may leads to anhidrosis or hypohidrosis. Due to this reduced sweating, it disturbs the body's natural cooling effect

and make it difficult to release excess body heat.

Case report of drug induced anhidrosis and heat related illness

1. Vaja and prasad (2025) reported a rare case of heatstroke in which the 28 years old man is suffering from a depressive disorder and was taking multiple psychiatric medicines. The heatstroke is developed in patient during the outdoor working in hot weather. His body temperature increased upto 106 °F and he experienced seizures like movements, confusion and difficulty in breathing. The patient received emergency treatment which includes rapid cooling, breathing support and intensive medical care. After treatment, he recovered completely and was discharged in stable condition.
2. Ariana palacio et al. (2024) reported a case of generalised anhidrosis in 34-year-old man following a summer vacation. The patient was suffering from overheating, dizziness and palpitations, generally during exercise and exposure to high temperatures. Medical examination showed an absence of sweating in affected areas.
3. Kawamoto et al. (2024) reported report a case of topiramate-induced anhidrosis in 74-years-old woman suffering from epilepsy. During treatment with topiramate the patient experienced reduced sweating and increase in body temperature. A sweating test showed that approximately 89% of her body surface was not producing sweat. After stopping topiramate, her sweating gradually improved. Some improvements were observed within 10 days, and further recovery

occurred over the next three months.

4. Manivannan et al. (2021) reported a case of severe hyperthermia in a 64-years-old woman taking multiple medications having anticholinergic effects like amitriptyline, cyclobenzaprine, and benztropine. She was found feeling unconscious in a room where air conditioning was not present during outside temperature was above 33°C. The researchers suggest that combined effect of this medication leads to reduced sweating and affects body's regulation. The woman received emergency treatment in intensive care and recovered.

Risk factor associated with drug induced heat related illness

Drug induced heat related illness generally occurs when some medications interfere with body's normal temperature-regulating mechanisms. Certain medicines reduce sweating, may cause dehydration, or affect the nervous system which is responsible for controlling body temperature. Some patient-related and environmental factors may increase the risk of developing heat exhaustion or heat stroke.

Major Risk Factors

1. **Older Age**

   Older age particularly the age above 65 years has the higher risk of heat-related illness. With increasing age, their body may become less effective to regulate temperature. Older people use multiple medicines that may interfere with sweating and temperature regulation.

2. **Use of multiple medicines**

   Taking multiple medicines together can increase the risk of heat related illness. For example, taking anticholinergic with diuretics may increase the risk of heat-related illness. Because anticholinergic drugs reduce sweating while diuretics increase water loss from body.

3. **Dehydration**

   Dehydration occurs when body loses more water than it takes in. certain medicines like diuretics can increase water loss through urine. Due to this dehydration cause which make body difficulty in maintaining the temperature.

4. **High environmental temperature**

   High environmental temperature generally during summer increases the chances of heat-related illness. People taking medicines get reduced sweating that may cause difficulty in cool down their bodies in hot weather.

5. **Physical activity**

   Heavy exercise, outdoor work, and long period of physical activity increase heat production in body. When sweating is reduced due to certain medicines the excessive heat cannot remove from the body which may cause heat-related illness.

6. **Impaired thermoregulation**

   Some medicines affect the hypothalamus and nervous system that controlling body temperature. This can disturb the body's normal response to heat and increase the risk of overheating like hyperthermia.

Diagnosis and clinical management

Diagnosis involves identifying reduced or absent sweating and determining whether it is caused due to medication use. Early diagnosis is important because reduced sweating can disturb the body's ability to regulate temperature and increase the risk of overheating.

1. **Medical and medication history**

   The doctor collects information about the patients' symptoms, medical history and current medications. Special attention is given to drugs that may reduce sweating, such as

anticholinergic drugs, topiramate and certain antidepressants.

2. **Physical examination**

   The doctor notices the skin and observes the distribution of sweating. Patients may report dry skin, heat tolerance, dizziness and unusual body warmth.

3. **Thermoregulatory sweat test**

   The thermoregulatory sweat test evaluates the body's sweating response when the patient exposed to hot weather. It helps to identify which part of body is unable to produce sweat.

4. **Laboratory investigation**

   Blood tests may be performed to check weather reduced sweating is caused by other heath problems, such as diabetes, immune system, disorders or changes in body metabolism.

5. **Skin biopsy**

   In some selected cases the small skin sample is examined under a microscope to evaluate sweat glands and supporting nerve's structure.

Management mainly focuses on identifying the causative medication, preventing overheating and treating associated complications.

1. **Discontinuation of causative drug**

   If doctor found the particular medicines responsible for reduced sweating, then doctor may change the medication, reduce the dose, or discontinue it. Medication should not be stopped without medical supervision.

2. **Adequate hydration**

   Patient should maintain the required amount of

fluid intake, particularly during hot weather and physical activity. It helps to prevent dehydration and supports normal body functions.

3. **Avoidance of excessive heat**
   The patient should avoid staying for long period in direct sunlight, excessive physical activity during summer temperature.
4. **External cooling method**
   External cooling helps body to maintain normal temperature when sweating is reduced. These include using fans, air conditioning, taking cool showers, using cold packs when necessary.
5. **Patient education and monitoring**
   Patient should be educated about the symptoms of reduced sweating and heat-related illness. They should be advised to maintain their body temperature, avoid long-term staying in direct sunlight. Regular monitoring is important, for patient taking medicines related to anhidrosis.
6. **Treatment of heat-related illness**
   Patient suffering from heat exhaustion may require rest, cooling and fluid replacement. In severe cases immediate medical attention is required.

Future prospects:

1. Develop better methods to identify Hypohidrosis at an early stage.
2. Identification of more medications that can cause Hypohidrosis and Anhidrosis.
3. Conduct more clinical studies to understand the relationship between

medicines, sweating and heat-related illness.

4. Further study how drug combinations of medicines increase the risk of anhidrosis and hypohidrosis.
5. Health care professional and pharmacist should aware individuals about reduced sweating.
6. Special attention should be given to children, elder patients and patients taking multiple medicines which may cause heat related complications.

Conclusion

Drug-induced anhidrosis is an important but it is a side effect of some medicines which cause reduced sweating or stop sweating which is often ignored but it affects body's ability to regulate its temperature and make body difficult to release excess heat. This may increase the risk of overheating, heat exhaustion and heat stroke generally during hot weather. Early identification of medicines causing reduced sweating is important to prevent serious complications. Healthcare professionals and pharmacist should give information to patients about the possible warning signs and risks related with these medicines. Increased pharmacovigilance reporting and further research can help to identify harmful medicines, improve patients' safety and prevent illness caused by excessive heat.

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