

Why Does the Face Turn Red During Exercise? A Review of Exercise Intensity, Facial Blood Flow, and Thermoregulation

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Abstract

Facial flushing during physical activity is a common and highly visible response, yet the physiology behind it is not widely understood. This review synthesizes research on the mechanisms that link exercise to facial redness. During exercise, contracting muscles release most of their metabolic energy as heat, and the body dissipates this heat largely by increasing skin blood flow and sweating. Skin blood flow is controlled by a sympathetic vasoconstrictor system and an active vasodilator system, and during exercise these responses are modified: vasodilation begins at a higher core temperature than at rest, and skin blood flow tends to plateau as core temperature approaches about 38 °C. A study using laser speckle flowgraphy found that blood flow in facial skin regions increased with exercise intensity in a similar way across the forehead, eyelid, nose, cheek, and ear, whereas blood flow in the lip did not rise at the highest intensity; in contrast, static handgrip exercise produced uneven responses across facial regions. Environmental heat, hydration, aerobic fitness, heat acclimatization, and individual characteristics further modify these responses. A key gap remains: existing studies measure blood flow rather than visible skin color, so how closely facial redness tracks exercise intensity is not yet established. Because facial flushing is a familiar experience, it offers an accessible entry point for teaching students and families about thermoregulation, provided that education also acknowledges that facial redness can have causes unrelated to exercise. Future research should relate measured facial blood flow to objectively quantified skin color across exercise intensities and environmental conditions.

Keywords: *exercise physiology; thermoregulation; skin blood flow; facial flushing; cutaneous vasodilation; health literacy*

1. Introduction

Facial redness during exercise is a common physiological response, yet its strength can differ with exercise intensity, environmental conditions, and individual physiological characteristics. During physical activity, the body's metabolic rate rises because contracting muscles require additional energy. Because most of this energy is released as heat rather than converted into mechanical work, the body must move heat from the working muscles and deeper tissues toward the body surface to maintain temperature balance (Sawka et al., 1993). Increased skin blood flow and sweating are the two major mechanisms that accomplish this (Sawka et al., 1993; Charkoudian, 2010).

Many people notice that their face becomes red during running, sports, or other physical activities without knowing that the change is related to circulation and temperature regulation.

Although the general physiological basis of exercise-related flushing is well established, the connection between exercise intensity and the visible appearance of facial redness is less clearly defined. This review therefore examines (1) how heat is produced and dissipated during exercise, (2) how skin blood flow is controlled during exercise, (3) how facial blood flow responds to different exercise intensities, and (4) which factors modify these responses. It then considers the gap between measured blood flow and visible redness, and the implications of this research for health education.

2. Heat Production and Heat Dissipation During Exercise

Exercise greatly increases metabolic heat production, and if this heat were not removed, core body temperature would rise rapidly (Sawka et al., 1993). The body loses heat to the environment mainly through the skin. Blood carries heat from the core and working muscles to the skin surface, where it can be released, while the evaporation of sweat removes additional heat (Sawka et al., 1993; Charkoudian, 2010). Increasing the amount of blood that flows through the skin is therefore central to temperature regulation during exercise.

Cutaneous vasodilation, the widening of blood vessels in the skin, is the process that allows more warm blood to reach the body surface (Charkoudian, 2010; Kellogg, 2006). In most areas of human skin, blood flow is controlled by two branches of the sympathetic nervous system: a vasoconstrictor system that narrows skin blood vessels and an active vasodilator system that widens them (Charkoudian, 2010; Kellogg, 2006; Johnson et al., 2014). During heat stress, the active vasodilator system is responsible for most of the increase in skin blood flow, which can rise substantially above resting levels (Charkoudian, 2010; Kellogg, 2006). In addition to these nerve-controlled reflexes, warming of the skin itself can widen local skin blood vessels, so skin that is directly heated, for example by sun or hot air, may receive even more blood (Johnson et al., 2014). A visible consequence of this increased circulation near the skin is flushing, which is often most noticeable on the face.

3. Control of Skin Blood Flow During Exercise

The relationship between physical activity and skin blood flow is more complicated than a simple, steady increase in circulation. At the onset of exercise, sympathetic vasoconstrictor activity can briefly reduce skin blood flow; as exercise continues and core temperature rises, active vasodilator mechanisms then increase skin circulation (Johnson, 1992; Kenney & Johnson, 1992). Compared with rest, skin vasodilation during exercise begins at a higher core temperature, and skin blood flow tends to plateau once core temperature approaches about 38 °C, which limits how much further it can rise (Kenney & Johnson, 1992).

These modifications reflect the competing demands placed on the cardiovascular system. During exercise, the heart must simultaneously supply oxygen to the active muscles, maintain blood pressure, and deliver blood to the skin for heat dissipation (Johnson, 1992; Kenney & Johnson, 1992; González-Alonso et al., 2008). Blood directed to the skin is not available to the muscles, so the body limits skin blood flow when cardiovascular demands are high. During prolonged, intense exercise in the heat, the combined effects of dehydration and rising body temperature can even cause cardiac output, skin blood flow, and blood flow to the working muscles to decline (González-Alonso et al., 2008). For this reason, a rise in exercise intensity

does not mean that skin blood flow will increase without limit, and the relationship between intensity and visible redness is more complicated than a simple “harder exercise equals a redder face” model.

4. Facial Blood Flow and Exercise Intensity

Most research on skin blood flow during exercise has focused on the forearm or other limbs, but research that specifically examines facial circulation provides a more direct perspective on flushing. Hayashi and colleagues used laser speckle flowgraphy to measure facial blood flow in 12 participants during 15 minutes of cycling at heart rates of 120, 140, and 160 beats per minute (Hayashi et al., 2021). Blood flow and the vascular conductance index increased significantly with exercise intensity in the facial skin regions studied: the forehead, eyelid, nose, cheek, and ear. The lip, however, showed a different pattern. Its blood flow increased at the two lower intensities but did not differ from resting values at the highest intensity (Hayashi et al., 2021).

These findings suggest that the facial skin regions respond similarly to dynamic exercise, whereas the lip, a tissue that differs from the surrounding skin, may be regulated differently. This contrasts with an earlier study by the same research group, in which 20 adults performed static handgrip exercise, squeezing a grip device without moving the arm. In that study, skin blood flow increased by about 6–10% in the forehead, cheek, and lower lip, while the other facial regions showed no significant change (Kashima et al., 2013). Comparing the two studies suggests that the type of exercise may influence how evenly the face responds: dynamic exercise such as cycling produced a similar response across facial skin, whereas static exercise produced regional differences (Hayashi et al., 2021; Kashima et al., 2013). Together, this evidence supports the everyday observation that the face tends to become redder as exercise becomes harder, while showing that not every facial region follows the same pattern in every type of exercise.

5. Factors That Modify the Response

Because skin blood flow reflects a balance between heat loss and cardiovascular demands, conditions that change either side of this balance also change the response. Environmental heat is one of the most important. When the skin is hot, more blood is directed to the skin, which reduces the volume of blood returning to the heart and increases heart rate and overall cardiovascular strain during exercise (Chou & Coyle, 2023). Hydration also matters: loss of body water through sweating reduces the body’s ability to sustain both skin blood flow and sweating, making thermoregulation less effective (Sawka et al., 1993; González-Alonso et al., 2008).

Individual characteristics influence the response as well. Repeated exposure to exercise in the heat (heat acclimatization) causes sweating and skin blood flow to begin earlier and at lower core temperatures (Sawka et al., 1993). Exercise training can also alter the control of skin blood flow, although the extent to which these changes reflect adaptations within the skin’s blood vessels themselves is still debated (Simmons et al., 2011). Other factors, including sex, aging, and reproductive hormones, modify reflex control of skin blood flow (Charkoudian, 2010; Johnson et al., 2014). As a result, two people performing the same activity may not experience identical changes in facial redness, and facial flushing is not a perfectly predictable response that appears the same in every person.

6. From Blood Flow to Visible Redness

An important distinction in this literature is between measured blood flow and visible facial redness. The facial blood-flow studies described above measured perfusion, not the color of the skin (Hayashi et al., 2021; Kashima et al., 2013). Research on facial appearance shows that the color of facial skin does reflect blood perfusion and oxygenation. When participants were asked to adjust the color of facial photographs so that the faces looked as healthy as possible, they increased skin blood color, especially the color associated with oxygenated blood (Stephen et al., 2009). This indicates that changes in facial blood are visible and that people are sensitive to them. However, such studies examine color in still photographs rather than changes that occur during exercise. The exercise studies therefore support a relationship between exercise intensity and facial circulation, but they do not establish that every increase in blood flow produces a proportionally greater visible change in skin color. How red a face appears is likely to depend on additional factors, such as skin tone and how close blood vessels lie to the skin surface. Physiological measurements and visible appearance are therefore related but not identical outcomes, and the precise link between exercise intensity and what people actually see remains an open question.

7. Implications for Health Education

Facial flushing is an everyday phenomenon that many students and families observe but may not understand, which makes it a useful entry point for teaching human physiology. Explaining the chain from muscle contraction to heat production, heat transport by the blood, and cutaneous vasodilation can help people interpret a familiar physical response using physiological knowledge rather than assumptions based only on appearance, which can improve health literacy.

At the same time, such education should not suggest that all facial redness is caused by physical activity or that redness is always harmless, because facial flushing can also result from causes unrelated to exercise, such as fever, emotional responses, or skin conditions. Educators must also balance scientific accuracy with accessibility. Terms such as cutaneous vasodilation, vascular conductance, sympathetic activity, and thermoregulation are precise but can make material difficult for an audience without a physiology background. Focusing on the relationships between these concepts, for example by moving step by step from the question “Why does my face get so red when I exercise?” to the underlying mechanisms, may be more effective than emphasizing terminology.

8. Limitations

The evidence reviewed here has several limitations. Studies of facial blood flow are few, often rely on specialized measurement technologies, and use small samples; the two facial studies discussed in this review included 12 and 20 participants (Hayashi et al., 2021; Kashima et al., 2013). Much of what is known about the control of skin blood flow during exercise comes from measurements at other body sites, and it is not certain that the face responds identically. In addition, this is a narrative review based on a limited number of sources rather than a systematic review, so relevant studies may not have been included.

9. Future Directions

Future research could investigate the relationship between measured facial blood flow and objectively quantified skin color, for example using colorimetry or standardized photography during exercise. Comparing multiple facial regions across different exercise intensities, exercise types, and environmental conditions could clarify whether certain areas consistently show stronger relationships between circulation and visible color change. Studies including participants with a range of ages, fitness levels, and skin tones would also help determine how individual characteristics shape visible flushing. Finally, educational programs based on this topic could be evaluated with pre- and post-assessments and follow-up testing to determine whether they improve and sustain understanding of thermoregulation.

10. Conclusion

Facial redness during physical activity is a visible sign of the body's broader cardiovascular and thermoregulatory responses. As exercise increases metabolic heat production, the body increases skin circulation and sweating to maintain temperature balance, but this response is limited by the competing demands of the working muscles and blood pressure regulation. Research indicates that blood flow in facial skin rises with exercise intensity in a similar way across facial regions during dynamic exercise, while the lip responds differently at high intensity, and the overall response is further shaped by environmental heat, hydration, fitness, and individual characteristics. Further research is needed to connect objectively measured facial blood flow with the visible appearance of facial redness and to determine how consistently exercise intensity predicts this response. In the meantime, the familiar question of why the face turns red during exercise provides an accessible way to introduce students and families to the physiology of temperature regulation.

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