



Diet, Food Insecurity, and CVD Risk in Sexual and Gender Minority Adults

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Abstract

Purpose of Review Sexual and gender minority (SGM) adults experience significant cardiovascular health disparities, yet little is known about diet and food insecurity in this population. This review summarizes recent literature on diet and food insecurity in SGM adults and their contribution to cardiovascular disease (CVD) risk in this population.

Recent Findings Existing evidence on diet and food insecurity disparities among SGM adults is inconclusive and research examining their link with CVD risk in SGM adults is limited. The majority of existing studies lack standardized and validated assessments of diet and food insecurity. Correlates of unhealthy diet and food insecurity among SGM adults are poorly understood.

Summary Research examining the associations between diet and food insecurity with CVD risk in SGM adults is limited. Longitudinal studies are needed to investigate whether diet and food insecurity contribute to the cardiovascular health disparities observed in SGM adults.

Keywords Sexual and gender minorities · Diet · Nutrition · Food insecurity · Cardiovascular disease

Introduction

Sexual and gender minority (SGM) adults experience significant cardiovascular health (CVH) disparities related to greater exposure to marginalization and discrimination [1]. Table 1 describes terms relevant to SGM health that are used in this review. Growing evidence demonstrates that SGM adults are at higher risk for cardiovascular diseases (CVD) than their non-SGM counterparts [2•, 3•, 4]. For instance, lesbian and bisexual women have a higher prevalence of tobacco use, obesity, and hyperglycemia than heterosexual women [5–8]. Bisexual men are two to three times more likely than heterosexual men to meet criteria for obesity and type 2 diabetes [9]. Also, a recent meta-analysis of 20 studies found that bisexual men were two times more likely than heterosexual men to have hypertension [10]. Compared to cisgender men and women (i.e., individuals whose gender identity is aligned with their sex assigned at birth), transgender women are two to three times more likely to have been diagnosed with a heart attack or ischemic stroke [11–14]. However, evidence of CVH disparities among transgender men is conflicting [13, 15].

Much of the risk for CVD in SGM adults is attributed to psychosocial, clinical, and behavioral factors. The minority

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Table 1 Terms relevant to sexual and gender minority health

Terms relating to sexual orientation	
Sexual orientation (noun)	Refers to how a person characterizes their physical, emotional, or romantic attachments in relation to gender. Separate from gender identity. Can be defined based on sexual identity, sexual behavior, and/or sexual attraction
Sexual minority (noun)	Refers to individuals who have a sexual orientation that is anything other than heterosexual. Can include lesbian, gay, bisexual, or queer individuals as well as persons with other sexual orientations
Queer (adjective)	Queer is frequently used as an umbrella term to represent all individuals who identify outside traditional categories for sexual orientation and gender identity. Historically a derogatory term used against sexual and gender minority individuals. It has been reclaimed by many sexual and gender minority individuals as a term of empowerment
Heterosexual (adjective)	Refers to individuals who are attracted to people of a gender different than their own. Often used interchangeably with “straight.” Cisgender and transgender individuals may identify as heterosexual
Terms relating to sex and gender	
Sex (noun)	Refers to biological and anatomical sex characteristics (including chromosomes, gonads, sex hormones, and/or genitals). Categories include male, female, and intersex. Often used interchangeably with “sex assigned at birth” or “biological sex.”
Sex assigned at birth (noun)	Used to describe an infant based on their external anatomy and typically categorized as male or female; different from gender identity
Gender identity (noun)	Refers to a person’s inner sense of being a boy/man, a girl/woman, a combination of boy/man and girl/woman, having no gender at all, or something else
Gender minority (noun)	Refers to individuals who experience an incongruence between their gender identity and what is typically expected based on their sex assigned at birth. Can include transgender, gender non-binary persons, intersex, and other gender diverse persons
Cisgender (adjective)	A gender identity used to describe people whose gender identity is consistent with societal expectations based on their sex assigned at birth. A female-identified person who was assigned female sex at birth would be considered a cisgender female or woman
Gender non-binary (adjective)	A term used by people who identify outside the typical expectations of the gender binary. This term is often used interchangeably with “gender non-conforming,” which is considered more outdated

stress model, the prevailing framework for understanding SGM health disparities [16, 17], posits that SGM individuals experience unique psychosocial stressors, called minority stressors, related to their marginalized status in society [16, 17]. These minority stressors can exist at the individual (e.g., expectations of rejection), interpersonal (e.g., experiences of discrimination), and structural (e.g., anti-SGM legislation) levels [2•, 3•]. With few exceptions, there has been limited research examining the link between minority stressors and CVD risk in SGM adults [2•, 3•]. Most prior research has focused on the relationships between minority stressors and tobacco use in SGM adults [18–20]. Another factor posited to contribute to CVD risk in gender minority adults is the use of gender-affirming hormones (e.g., estrogen, testosterone), which are used to acquire secondary sex characteristics that are more aligned with one’s gender identity [2•, 13, 15]. More than 50% of transgender adults report using gender-affirming hormones [21, 22]. Evidence of the cardiovascular effects of gender-affirming hormones is largely mixed [2•, 13, 15, 20]. However, in a recent cohort study of > 100,000 adults (5% transgender), Getahun et al. [11] found that use of estrogen during 8-year follow-up was associated with an increased incidence of stroke among transgender women, relative to cisgender women.

Behavioral factors are hypothesized to play a role in CVD risk among SGM adults. Although disparities in tobacco use and physical inactivity have been documented among SGM adults [2•, 3•, 23], research on diet in this population remains limited. Diet is an important predictor of CVD risk and a key metric of CVH [24–27]. In fact, analyses of data from the Global Burden of Disease Study found that diet was the top modifiable risk factor for CVD mortality, accounting for ~70% of CVD-related deaths worldwide between 1990 and 2017 [28]. Multiple systematic reviews and meta-analyses have found that increased intake of certain dietary components (e.g., whole grains, fish, fruits, vegetables, and plant-based proteins) is associated with lower cardiovascular and all-cause mortality among adults [29–32]. Despite slight improvements in diet quality among adults in the general population over the past two decades, diet quality is the CVH metric that is the least likely to meet recommended criteria [33–36].

Food insecurity, defined as the lack of “consistent, dependable access to enough food for active, healthy living [37],” is a recognized social determinant of poor diet quality [38, 39]. Food insecurity is a highly prevalent public health concern. In 2019, an estimated one in ten people were exposed to severe food insecurity worldwide [40]. Further, findings from systematic reviews indicate that

food insecurity is associated with a higher risk for incident hypertension, type 2 diabetes, and CVD, as well as greater cardiovascular mortality [41–45]. Certain groups of SGM adults, including lesbian women and bisexual and transgender adults, have higher rates of poverty compared to their non-SGM counterparts, which may increase their risk for food insecurity [46, 47]. In addition, food insecurity is strongly linked with exposure to violence [48], which is more prevalent among SGM adults relative to non-SGM adults [49–51]. Yet, studies on food insecurity among SGM adults are limited.

Although there is growing evidence that SGM adults have a higher prevalence of CVD risk factors than their non-SGM counterparts [2•, 3•], to date, no review has examined the influence of diet and food insecurity on CVD risk in SGM adults (ages 18 and over). The purpose of this review was to summarize recent literature related to diet and food insecurity in SGM adults and their contribution to CVD risk in this population. For the purposes of this review, we defined diet broadly to include measures of diet quality, meal patterns, eating behaviors, nutritional intake, and food choice behaviors. Similarly, for food insecurity, we included studies that measured food insecurity or food insufficiency. We did not include studies that reported on disordered eating or body image concerns in SGM adults as these topics have been comprehensively reviewed in prior reviews [52–54].

Diet in SGM Adults

We summarize findings for studies that investigated some component of diet among SGM adults (Supplemental Table 1). The majority of these studies were cross-sectional ($n=14$), except for three longitudinal analyses of data from the Nurses' Health Study and the Growing Up Today Study [55, 56••, 57••]. All but one of these studies was conducted in the United States (U.S.).

Sexual Minority Adults

Findings from research examining diet among sexual minority adults are largely conflicting. Analyses of data from the College Student Health Survey [58] showed significant differences in meal patterns between sexual minority and heterosexual college students. Breakfast consumption was assessed by asking participants: "In the past 7 days, how many days did you eat breakfast?" Responses were categorized as 0–1 days per week, 2–4 days per week, or 5–7 days per week. Compared to heterosexual women, bisexual women were more likely to eat breakfast on only 0–1 days per week (17.3% vs. 12.2%, $p=0.004$). In contrast, bisexual women were less likely than heterosexual women to report consuming fast foods several times per week (50.8% vs.

59.4%, $p<0.001$). Fruit/vegetable or soda consumption did not differ by sexual identity among women or men. Similarly, two studies using data from the National Health and Nutrition Examination Survey (NHANES) (2001–2012) found no significant differences in dietary fat intake (i.e., ratio of unsaturated to saturated fat derived from the Healthy Eating Index-2010) between sexual minority and heterosexual adults of the same sex [7, 9].

In analyses of data from the Nurses' Health Study II, VanKim et al. [55] found significant differences in validated measures of diet quality between sexual minority and heterosexual women. Both lesbian and bisexual women had higher Alternative Health Eating Index (AHEI) and Dietary Approaches to Stop Hypertension (DASH) scores than heterosexual women, indicating better diet quality. Lesbian women reported lower total fat intake and lower dietary glycemic index (i.e., a measure of how quickly carbohydrate-containing foods raise blood sugar levels). Differences in diet quality between bisexual and heterosexual women were mixed. Compared to heterosexual women, bisexual women had diets with higher fiber intake and which were lower on the glycemic index. In contrast, bisexual women reported consuming more calories per day than heterosexual women. Sexual identity differences in AHEI scores were more pronounced among women over the age of 50 [55]. Consistent with these findings, data from the Nurses' Health Study 3 revealed that women who identified as lesbian or "mostly lesbian" had higher DASH and American Heart Association diet scores than exclusively heterosexual women, indicating better diet quality [56••].

Similar trends between sexual minority and heterosexual women were documented in the Growing Up Today Study [57••]. Compared to exclusively heterosexual female participants, women who identified as "mostly heterosexual" or bisexual were more likely to report regularly consuming breakfast on five or more days each week. "Mostly heterosexual" women also had higher AHEI scores compared to exclusively heterosexual women ($B=0.70$, 95% CI=0.10–1.3, $p<0.05$).

On the other hand, additional studies found lesbian and bisexual women had lower or no difference in diet compared to heterosexual women. Minnis and colleagues [59] found that sexual minority women reported higher odds of consuming sugar-sweetened beverages in the past week than heterosexual women. Compared to heterosexual women, lesbian women also reported lower daily vegetable consumption [59]. In analyses of data from the Epidemiologic Study of Risk in Women ($N=867$), Caceres et al. [49] found no difference in the number of times that sexual minority and heterosexual women ate fast food in a usual week ($p=0.96$), which contradicts findings from Laska and colleagues [58].

We identified fewer studies that focused on diet among sexual minority men, but findings were also mixed. The

aforementioned analyses of the Growing Up Today Study indicated no differences in AHEI scores by sexual identity among male participants [57••]. Further, analyses of data from the 2013–2014 Adult Targeted Surveillance Survey found that gay men were more likely than heterosexual men to consume meals prepared away from home and sugar-sweetened beverages in the past week [59]. Bisexual men reported higher daily fruit consumption than heterosexual men [59].

Gender Minority Adults

Only four studies examined diet in gender minority adults [57••, 60–62]. In an online cross-sectional study of over 3000 adults (9.9% gender minority), investigators found that transgender women were less likely than cisgender women to eat ≥ 5 servings/day of fruit (21.1% vs. 39.6%, $p < 0.05$). Compared to cisgender men (25.5%) and cisgender women (34.6%), transgender women (11.3%) were also less likely to eat ≥ 3 servings/day of vegetables [62]. Using longitudinal data from the Growing Up Today Study, investigators examined gender expression (i.e., very gender-conforming, mostly gender-conforming, gender non-conforming) differences in diet quality scores and eating habits among young adults [57••]. Male-identified participants who were mostly gender-conforming had higher AHEI scores compared to very gender-conforming participants of the same sex, but AHEI scores did not differ by gender expression among female-identified participants. Similarly, breakfast consumption did not differ by gender expression among male-identified participants, but gender non-conforming females were less likely to consume breakfast than very gender-conforming females [57••]. In one of the few studies conducted outside of the U.S., investigators found that in a community sample of 200 transgender adults living in India, the majority reported consuming less than the recommended five servings of fruits and/or vegetables per day (90.5%) [61].

Correlates of Diet in SGM Adults

Only three studies reported on correlates of diet among SGM adults [60, 63, 64]. In an online sample of 670 SGM adults, investigators [63] found that $> 70\%$ of participants reported diets high in saturated fat or sodium. In addition, higher report of distal minority stressors (such as harassment and discrimination) was associated with higher odds of reporting a diet high in saturated fat or sodium among men only [63]. A notable limitation of the study was the use of a single dichotomous measure to assess if participants had diets high in both saturated fats and sodium [63]. Therefore, it is unknown whether minority stressors were more strongly associated with either saturated fat or sodium intake. Further, in a qualitative study of sexual minority college

students ($N = 30$), investigators explored participants' perceptions about sexual orientation–related barriers to healthy eating [64]. Responses were mixed, with approximately half of participants reporting they felt that their sexual orientation did not influence their decisions around eating. Other participants felt that being more connected to the SGM community promoted healthy eating habits [64]. In addition, a mixed-methods study conducted to assess barriers to health and nutrition among gender minority college students ($N = 26$) [60] found that $< 50\%$ of participants ate fruit or vegetables daily during the past seven days, and $> 55\%$ did not eat whole grains in the past week. Several barriers to eating more fruits and vegetables were identified, including limited access to cooking spaces, lack of transportation to affordable grocery stores, and increased cost of fresh foods [60].

Diet and CVD Risk in SGM Adults

There is limited research examining diet as a predictor of CVD risk in SGM adults and findings are largely null [7, 9, 65–67]. All of these studies were focused on sexual minority populations; no studies have investigated the associations of diet and CVD risk in gender minority adults. Moreover, only three of these studies used validated diet measures [7, 9, 66]. The most commonly studied CVD risk factor was obesity ($n = 5$), followed by hypertension ($n = 3$), hyperlipidemia ($n = 3$), and type 2 diabetes ($n = 2$).

In their cross-sectional online survey of 377 lesbian women (ages 18–30), Mason et al. [66] found that diet quality, measured by the Rate Your Plate simplified food frequency questionnaire, was not correlated with weight status. Diet quality scores did not differ between women of normal weight compared to women who were overweight or obese [66]. Additional studies found that dietary fat intake was not associated with higher odds of obesity, type 2 diabetes, or hypertension among sexual minority adults [7, 9]. Further, in a mixed-methods study of 40 men who have sex with men (MSM) living with HIV/AIDS, Sackey et al. [65] found no significant differences in BMI based on dietary scores. Only one study found that at least one component of diet was associated with increased obesity prevalence in sexual minority women [67]. In a convenience sample of 219 African-American lesbian and bisexual women in the U.S., Matthews and colleagues [67] found that participants who were overweight (21.8%) and obese (30.8%) were more likely to report consuming red meat three or more times per week compared to participants of normal weight (11.1%). They found no differences in fruit or vegetable intake by weight status [67].

We identified only one intervention that targeted diet quality to reduce CVD and chronic disease risk in SGM adults. In a randomized controlled trial of lesbian and

bisexual women ($N=80$) comparing a 12-week mindfulness-based stress reduction intervention to a waitlist control group, investigators found few differences in diet between the immediate-start and waitlist control participants [68]. The intervention also included nutrition education (led by a registered dietician), physical activity, and health education and knowledge building. At the conclusion of the intervention, fruit ($p=0.10$) nor vegetable ($p=0.17$) intake differed between the immediate-start and waitlist groups. Notably, investigators did not report if changes in diet measures influenced CVD risk [68].

Food Insecurity in SGM Adults

The eight studies that investigated some aspects of food insecurity among SGM adults were published between 2019 and 2021 and were all conducted in the U.S. Six of these studies were cross-sectional, one study reported results of a longitudinal analysis, and one used a mixed-methods approach (Supplemental Table 1). The prevalence of food insecurity varied considerably across studies (range 10–80%). Measures of food insecurity also varied across studies, but the U.S. Department of Agriculture's Food Security Survey Module (FSSM) was the most widely used measure ($n=3$). Two studies did not provide sufficient detail about their measures of food insecurity. The remaining studies used non-validated measures to assess food insufficiency ($n=2$) and food stress ($n=1$).

Sexual Minority Adults

In one of the few studies to focus specifically on food insecurity among sexual minority women, Patterson and colleagues [69••] analyzed cross-sectional data from the NHANES (2004–2014) to determine the prevalence of household food insecurity over the past 12 months (measured using the FSSM) among sexual minority and exclusively heterosexual women. Sexual minority women had higher prevalence ratios for food insecurity and severe food insecurity compared to exclusively heterosexual women. In addition, lesbian women and heterosexual women who reported having sex with women were 89% and 43% more likely, respectively, to report use of emergency food assistance compared to exclusively heterosexual women [69••].

Moreover, two studies examined aspects of food insecurity in sexual minority men, but only one of these included comparisons with heterosexual men. Using 2003–2012 data from the California Health Interview Survey [70], investigators found that among participants living in poverty, sexual minority men were less likely to be food insecure than heterosexual men (4.6% vs. 7.6%, $p<0.001$). Analyses of the

Healthy Young Men's Cohort Study data found that more than one-third (36%) of MSM reported food insufficiency in the previous 12 months (e.g., ate less or skipped meals because there was not enough money) [71].

Gender Minority Adults

Only four studies examined aspects of food insecurity among gender minority persons [60, 72, 73, 74••]. In a mixed-methods study of gender minority college students ($N=26$), Kirby and Linde [60] found that food insecurity was common in this population with > 50% of participants reporting limiting their food intake and > 30% reporting going hungry because of concerns related to food costs. Approximately 40% indicated they experienced food insecurity almost every month in the past year [60]. Also, in an online convenience sample of SGM adults ($N=253$), investigators found that the prevalence of food insecurity (measured with the FSSM) was highest among gender minority participants [73]. Transgender male participants (64.8%) reported a higher prevalence than gender non-binary (58.7%), cisgender male (48.1%), and cisgender female (46.6%) participants. However, correlates of food insecurity were not examined [73].

Two studies found no differences in food stress and food insufficiency between gender minority and cisgender adults [72, 74••]. In analyses of data from the 2014–2015 Behavioral Risk Factor Surveillance System (BRFSS), investigators compared the prevalence of food stress between transgender ($n=261$) and cisgender adults ($n=52,799$) [74••]. The 2014–2015 BRFSS included a single item to measure food stress. Transgender and cisgender participants did not differ in their odds of reporting food stress (AOR 1.25, 95% CI=0.63–2.50). Compared to heterosexual adults, sexual minority adults reported 49% higher odds of food insecurity, independent of gender identity [74••]. Similarly, analyses of data from the COVID-19 Resiliency Survey in Chicago ($N=201$) found no difference in food insufficiency between transgender and cisgender participants (10.0% vs. 10.7%, $p=0.94$) [72].

Correlates of Food Insecurity in SGM Adults

Research on correlates of food insecurity among SGM adults is limited. In the aforementioned analyses of data from the Healthy Young Men's Cohort Study, Kipke and colleagues [71] found that Black MSM (35%) were more likely to report food insecurity than both Hispanic (21%) and multi-racial MSM participants (22%). In an online convenience sample of gender minority adults living in the Southeast U.S. ($N=105$), Russomanno and Jabson Tree [75] found ~ 80% reported food insecurity (measured using the FSSM) and ~ 20% used local food assistance resources. Gender-related minority stressors and resilience factors were

generally not associated with food insecurity. However, participants who reported greater transgender pride reported higher odds of using local food pantries to obtain food (AOR 1.09, 95% CI = 1.00–1.19, $p=0.04$) [75]. In analyses of 2014–2015 BRFSS data, investigators identified several correlates of food stress among SGM adults [74••]. Factors associated with lower odds of food stress in the full sample were increasing age, male sex, higher household income, and being retired. Factors associated with higher odds of food stress were identifying as multi-racial, being formerly married, and being unemployed [74••].

Food Insecurity and CVD Risk in SGM Adults

Although food insecurity has been associated with increased CVD risk and CVD mortality among adults [41–45], to date, no studies have examined whether food insecurity influences CVD risk in SGM adults. There are also no existing interventions focused on reducing food insecurity and related CVD risk among SGM adults.

Limitations of Existing Research

Studies that have investigated diet and food insecurity in SGM adults demonstrated significant methodological limitations and few examined their influence on CVD risk. Despite evidence that food insecurity is a predictor of poor diet quality [38, 39] and CVD risk [41–45], no study has examined these associations among SGM adults. Overall, there was inconsistent measurement of diet and food insecurity making it difficult to draw meaningful comparisons across studies. Most researchers have relied on single-item measures of diet and food insecurity, rather than validated instruments. In fact, <40% of studies included in this review used validated instruments to assess diet and food insecurity. Most of the evidence summarized in this review was drawn from cross-sectional studies (83%), which limits causal inference. In addition, several factors limit the generalizability of our findings. Approximately 70% of studies used convenience sampling methods to recruit SGM adults and all but one study was conducted in the U.S. Also, three out of the five studies that examined the associations of diet with CVD risk recruited SGM individuals from SGM community groups. Prior work suggests that greater SGM community connectedness is inversely associated with health concerns among SGM adults, such as depressive symptoms and sleep problems [76–78]. Participants recruited from SGM community groups may be better connected to the SGM community [65–67]. Therefore, SGM participants in the included studies may have had overall better health than SGM adults who are less connected to SGM community resources.

Recommendations for Future Research

Research on diet and food insecurity as contributors to CVD risk in SGM adults is nascent. Given the identified limitations of existing research, there is a need for future longitudinal studies that investigate the link between diet and food insecurity with CVD risk in SGM adults. We found that only five studies reported on correlates of diet and food insecurity among SGM individuals [60, 63, 64, 71, 74••]. Therefore, this review underscores the need for future studies that assess contributors to poor diet and food insecurity among SGM individuals. Intersectionality is a theoretical framework that is useful for examining how exposure to multiple forms of oppression (e.g., homophobia, sexism) influences health outcomes in minority populations [79, 80]. Only one study in this review employed an intersectional approach to investigate differences in food insecurity [74••]. In their analyses of BRFSS data, Henderson et al. [74••] investigated whether race/ethnicity and employment status moderated the associations of gender identity with food insecurity. They found no evidence of moderation, but their analysis only included 261 gender minority participants, which may have limited their statistical power to detect moderation. Recent studies have found that Black and Hispanic SGM individuals may be at greatest risk for CVD within the SGM community [19, 81, 82]. This review supports the need for future studies that use intersectional approaches to assess whether diet and food insecurity differ among SGM adults exposed to multiple forms of oppression, such as people of color. Such research can inform public health and policy interventions that target SGM adults most at risk for poor diet and food insecurity.

Recommendations for Clinical Practice

Although the findings of this review are mixed, they have important implications for clinical practice with SGM adults. In prior qualitative research, investigators have found that traditional approaches to weight loss may be less effective and less culturally appropriate for sexual minority women [83]. Sexual minority women also report considerable variability and confusion about what is considered a healthy diet [84]. Among gay men, changes to diet intake may be more motivated by a desire to lose weight rather than eating healthily [85]. Growing evidence demonstrates that clinicians receive little education on SGM health issues and most lack adequate knowledge to care for SGM adults, particularly gender minority individuals [86–88]. Further, analyses of population-based data in the U.S. suggest that SGM adults are more likely than non-SGM adults to delay or avoid

seeking healthcare due to concerns related to cost and other factors (e.g., transportation) [6, 89, 90]. This may place them at greater risk for undiagnosed risk factors for CVD (such as hypertension and type 2 diabetes). Tailored approaches to increase SGM individuals' engagement in healthcare and to reduce their CVD risk are needed. In particular, clinicians should be educated about important within-group social norms and attitudes related to diet among SGM individuals.

Conclusions

In this review, we summarize recent literature related to diet and food insecurity in SGM adults and their contribution to CVD risk in this population. Research investigating the associations of diet and food insecurity with CVD risk in SGM adults is nascent but has grown exponentially in the past three years. Overall, the rigor of existing studies is limited due to methodological concerns. Identified limitations in the extant literature support the need for future longitudinal studies that use validated measures to investigate the associations of diet and food insecurity with CVD risk in SGM adults. Findings highlight the need for clinicians to better understand the diet and health needs and preferences of SGM adults to promote their CVH.

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Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- Of importance
- Of major importance

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