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REVIEW

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Updating the association between socioeconomic status and obesity in low-income and lower-middle-income sub-Saharan African countries: A literature review

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Summary

Globally, the literature tends to emphasize negative associations between socioeconomic status (SES) and bodyweight in countries improving their economic development. However, little is known about the social distribution of obesity in sub-Saharan Africa (SSA) where economic growth has been highly heterogeneous the last decades. This paper reviews an exhaustive set of recent empirical studies examining its association in low-income and lower-middle-income countries in SSA. Although there is evidence of a positive association between SES and obesity in low-income countries, we found mixed associations in lower-middle-income countries, potentially providing evidence of a social reversal of the obesity burden.

KEYWORDS
nutrition transition, obesity, socioeconomic status, sub-Saharan Africa

1 | INTRODUCTION

In recent decades, excess weight and obesity have continually increased around the world, contributing to the rise in related chronic diseases such as diabetes, cancers, and cardiovascular diseases. By 2025, a global obesity prevalence of 18% among men and 21% among women is predicted, with one in every two adults being classified as overweight.[1] In parallel with the globalized weight gain, the worldwide nutritional panorama remains contrasted, with regional disparities. Whereas high-income and higher middle-income countries, mostly located in Europe, Asia, and America, are facing a dramatic overweight and obesity epidemic, low-income and lower-middle-income countries, most of which are in sub-Saharan Africa (SSA), are in an unprecedented situation. Indeed, in SSA, the increase in obesity coexists alongside a persistence of hunger and starvation. In West, Central, and East Africa, for instance, the prevalence of female overweight increased significantly between 1975 and 2014 and currently ranges from 30% to 40%, whereas female underweight prevalence remains high (from 10% to 15% depending on the region).[1] There is also evidence that excess weight prevalence reaches higher levels in urban areas and among women compared with rural areas and men.[2] This coexistence of high rates of both underweight and excess weight in the same region or country is referred to in the literature as the double burden of malnutrition[3] and constitutes a major public health concern, with significant policy implications.[4] Investigating the socioeconomic determinants of weight gain in SSA thus calls for greater attention among scholars.

The social and economic drivers of individual bodyweight, such as education, income, wealth, and occupation, may strongly depend on the national level of economic development.[5] Previous literature surveys have contrasted the situation in high-income and low-income countries[5–7] with a negative relationship being noted in richer countries (i.e., excess weight affects the lowest socioeconomic groups in particular) versus a positive relationship in poorer countries (i.e., excess weight affects the highest socioeconomic groups in particular). Nowadays, the worldwide nutritional panorama has changed

and does not seem so dualistic. In SSAn countries namely, whereas certain authors find a positive association between SES and body mass indicators, others find no association and, sometimes, negative associations. Even if the literature is still unclear about the association between SES and excess weight in SSA, there is emerging, albeit limited, evidence of a shift in the distribution of overweight and obesity across SES groups, in line with the *diffusion theory* established by Agyemang et al.[8] Inspired by Monteiro et al.,[9] this theory states that obesity and related chronic diseases spread from the rich to the poor as the living standards of the poorest improve. Empirical evidence confirms this theory in the case of upper-middle-income countries such as China,[10,11] Mexico,[12,13] Indonesia, and South Africa.[14]

The existence of a shift in the SES-excess weight association is closely linked to complex economic, social, and cultural dynamics embedded in the nutrition transition process. Theorized by Popkin,[15] nutrition transition refers to changes in the composition of diet, resulting in an increase in calorie intake accompanied by a reduction in energy expenditure due to the adoption of more sedentary lifestyles. People tend to gain weight because of this increasing calorie imbalance, and such nutritional changes generally occur with economic development, urbanization, technological change, and globalization.[16] Many SSAn countries are experiencing a rapid and intense nutrition transition,[17] and two main factors may account for the potential shift in the SES-excess weight association in this specific context. First, the environmental and economic conditions undoubtedly matter. Influenced by rapid urbanization driven by rural-to-urban migration and the improvement in lifestyle conditions linked to economic development, abundant food has become more widely available, explaining why excess weight gradually affects lower-SES groups. Second, according to Agyemang et al.,[8] the literature has also alluded to the role of nutritional and weight perception issues in the specific context of SSA. Lastly, the influence of socio-cultural beliefs linking excess weight to prosperity, power, or good health, as noted by several scholars (e.g., Renzaho[18]), appears to have lost ground, especially among higher SES groups. The spread of westernized ideals of thinness together with healthy dietary recommendations through an improved access to high schools and universities may explain why higher SES groups are increasingly rejecting stoutness and adopting healthier behaviors.[19]

The purpose of this literature review is to provide a detailed overview of the complex shift in the SES-bodyweight association that is taking place during the ongoing nutrition transition in SSA. Although several literature surveys have already been conducted on the topic,[8,20–22] this review brings two main contributions. First, it provides insights based on a comparison of low-income and lower-middle-income SSAn countries regarding the SES-bodyweight association. Based on a survey of recently published studies (i.e., between 2010 and 2020), our comparative approach emphasizes different associations between low-income and lower-middle-income SSAn countries. Whereas there is evidence of a positive association between SES and excess weight in low-income SSAn countries, the associations are mixed in lower-middle-income countries. A second contribution of this review is to highlight comparative evidence from rare empirical and analytical studies reporting U-inverted trends between SES and body mass index (BMI) in samples of middle-income countries.[23–25] This suggests a social reversal of the obesity burden along with the process of economic development and nutrition transition, confirming the *diffusion theory*.

2 | METHOD

2.1 | Search strategy and inclusion/exclusion criteria

A comprehensive search through the existing literature was carried out on Google Scholar and PubMed databases using specific keyword combinations associating two-by-two weight-based and SES-based terms. We systematically associated "obesity," "overweight," "excess weight," "bodyweight," and "body mass index" with "socioeconomic status", "social class," "household income," "wealth," or "education" (i.e., a total of 25 combinations). Next, to minimize exclusion errors, we also used an alternative search approach whereby articles cited within another article were reviewed.

Several exclusion and inclusion criteria were applied in the search strategy to capture papers of interest that matched the study objectives. First, we only included applied quantitative research in the review, based on population or household surveys (using statistics, biostatistics, or econometrics), with a focus on adult populations. Most of the selected studies consider bodyweight indicators as dependent variables and SES measures as explanatory variables, although three articles do the opposite (i.e., Capingana et al. and Zeba et al.[26,27] and Stringhini et al.[28]). Second, we exclusively included articles focusing on SSAn countries published between 2010 and 2020 so as to capture an updated picture of the relationship between SES and bodyweight in this region of the world. Third, to ensure the scientific quality of the selected studies, we only included papers published in academic journals (i.e., with a blind peer review process) referenced by SciMago or Web of Science. Fourth, we only considered papers written in English or French, which is not an issue as most SSAn countries are French- or English-speaking. Fifth, we excluded SSAn countries involved in heavy armed conflict from the literature review (e.g., Central African Republic and South Sudan) or affected by extreme poverty conditions (e.g., Niger and Chad), where overweight and obesity are not (yet) major issues. Given the low availability of recent data in these countries, no published articles analyzing the SES-obesity association were found. Finally, the literature review focused exclusively on low-income and lower-middle-income countries in SSA, as per the most recent World Bank classification.[3] Thus, the study could potentially cover 41 countries, excluding Botswana, Equatorial Guinea, Gabon, Mauritius, Namibia, and South Africa, which belong to the upper-middle-income group, and the Seychelles, which is classified as a high-income country. In line with Strauss and Thomas,[14] these richer countries were excluded from the sample as they have already reached a more advanced stage of nutrition transition. Moreover, upper-middle-income and high-income countries in

SSA have already been the object of numerous investigations into the social and economic determinants of obesity and non-communicable diseases.[29] Hence, in this review, we decided to focus on low-income and lower-middle income countries for which retrospective research is missing. All in all, we were able to collect 52 articles that examine 131 associations. Among these 131 associations, 78 concern lower-middle-income countries and 53 concern low-income countries.

2.2 | Indicators

In the empirical literature reviewed in the study, several indicators were used to quantify bodyweight among individuals, specified as a dependent variable in statistical models. BMI was the most common indicator, defined as weight (kg) divided by squared height (m^2). Using BMI values, the World Health Organization (WHO) classifies male and female adults into four groups: underweight (lower than 18.5 kg/m^2), normal weight (18.5–25 kg/m^2), overweight (25–30 kg/m^2), and obesity (higher than 30 kg/m^2). Other bodyweight indicators were also used in the articles reviewed: waist circumference (WC), waist-to-height ratio (WHtR), waist-to-hip ratio (WHR), percentage of body fat (%BF), and sum of the three skinfolds (STS). Although BMI is the most widely used indicator, it is increasingly criticized for two main reasons.[30] First, BMI does not allow for a differentiation between fat and fat-free mass such as bone and muscle. Second, it does not provide information on the location of fat in the body, leading to the misclassification of some segments of the population. This explains why alternative indicators such as WC or WHtR are becoming increasingly popular. They give a precise idea of abdominal adiposity (or visceral fat accumulation), which is particularly deleterious to human health. Among the 131 associations examined, 113 used BMI as a bodyweight indicator, and 14 used WC. Four associations were based on other bodyweight outcomes such as WHtR, WHR, %BF, and STS (see Tables 1 and 2).

Different indicators were also used to capture household or individual SES, generally specified as the explanatory variable of interest in the empirical papers reviewed. SES is a multidimensional concept that can be defined as an individual's or household's position within a hierarchical social structure.[31] In the empirical literature, SES is generally measured by household income, household assets, individual occupation, and/or individual education attainment. Due to data availability issues, the papers tend to focus on individual education attainment and household wealth or assets (respectively, 61 and 34 associations). However, some studies use household income, individual employment, or household-based composite indices as SES indicators.

3 | RESULTS

We list the results of the papers that focus on low-income and lower-middle-income SSAn countries in Tables 1 and 2, respectively. A total of 52 empirical studies focusing on a single or several countries in SSA were reviewed, with 131 associations examined. To increase the results' readability, Tables S1 and S2 also present the nature of associations found according to the SES indicator and the sub-period (2010–2015 and 2016–2020) considered. Table S3 lists the studies reviewed with information on the bodyweight indicator(s) selected, the number of associations highlighted, and the type of sample considered (women only or both sexes).

3.1 | Low-income countries

As shown in Table 1, a total of 53 associations were identified for 8 low-income SSAn countries. Approximately 60% of the associations between SES and bodyweight indicators in low-income countries are positive and significant (32/53 associations), other associations being positive but not significant. Although BMI-based indicators are mainly used in these studies, various SES indicators are considered: individual education attainment, wealth indices, household assets or household income, and composite indices crossing several SES dimensions. The justifications put forward by the literature for the positive association between SES and BMI remain in line with previous discussions on the topic. Low-income countries are at the very beginning of their nutrition transition, which means that they still face a real challenge in terms of food scarcity and undernutrition.[42] Furthermore, while Delisle et al.[39] and Zeba et al.[32] point to the introduction of unhealthy eating habits in Benin and Burkina Faso (e.g., meat and poultry, dairy products, sweets, and sweet drinks), these energy-dense foods remain relatively expensive and cannot be consumed by the poorest members of society.[33–35] Finally, for several authors, the positive link between SES and excess weight in low-income countries is also due to macroeconomic drivers such as urbanization, tertiarization, and globalization.[34,35,40,43,52] In short, Western lifestyles have gained a foothold among the most affluent members of the poorest SSAn countries as the latter have better access to obesogenic goods (i.e., ultra-high calorie meals and sedentary free time such as watching TV) and disproportionally live in cities and occupy the highest (non-physically intensive) job positions.[44,45,48,49]

Notwithstanding the large number of positive and significant associations, around 40% of the associations examined are positive and non-significant (21/53). These non-significant associations among low-income countries in SSA temper previous observations. Another corpus of studies argues that the so-called double burden of malnutrition simultaneously and disproportionally affects lower-socioeconomic groups in SSA,[3] even within the same household.[24] For example, in Burkina Faso, an adult without formal education and with a low income has a high risk of being affected by overweight or obesity, in addition to suffering from serious micronutrient deficiencies.[27] Therefore, we can assume that the coexistence of malnutrition and overweight within poor households, and within poor individuals, contributes to making the association between SES and bodyweight indicators unclear.

TABLE 1 List of reviewed articles focusing on low-income countries in SSA.

	Positive relationship					Negative relationship				
SES indicator	**Nb**	**Ref.**	**Country**	**Bodyweight indicator (#)**	**♀**	**Nb**	**Ref.**	**Country**	**Bodyweight indicator (#)**	**♀**
Income	4	NCD Risk Factor Collaboration and Krieger et al.[1,31]	Benin, Burkina Faso	BMI(2), WC(2)	0					
Education Employment	9 2	Previous studies[10,20,31,33–37]	Malawi, Ethiopia, Burkina Faso, Mali, Benin, Uganda, Mozambique, Malawi, Mozambique	BMI(9) BMI(2)	5 2					
Wealth/owned assets	15	Previous studies[6,10,19,20,22,24,26,33,35–38]	Ethiopia, Mali, Tanzania Uganda, Malawi, Burkina Faso, Mozambique	BMI(15)	11					
Composite index	2	Fernald and Kimmel et al.[12,17]	Tanzania, Uganda	BMI(2)	0					
Total	32			BMI(30), WC(2)	18	0				

Note: "Nb" refers to the number of associations found in the sample of reviewed articles. "#" refers to the number of times a given bodyweight indicator is used in a given association. "♀" refers to the number of associations focusing exclusively on female population. Bodyweight indicators are body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), waist-to-hip ratio (WHR), percentage of body fat (%BF), and sum of the three skinfolds (STS). References are listed in Table S3.
Abbreviations: SES, socioeconomic status; SSA, sub-Saharan Africa.
Source: Authors.

TABLE 1 (Continued)

	Nonlinear relationship					Nonsignificant relationship					
SES indicator	**Nb**	**Ref.**	**Country**	**Bodyweight indicator (#)**	**♀**	**Nb**	**Ref.**	**Country**	**Bodyweight indicator (#)**	**♀**	**Total**
Income						4	Previous studies[12,13,32]	Uganda, Mozambique, Benin	BMI(2), WC(2)	0	8
Education Employment						15 2	Previous studies[1,12–14,17,22,24,26,31,32,37,38]	Benin, Uganda, Mozambique, Malawi, Burkina Faso, Tanzania, Ethiopia, Malawi, Mozambique	BMI(11), WC(4) BMI(2)	6 2	24 4
Wealth/owned assets											15
Composite index											2
Total	0					21			BMI(15), WC(6)	8	53

Note: "Nb" refers to the number of associations found in the sample of reviewed articles. "#" refers to the number of times a given bodyweight indicator is used in a given association. "♀" refers to the number of associations focusing exclusively on female population. Bodyweight indicators are body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), waist-to-hip ratio (WHR), percentage of body fat (%BF), and sum of the three skinfolds (STS). References are listed in Table S3.
Abbreviations: SES, socioeconomic status; SSA, sub-Saharan Africa.
Source: Authors.

TABLE 2 List of reviewed articles focusing on lower-middle-income countries in SSA.

	Positive relationship					Negative relationship				
SES indicator	Nb	Ref.	Country	Bodyweight indicator (#)	♀	Nb	Ref.	Country	Bodyweight indicator (#)	♀
Income	5	Previous studies[2,18,39–41]	Kenya, Nigeria, Angola, Cameroon	BMI(5)	1					
Education	15	Previous studies[2,4,7,9,11,18,23,27,29,41,42,46,51,52]	Kenya, Ghana, Nigeria, Zimbabwe, Lesotho	BMI(14), WC(1)	9	5	Previous studies[8,28,30,40]	Nigeria, Ghana, Cameroon	BMI(3), WC(1), WHtR(1)	0
Employment	8	Previous studies[7,25,27,29,37,47]	Ghana, Zimbabwe, Swaziland, Lesotho, Sao Tome and Principe	BMI(8)	6					
Wealth/owned assets	18	Previous studies[4,7,9,11,23,25,37,44,45,47–51]	Ghana, Nigeria, Kenya, Zimbabwe, Lesotho, Swaziland, Sao Tome and Principe	BMI(17), WC(1)	10					
Composite index	2	Shekar and Popkin and Sobal and Stunkard[3,5]	Kenya, Ghana	BMI(2)	2					
Total	48			BMI(46), WC(2)	28	5			BMI(3), WC(1), WHtR(1)	0

Note: "Nb" refers to the number of associations found in the sample of reviewed articles. "#" refers to the number of times a given bodyweight indicator is used in a given association. "♀" refers to the number of associations focusing exclusively on female population. Bodyweight indicators are body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), waist-to-hip ratio (WHR), percentage of body fat (%BF), and sum of the three skinfolds (STS). References are listed in Table S3.

Abbreviations: SES, socioeconomic status; SSA, sub-Saharan Africa.

Source: Authors.

TABLE 2 (Continued)

	Nonlinear relationship					Nonsignificant relationship					
SES indicator	Nb	Ref.	Country	Bodyweight indicator (#)	♀	Nb	Ref.	Country	Bodyweight indicator (#)	♀	Total
Income						2	Burkhauser and Cawley[30]	Nigeria	BMI(1), WC(1)	0	7
Education	2	Popkin and Burkhauser and Cawley[15,30]	Nigeria, Zambia	BMI(1), WC(1)	0	15	Previous studies[8,21,25,37,41–47]	Kenya, Zimbabwe, Senegal, Cape Verde, Ghana, Nigeria, Sao Tome and Principe, Swaziland, Lesotho	BMI(13), WHR(1), STS(1)	6	37
Employment						1	Clément et al.[37]	Lesotho	BMC(1)	0	9
Wealth/owned assets						2	Mabchour et al. and Pereko et al.[42,46]	Senegal	BMI(2)	0	20
Composite index						3	Shekar and Popkin and Kirunda et al.[3,52]	Kenya, Nigeria	WC(2), %BF(1)	1	5
Total	2			BMI(1), WC(1)	0	23			BMI(17), WC(3), WHR(1), %BF(1), STS(1)	7	78

Note: "Nb" refers to the number of associations found in the sample of reviewed articles. "#" refers to the number of times a given bodyweight indicator is used in a given association. "♀" refers to the number of associations focusing exclusively on female population. Bodyweight indicators are body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), waist-to-hip ratio (WHR), percentage of body fat (%BF), and sum of the three skinfolds (STS). References are listed in Table S3.

Abbreviations: SES, socioeconomic status; SSA, sub-Saharan Africa.

Source: Authors.

3.2 | Lower-middle-income countries

As shown in Table 2, 78 associations focus on lower-middle-income SSAn countries. It is worth noting that among the 11 countries covered, Ghana, Kenya, and Nigeria were those most investigated in the existing literature. Broadly speaking, contrary to what we observe for low-income countries, the relationship between SES and bodyweight is even more ambivalent in lower-middle-income countries, probably because these richer countries are at a more advanced stage of their nutrition transition.

In the sample, 61.5% of associations between SES and bodyweight indicators are positive and significant (48/78). Although the preferred SES indicators are household assets (18/48) and individual educational attainment (15/48), we also found evidence of a positive association for household income (5/48), individual employment status (8/48), and, to a lesser extent, composite indices (2/48). For the measurement of individual bodyweight, however, a lack of diversity may be noted. Among the papers reporting a positive association, BMI-based indicators (continuous and clinical classification) are predominantly used as bodyweight indicators (46/48).

In contrast, we also found a large number of studies reporting non-significant linear associations between SES and bodyweight indicators (29.5%, 23/78), neither positive nor negative. These non-significant associations are less diverse with regard to SES indicators (15/23 focus on educational outcomes).

Interestingly, two studies managed to demonstrate the presence of nonlinearity in the relationship considered but only for the educational component of SES. In Zambia (Lusaka city), Rudatsikira et al.[50] observe a higher obesity risk (as defined with BMI) among individuals with primary or secondary education than among those with college education or no education. This may suggest the existence of a U-inverted association between education and excess weight that could be justified by two contradictory factors linked to education-related health benefits and body perception. More precisely, Rudatsikira et al.[50] explain that although higher educational attainment is associated with increased knowledge that, in turn, enables individuals to make healthier choices, the fact that excess weight is still considered as a symbol of wealth can counterbalance the educational benefits, especially among males. It may be argued that this latter factor is particularly important among adults with intermediate levels of education. In contrast, among the non-educated individuals, although stoutness is also valued as a symbol of health, the lack of economic resources tends to limit calorie intakes and weight gain. Likewise, in Nigeria, Oguoma et al.[53] found that average WC is highest among adults with only primary education and lowest among graduate and post-graduate individuals compared with individuals with no formal education (i.e., a U-inverted trend between education and WC).

Finally, five negative and significant associations (6.5%, 5/78) between SES and bodyweight indicators were identified. Even though such negative associations are relatively uncommon in lower-middle-income countries, they may reflect a certain shift in the socioeconomic gradient of the obesity epidemic in SSA. These associations were found with several bodyweight indicators (BMI, WHtR, and WC) in Nigeria, Ghana, and Cameroon. Interestingly, education is again the only SES indicator for which a negative relationship is found, confirming the assumed protective effect of education against obesity. Moreover, we should note that Nigeria, Cameroon, and Ghana are at an advanced stage of nutrition transition on the continent, with a high prevalence of obesity and the implementation of large-scale public health policies to prevent obesity, especially in urban areas. Hence, it is not surprising that Anyanwu et al.[41] observe a significant negative correlation between adiposity indicators (WC and WHtR) and educational attainment among adults in Nigeria (from the Ibos ethnic group). In the same vein, Pereko et al.[46] found that people in three fishing communities in the metropolis of Cape Coast in Ghana have a lower risk of being overweight if they have completed more than 13 years of formal education. Finally, Aminde et al.[38] report that in the semi-urban context of Buea in Cameroon, individuals who had attended university were less likely to be affected by obesity or overweight than less educated individuals. The authors argue that in these relatively richer countries that have reached an advanced stage of nutrition transition, better access to health-related information combined with greater ability to handle such information explain the shift in the obesity burden from the more well educated to the less well educated. Formal education enables people to improve their choices regarding healthier practices, with a decrease in alcohol consumption and high-fat food, along with an increase in physical activity. In addition, we can assume that overexposure to obesity-related health risks in privileged settings also leads far fewer educated people to value stoutness as a symbol of health.

3.3 | Gender heterogeneity?

The existing literature notes the presence of gender heterogeneity in the SES-BMI relationship. Indeed, most studies show that the social reversal of the obesity burden in line with economic development (shift from the rich to the poor) occurs earlier for women than for men.[9,36,51] Such gender differences can be explained by the fact that women are more sensitive to the diffusion of ideals of thinness and health-related benefits, whereas norms and values associating excess weight with prestige and power remain more persistent in the male population. Surprisingly, we failed to find evidence of such an early reversal for women in the studies reviewed, even for lower-middle-income countries. For these latter countries, the prevalence of a positive association is even greater in studies focusing on female populations (80%, 29/36) than when all the studies reviewed are taken into consideration (61.5%, 48/78).

4 | LIMITATIONS IN THE EXISTING LITERATURE

The mixed results point to a shift that is difficult to grasp regarding the socioeconomic distribution of excess weight and obesity in SSA. Several methodological limitations can explain why the results are unclear, especially in the context of lower-middle-income countries.

First, a high proportion of studies in the literature investigating the association between SES and adult bodyweight in SSA focus exclusively on women. Among the 130 associations examined, approximately 48% focus exclusively on female adults, whereas 52% analyze both sexes. This is primarily due to the fact that the main data sources used to examine the determinants of bodyweight in SSA are Demographic and Health Surveys (DHS), which only collect anthropometric data for women (and their children). This means that there is a potential gender bias in our current understanding of the relationship. Another well-known limitation of DHS data is the absence of income or expenditure data and detailed information on labor market participation. This explains why most of the reference studies tend to focus on education and household wealth as measures of SES, resulting in an incomplete overview of the SES–bodyweight association. Although DHS remains a useful source of quantitative information, we suggest that nutrition-specific surveys need to be conducted for a more in-depth analysis of the socioeconomic determinants of bodyweight in SSA, such as those already conducted in non-African developing countries (e.g., National Survey of the Nutritional Situation [ENSIN] in Colombia, National Survey on Health and Nutrition [ENSANUT] in Mexico, and China Health and Nutrition Survey [CHNS] in China). These surveys provide rich information on SES (income, assets, employment, and education) as well as on nutritional outcomes, dietary patterns, eating practices, food preferences, time allocation, and physical activity. Conducting such surveys in the SSA context would undoubtedly help to extend our understanding of the association between SES and excess weight and to explore the dynamics underlying the rise in excess weight and obesity.

Second, as shown in Tables 1 and 2, results are highly dependent on the bodyweight and SES indicators used. As Clément et al.[37] noted, there is no universal clinical classification to categorize individual bodyweight. Given that 73% of the studies in the literature review include discrete variables as bodyweight indicators (often based on the BMI classification), other country-specific cut-offs should be adopted in order to take ethnic variations and major differences in morphology into account.[47] In Asia for instance, a growing number of studies use country-specific cut-offs to classify individuals affected by overweight and obesity. In contrast, most of the studies focusing on SSA use the WHO-based universal BMI cut-offs, even though these cut-offs were initially defined from and for Caucasian populations.[54] Estimating optimal BMI cut-offs for the Ethiopian population, Sinaga et al.[55] argue that suitable overweight and obesity thresholds should be far below the commonly-used WHO-based universal thresholds. Furthermore, the multiplicity of SES indicators used in the literature sometimes leads to conflicting results and makes it difficult to compare empirical studies. Likewise, each SES indicator has advantages and drawbacks that are rarely debated in empirical research. For instance, while education attainment can be used as a long-term indicator as it remains unchanged across time (at least for adults), income may change across time and should be considered as a short-term indicator that depends on shocks and seasons.

Third, significant model-based limitations hamper previous investigations on the topic. The vast majority of studies focusing on SSA rely on regression frameworks (i.e., linear or logistic regressions) that analyze adjusted linear correlations between SES and nutritional outcomes. Some recent papers have demonstrated the need to explore potential nonlinearities in this relationship, namely, by testing curvilinear associations in SSA (e.g., Daran and Levasseur[23]). Moreover, few scholars have analyzed longitudinal data, and none have dealt with potential endogeneity issues.[56] Yet, there are two potential sources of endogeneity (i.e., reverse causality and unobserved heterogeneity) that could overstate the positive association between SES and bodyweight measurements observed in several correlational studies. For example, in SSA, men with a large body mass might be considered more positively in a job interview and may thus obtain a job and a regular income more easily (i.e., reverse causality) than very thin men who are perceived as sick. Likewise, we can assume that the usual omission of socio-cultural specificities regarding weight perception in the empirical literature biases econometric estimations, as such perceptions are endogenous to SES, lifestyles (calorie intake and physical exercise), and nutritional outcomes.

5 | DISCUSSION

5.1 | Interpretation of the results

Despite a high increase in obesity rates, a large part of the epidemiological and economic literature still tends to consider a positive association between SES and bodyweight in SSA. Indeed, previous states of the art concluded that excess weight remained concentrated among the higher-SES groups.[8,20–22] The thinking behind this view is that SSAn countries are still at the first stage of their nutrition transition and that the switch from rural to urban lifestyles results in a significant increase in calorie intake for individuals with sufficient economic resources. In addition, some consider that the sociocultural environment that traditionally values stoutness widely persists. We argue that this view needs to be updated insofar as many SSAn countries are experiencing rapid nutrition transition (e.g., Kimmel et al.[17]). Moreover, while appreciation of stoutness may persist in certain groups (e.g., among older individuals and in rural areas), new bodyweight norms valuing thinness are gaining traction given the large diffusion of Western ideals among educated individuals (e.g., Agyemang et al.[8]).

This literature review aimed to compare evidence of SES-bodyweight association between low-income and lower-middle-income African countries through a comprehensive examination of articles published on the topic between 2010 and 2020. Based on this extensive survey, we detected potential changes in the SES–bodyweight relationship in SSA, excluding extreme cases where such a link is better known (i.e., higher middle-income countries, high-income countries, war-torn countries, and extremely poor countries).

As expected, the results are highly dependent on the country's level of economic development and its stage in the nutrition transition process. Among lower-middle-income countries, we noted clear inconsistencies in studies that used linear regressions: 61.5% showed a positive and significant association, 29.5% showed no significant

association, and 6.5% even observed a negative and significant association. To our mind, the most convincing studies are those based on nonlinear specifications that exhibit U-inverted associations between the level of completed education and bodyweight indicators in Nigeria and Zambia.[50,53] These studies show that adults with intermediate levels of completed schooling (primary or secondary) have the highest risk of being affected by overweight or obesity compared to less educated and more educated adults. In contrast, empirical research based on low-income countries in SSA is more consensual: 60% of the associations examined are positive and significant, whereas the remaining 40% are positive but not significant.

From these results, we could speculate that in low-income African countries (at an early stage of their nutrition transition), excess weight remains concentrated among the higher-SES groups because the urbanization process and improvements in living conditions are still too limited to trigger a large-scale diffusion of weight gain among the lower-SES groups. Conversely, inconsistencies in lower-middle-income countries may underline the existence of a turning point in the SES-bodyweight association in SSA (taking a kind of U-inverted form), confirming at a larger scale what few comparative cross-country studies already observed in samples of middle-income SSAn countries.[23–25] All in all, our results on SSAn lower-middle-income countries appear to confirm the occurrence of a social shift in obesity distribution (from the richest to the poorest) in parallel with economic development and nutrition transition, and in line with the *diffusion theory*, as also observed for some higher middle-income countries around the world.[10,11,13,14] This social reversal could be driven by changes in environmental conditions (i.e., access to food), living conditions, weight perceptions, and anti-obesity public policies. More specifically, given the higher exposure to thinness ideals and increased aversion to obesity-related health problems, it could be argued that the most affluent people tend to adopt strategies to avoid weight gain and related morbidity. In contrast, while the poorest value stoutness as a symbol of health and success, they do not have the economic resources or environmental conditions that allow them to eat sufficiently and thus to be exposed to weight gain. Finally, people from intermediate SES probably still value stoutness, tend to live in urban settings, and benefit from improved living conditions, all factors that potentially result in weight gain.

5.2 | Literature gaps and avenues for further research

In addition to highlighting significant methodological limitations in the empirical literature (see Section 4), this article attempts to identify gaps in the research that would benefit from being addressed. First, addressing gender heterogeneity in the SES–bodyweight relationship more systematically offers an interesting research avenue. In line with the pioneering work of Monteiro et al.[57] and Mendez et al.,[36] the literature shows that the reversal in the social gradient of obesity occurs at earlier stages of economic development for women than for men. Although we did not find evidence of such earlier reversal in the context of lower-middle-income and low-income countries in SSA, the literature focusing on richer SSAn countries tends to confirm this idea.[14,51,58,59] Cohen et al.[60] give a convincing explanation of the ambivalent situation that African women face in cities. On the one hand, women from lower-socioeconomic groups (often emigrating from rural areas) gain substantial weight by eating high-calorie industrial food in order to feel part of and enjoy the Western lifestyle. On the other hand, women from upper-socioeconomic groups are more receptive to Western influences and the thinness ideals conveyed by education and the media and so increasingly reject stoutness.[61]

Second, the influence of cultural factors on the relationship between BMI and SES should also be explored in more depth, taking into account the high cultural heterogeneity of African countries. For instance, in former English colonies (e.g., Kenya and Zambia) where policy and urbanization features are directly inspired by the Anglo-Saxon development model, both income inequality and obesity rates are generally high and could exacerbate social differences in terms of lifestyle and bodyweight concentration. In comparison, the SES–bodyweight relationship is probably less significant (or perhaps different) in former French colonies (e.g., Ivory Coast and Senegal) where urbanization is less obesogenic and income distribution less polarized.[20,62]

Third, despite (limited) evidence of a potential U-inverted relationship between SES and excess weight among lower-middle-income SSAn countries (i.e., Rudatsikira et al. and Oguoma et al.[50,53]), the existing literature tends to neglect the potential influence of the increase in size of the middle-income group resulting from the decline in poverty.[63] In addition to obvious deficiencies in nutritional education and health-related knowledge, two further factors may explain hazardous weight gain among people escaping poverty: the *sociological phenomenon of social revenge* and the *economic phenomenon of time-inconsistencies*. The *social revenge* factor refers to the increased intake of processed and junk food by individuals escaping poverty, which is associated in people's minds with social success and Western culture, and makes them feel part of the modern lifestyle.[60,64] The *phenomenon of time-inconsistencies* refers to irrational nutritional behavior among vulnerable socioeconomic groups because of a preference for present satisfaction.[65] Given their limited (and potentially unstable) income, middle social groups emerging from poverty may prefer to maximize their present satisfaction by consuming high-fat foods perceived as palatable (qualified as "short-term low-risk strategies") rather than invest in a future and uncertain health-based satisfaction through suitable food intake restrictions and regular physical exercise (qualified as "long-term high-risk strategies").[66] In line with these assumptions, we found some studies emphasizing new food habits and lifestyles among the emerging middle class in SSA, including increased consumption of animal proteins[67,68] and non-essential products such as carbonated soft drinks and sweets.[69]

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CONFLICT OF INTEREST STATEMENT

No conflict of interest statement.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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