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Food insecurity and the double burden of malnutrition in Colombian rural households

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Abstract

Objective: This study aimed to examine in Colombian rural households the association between different severity levels of household food insecurity and the presence of the double burden of malnutrition (SCOWT), defined as the coexistence of a stunted child under 5 years of age and an overweight or obese (OWOB) mother.
Design: A secondary data analysis was conducted using cross-sectional data from the Colombian National Nutritional Survey (ENSIN) 2015. Household food insecurity status was assessed by using the Latin-American and Caribbean Food Security Scale (ELCSA). The household SCOWT status (child stunting and OWOB mother) was determined using anthropometric data from a mother and her child.
Setting: Rural Colombia.
Participants: Totally, 2·350 mother–child pairs living in the same household.
Results: Sixty-two per cent of the households were food-insecure and SCOWT was present in 7·8 % of the households. Moderate (OR: 2·39, 95 % CI (1·36, 4·21)) and severe (OR: 1·86, 95 % CI (1·10, 3·15)) food insecurity was associated with SCOWT in an unadjusted logistic regression. Only moderate food insecurity remained significantly associated with SCOWT in a multivariate logistic regression (adjusted OR: 2·41, 95 % CI (1·24, 4·68)).
Conclusions: Colombian rural areas are not exempt from the worldwide concern of increasing OWOB rates while stunting is still persistent. These results highlight the need of implementing double-duty rural actions targeting the most vulnerable households to SCOWT, particularly in terms of overcoming food insecurity beyond hunger satisfaction to prevent all forms of malnutrition.

Keywords
Food insecurity
Double burden of malnutrition
Stunting
Overweight
Obesity
Rural areas
Colombia

Household food insecurity is experienced when there are concerns regarding accessing available food; the food needed for an active and healthy life is insufficient; or when accesing food implicates using socially unacceptable practices[1]. This complex situation occurs when one or all of the four food security pillars fail to be achieved over time, which include physical availability of food, access to food (economic, physical and cultural), food utilisation and stability of these pillars[2].

Since food is produced mainly in the rural areas, it might be expected that such settings would have less food-insecure households given that rural areas contribute the most to food production. This scenario, however, seems to be only true for high-income countries[3]. In countries with lower economic development levels, rural areas are more inclined to food insecurity than urban centres[3–5]. According to the ENSIN (2015), 64 % of rural Colombian households were food-insecure *v.* 52 % in urban regions[6].

Food security pillars can be readily affected by socio-economic and cultural dynamic factors seen in rural areas, which may adversely impact one or more of those pillars. For instance, the pillar related to physical availability of food depends on food production. In Colombian rural areas, less than 2 % of the inhabitants have access to loans, technical assistance, land and irrigation, which likely negatively affects adequate food production[7]. Concurrently, the increased industrial mining activity in Colombian rural areas can threaten food security. Although industrial mining can contribute to the income of some households, food production could be adversely affected due to additional

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demands on water, land and workforce[7]. Moreover, Colombian rural areas have higher levels of poverty, low education and illiteracy than urban regions[7,8]. These latter socio-economic factors can compromise the pillars pertaining to adequate access and utilisation of food. Additionally, armed conflicts in Colombia have enormously affected the rural population[7] by compromising the stability of food security over time[9]. Taken together, the above factors lead to a significant disadvantage of rural areas of Colombia with respect to food security and so vulnerable to the adverse health and nutritional consequences of food insecurity.

Food insecurity diminishes quality of life and well-being[1,10–12]. Additionally, food insecurity has been associated with the presence of malnutrition reflected in child stunting in low- and middle-income countries and maternal overweight and obesity (OWOB) in high-income countries[13]. The latter health issues can be explained by food-insecure households having a lower consumption of healthy, diverse and nutritious foods and a higher consumption of energy-dense foods[14–18]. Such dietary patterns are the result of nutritional transitions occurring in developing countries that are also accompanied by low levels of physical activity[19]. These nutritional transitions can lead to growth stunting from undernutrition together with increased prevalence of excessive body weight[20].

In 2015, 10·8 % of the children under 5 years of age were reported to be stunted in Colombia[6]. Although there has been a remarkable progress in reducing the prevalence of growth stunting in this country, decreasing from a 26 % prevalence in 1990, the set millennium development goal to reduce the prevalence to 8 % by 2015 was not reached[6]. A particular concern was that child stunting was 15·4 % in rural areas as compared to a prevalence of 9 % seen in urban areas. Thus, growth stunting is still considered an important public health problem in Colombia[21].

There is currently worldwide concern about unbalanced dietary patterns that are implicated in the rising number of persons classified as either overweight or obese in both developed and developing countries[22]. Although such malnutrition had previously predominantly affected developed countries, this phenomenon is now rapidly rising in developing nations[2,22]. Moreover, the gap in the prevalence of OWOB that used to exist between the rural and urban areas is decreasing[22–24]. According to the ENSIN (2015), 49·7 % of women of childbearing age (13 to 49 years) in Colombia are OWOB with a slightly higher prevalence in rural *v.* urban settings (50·4 % and 49·5 %, respectively)[6].

The persistent prevalence of undernutrition in the form of stunting and the increasing rates of OWOB can lead to the coexistence of a stunted child, under 5 years of age, and an OWOB mother within the same household (SCOWT). The coexistence of undernutrition together with OWOB has been termed the double burden of malnutrition[25].

Both stunting and OWOB can lead to compromised quality of life and health outcomes since these forms of malnutrition have been associated with an increased chronic disease risk[26,27] and impaired cognitive development[28]. A major concern related to SCOWT is that the above health consequences can affect mother–child dyads that are sharing the same socio-economic environment. On the other hand, this type of double burden might be preventable by interventions addressing underlying household factors.

The association of food insecurity with SCOWT has been studied using nationally representative data in Brazil[29] and in an urban subpopulation of Indonesia[30]. The Brazilian study found that severe food-insecure households had a higher likelihood of SCOWT (adjusted OR (aOR) = 3·33, 95 % CI (1·41, 7·84))[29], whereas all severity levels of food insecurity were associated with this phenomenon in Indonesia (mild food-insecure aOR = 2·78; 95 % CI (1·54, 5·08)); moderate food-insecure (aOR = 2·53; 95 % CI (1·28, 4·98)) and severe food-insecure (aOR = 2·04; 95 % CI (1·08, 3·84))[30]. The lack of agreement between studies indicates an uncertainty regarding the impact of food insecurity severity levels on the occurrence of SCOWT. To our knowledge, no study has investigated the association of SCOWT with food insecurity in rural households.

The objectives of this research were to use nationally representative data to: (a) assess the association between different severity levels of household food insecurity and SCOWT and (b) identify factors related to social determinants of health that could be associated with SCOWT.

Methods

A secondary data analysis was done using cross-sectional data from the latest Colombian National Nutritional Survey (ENSIN 2015). This survey incorporated a probabilistic multistage, stratified, cluster sampling design. In this design municipalities were randomised and stratified according to rural and urban areas, in the following stages, blocks were segmented to finally select the unit of analysis, which consisted of households. The ENSIN survey includes representative data for the nation, rural and urban areas, six regions and thirty-two departments (provincial units). Detailed information on the sampling design can be found elsewhere[6].

The total sample size for the ENSIN 2015 survey was 44 202 households, from which a subsample consisting of mothers of childbearing age and their children under 5 years of age was selected. After applying the exclusion criteria (Chart 1), a final subsample of 2350 households with eligible mother–child pairs was chosen.

Outcome and exposure variables

Household SCOWT status

The dependent variable was the household SCOWT status which was constructed using anthropometric data from the mother and the child. Children with height-for-age *Z*-scores

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below –2 were classified as stunted, whereas when this index was equal to or above this value, the child was classified as not stunted[31]. Mothers were classified as being OWOB when their BMI was equal to or above 25 kg/m^2 (OWOB). Mothers with a BMI below 25 kg/m^2 were classified as normal weight. In cases where the household had a stunted child together an OWOB, the household was classified as SCOWT and assigned a value of 1. If a household did not have both conditions, a value of 0 was allocated. Overweight and obesity were considered together due to the low prevalence of SCOWT among households when only obesity was considered (3 %, *n* 67). Another consideration for grouping these two weight categories is that overweight (BMI of 25–29 kg/m^2) is also associated with increased chronic disease risk[32,33].

Child stunting and maternal OWOB were as well analysed as dependent variables to enable a comparison of the factors related to their occurrence with those associated with SCOWT. Hence, the three variables (child stunting, maternal OWOB and SCOWT) were analysed as categorical binary variables (having or not having the condition). Therefore, the reference group allowed for the comparison with all other forms of nutritional status classifications, not just with normal pairs. The rationale for this approach was based on the need to compare the presence of SCOWT against all different possible combinations of child–mother nutritional status, not just against normal pairs. Moreover, less than half of the pairs were found to be classified as having normal nutritional status, reducing the power of the analysis. A preliminary analysis excluding underweight mothers did not alter the results. On the other hand, it would have been inaccurate to treat child stunting, maternal OWOB and SCOWT pairs as categories of one multinomial variable since not all risk factors were shared between each, which would have affected the results from the multivariate logistic regression.

Household food security status

With regard to household food security status, the ENSIN survey used the Latin-American and Caribbean Food Security Scale (Escala Latinoamericana y del Caribe de Seguridad Alimentaria – ELCSA). This scale has been validated for Colombia and other countries of the region[34]. The ELCSA scale evaluates the experiences of the households with regard to food insecurity through the implementation of fifteen different questions (eight for households consisting only of members of 18 years old or older and seven questions for households with one child or more under the age of 18 years). When the head of the household answers affirmatively to a question, a score of 1 was assigned. On the other hand, a score of 0 was allocated if the respondent's answer was negative. A total score was calculated to classify the household as food-secure (score of 0), mild food-insecure (score of 1 to 5), moderate food-insecure (score of 6 to 10) or severe food-insecure (score of 11 to 15). Mild food-insecure households experience impaired food quality, whereas food quantity is also compromised in moderate food-insecure households. Severe food-insecure households are those that experience hunger[34].

To better understand the association of SCOWT and food insecurity, sixteen categorical covariates that were included in the ENSIN survey were incorporated in the analysis. These covariates were grouped according to the categories of the model of the social determinants of health proposed by Dahlgren and Whitehead[35]. The categories were (a) geographical location, (b) social conditions, (c) living and working conditions, and (d) individual factors (Table 1).

Statistical analysis

Multicollinearity was tested between all variables using the variance inflation factor (VIF)[36], when it was below 2·5 multicollinearity was considered as a problem. None of the variables reported a variance inflation factor below this value.

Statistical analysis was performed using SPSS version 23.0.0, and more specifically its complex samples module. All the analyses were done using sampling weights; hereafter, the sampling weight of the child was used to analyse the variables, SCOWT and stunting, the mother's sampling weight for OWOB, and the household sampling weight for the descriptive characteristics of the households. A 95 % CI was set, and analyses with a *P*-value of $P < 0{\cdot}05$ were considered to be significant. Descriptive characteristics of the sample and their corresponding 95 % CIs are also presented.

Pearson chi-squared tests were conducted to evaluate the associations between all independent variables and SCOWT, child stunting, and maternal OWOB. To better understand this association, a simple logistic regression, using crude OR and their 95 % CI, was used. Subsequently, a model adjusting for all significant covariates was implemented using a multivariate logistic regression. This model included the covariates that improved the model fit and showed an association with a *P*-value $< 0{\cdot}25$ in the Pearson chi-squared test[37]. The multivariate logistic regression used aOR and their 95 % CI.

All participants gave written consent before the interview and the Colombian National Institute of Health granted ethical approval for the implementation of the ENSIN 2015.

Results

Descriptive characteristics

Almost two-thirds (62 %) of the households experienced food insecurity. Maternal OWOB was present in almost half (49·8 %) of the households and child stunting in 16 % of the

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Table 1 Descriptive characteristics of children and mother's pairs according to all covariates

Social determinants of health categories	Variables	Categories	Total		
			n	%	95 % CI
Geographical location	Region	Atlántico	780	24·1	21·0, 27·6
		Oriental	414	23	19·5, 27·0
		Orinoquía and Amazonía	54	3·6	3·3, 3·9
		Central	579	25·3	23·0, 27·9
		Pacífica	521	23·9	20·4, 27·8
Social conditions	Self-reported ethnicity head of household	Afro-Colombian	277	9·4	6·8, 13·0
		Indigenous	350	12·5	8·6, 17·8
		None of the above	1695	78·1	74·0, 81·7
Living and working conditions	Head of household economic activity	Unemployed	29	1·4	1·0, 2·0
		Formally employed	335	24·4	21·0, 28·1
		Informally employed	1504	74·2	70·6, 77·6
	Size of the household	2 to 4 members	1079	48·8	46·7, 51·0
		5 to 6 members	832	34·7	32·0, 37·5
		7 or more members	439	16·5	15·1, 17·9
	Toilet with sewer connection	Yes	1711	81·1	78·5, 83·4
		No	639	18·9	16·0, 22·2
	Wealth index	Below the mean	1177	40	35·7, 44·6
		Above the mean	1173	60	55·4, 64·3
	Educational level head of household	Less than complete primary school	1039	43·4	37·8, 49·1
		Incomplete secondary school	836	33·6	30·3, 37·1
		Complete secondary and more	457	23	19·4, 27·2
	Educational level mothers	Less than complete primary school	515	20	17·6, 22·7
		Incomplete secondary school	1033	41·9	39·4, 44·4
		Incomplete undergraduate	767	37	34·2, 39·8
		Complete undergraduate and more	28	1·2	0·9, 1·5
	Women as the head of the household	No	543	75·5	73·0, 77·8
		Yes	1807	24·5	22·2, 27·0
	Number of children under 5 years of age	1	1931	83·9	82·0, 85·6
		2	385	15·2	13·6, 17·0
		3 or more	34	0·9	0·7, 1·3
Individual factors	Multiple births	No	2317	99·3	99·0, 99·6
		Yes	20	0·7	0·4, 1·0
	Mothers' age at birth	13 to 17 years	291	13·4	11·5, 15·5
		18 to 34 years	1772	76	74·1, 77·8
		35 to 49 years	272	10·6	9·7, 11·7
	Pre-term birth	Yes	288	13·3	11·9, 14·9
		No	1997	86·7	85·1, 88·1
	Birth spacing	< 24	252	8·8	7·5, 10·3
		>=24	1297	53·4	51·2, 55·6
		Unique child	787	37·8	35·1, 40·6
	Mothers' height	< 145	143	5·4	3·6, 8·1
		>= 145	2207	94·6	91·9, 96·4

Raw sample sizes are reported, and sample weights were used to compute estimates.

households. The presence of SCOWT was found in 7·8 % of mother–child pairs (Table 2).

Moreover, 2 % of the children suffered from both stunting and overweight. Almost three-quarters of the surveyed heads of households (74·2 %) were informally employed and 43·4 % did not have a completed primary school educational level (Table 1).

Bivariate analysis

As shown in Table 3, almost all covariates used for the analyses were associated with food insecurity. In the overall selected sample of mother–child pairs, there were 37·6 % food-secure households. However, food security decreased as social-economic conditions increased in inequality. For instance, among those identified as Afro-Colombians and as indigenous people, only 11·5 % and 18 % households were food-secure, respectively. Food security prevalence was lower than 30 % within households without a toilet with sewer connection, among mothers with the lowest educational level, and among those who had a height < 145 cm, and households with three or more children under 5 years of age (Table 3).

The chi-squared test revealed significant associations ($P < 0·05$) between food security and all dependent variables in terms of maternal OWOB, child stunting and SCOWT. The lowest prevalence of maternal OWOB was found among severe food-insecure households, which also had the highest prevalence of child stunting. Child stunting showed a dose–response pattern increasing as the severity of food insecurity increased. The association of SCOWT with food security had an inversed U-shaped curve, that

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Table 2. Household food security and children and mother's nutritional status

Variables	Total		
	n	%	95 % CI
Double burden pairs (SCOWT)			
Yes	199	7·8	6·7, 9·2
No	2151	92·2	90·8, 93·3
Child nutritional status			
Height/age			
Stunting (<–2 HAZ)	420	16	14·4, 17·8
Risk of stunting (≥–2 to <–1 HAZ)	682	29·6	27·0, 32·2
Normal height (≥ –1 SD HAZ)	1248	54·4	51·2, 57·6
Weight/height			
Wasting (<–2 WHZ)	28	1·4	1·0, 2·1
Risk of wasting (≥–2 a < –1 WHZ)	182	7·0	6·0, 8·3
Normal weight for height (≥–1 to ≤+1WHZ)	1555	65·2	62·7, 67·6
BMI/age			
Risk of overweight (>+1 to ≤+2 BMIZ)	450	20·7	18·9, 22·6
Overweight (>+2 to ≤+3 BMIZ)	107	4·7	3·9, 5·7
Obesity (> +3 BMIZ)	22	1·0	0·6, 1·6
Maternal nutritional status			
BMI and BMI/age*			
Underweight (< 18·5 kg/m^2; < –2 BMIZ*)	76	3	2·5, 3·7
Risk of underweight (≥–2 a < –1 BMIZ*)	7	0·2	0·1, 0·4
Normal BMI (≥18·5 a < 25 kg/m^2; ≥–1 to ≤+1 BMIZ*)	1058	47	45·1, 49·0
Overweight (≥25 a < 30 kg/m^2; >+1 to ≤+2 BMIZ*)	788	32·4	29·9, 35·0
Obesity (≥30 kg/m^2; > +2 BMIZ*)	421	17·4	15·5, 19·4
Overweight + obesity	1209	49·8	47·8, 51·7

HAZ, height-for-age *Z*-scores; WHZ, weight-for-height *Z*-scores; BMIZ, BMI-for-age *Z*-scores.
*This index was used for adolescent mothers (13 to 17 years old).
Raw sample sizes are reported, and sample weights were used to compute estimates.

is, the highest prevalence was found among moderate food-insecure households (Fig. 1).

The highest prevalence for both SCOWT and stunting was found in households that had three or more children under 5 years of age, in households with multiple child births and among those households in which the mother's height was < 145 cm. Maternal OWOB showed a highest prevalence among households in which the mother gave birth at the age of 35 to 49 years, among households in which birth spacing was at or above 24 months and in households located in the central region of Colombia (Table 4).

In the unadjusted bivariate analysis, moderate- (OR: 2·39, 95 % CI (1·36, 4·21)) and severe food-insecure households (OR: 1·86, 95 % CI (1·10, 3·15)) presented an increased likelihood of SCOWT when compared to food-secure households. The odds for child stunting were higher in households experiencing food insecurity when compared to those with food security, increasing with rising severity of food insecurity mild (OR: 1·45, 95 % CI (1·02, 2·06)), moderate (OR: 2·02, 95 % CI (1·39, 2·94)) and severe (OR: 3·70, 95 % CI (2·64, 5·17)). Conversely, the likelihood of finding households with maternal OWOB was significantly lower in severe food-insecure households (OR: 0·60, 95 % CI (0·47, 0·78)) (Table 5).

Multivariate analysis

As shown in Table 5, when adjusting for all covariates, an increased likelihood of SCOWT remained significant only for moderate food-insecure households (aOR: 2·41, 95 % CI (1·24, 4·68)). In the multivariate analysis, child stunting and maternal OWOB were no longer significantly associated with food insecurity.

Mothers' height < 145 cm had the highest adjusted odds for SCOWT, increasing its occurrence by almost four times when compared to mothers who had a height >= 145 cm (aOR: 3·92, 95 % CI (2·25, 6·81)), followed by multiple births (aOR: 3·42, 95 % CI (1·07, 10·89)), and for households having three or more children under 5 years of age (aOR: 3·42, 95 % CI (1·28, 9·12)). These variables were also associated with a highest occurrence of child stunting.

SCOWT was more likely to occur in households with the following characteristics: more than seven members (aOR: 3·00, 95 % CI (1·67, 5·41)); women as the head of the household (aOR: 2·11, 95 % CI (1·22, 3·64)); an indigenous head of the household (aOR: 1·53, 95 % CI (1·01, 2·32)); child birth spacing of more than 24 months (aOR: 2·02, 95 % CI (1·20, 3·38)). Although being self-recognised as indigenous increased the presence for both SCOWT and stunting, this characteristic was also associated with a lower likelihood of maternal OWOB. The presence of a toilet without sewer connection and a wealth index below the mean also decreased the likelihood of maternal OWOB.

Discussion

In this study, the coexistence of child stunting and maternal OWOB was found in 7·8 % of the rural households. This

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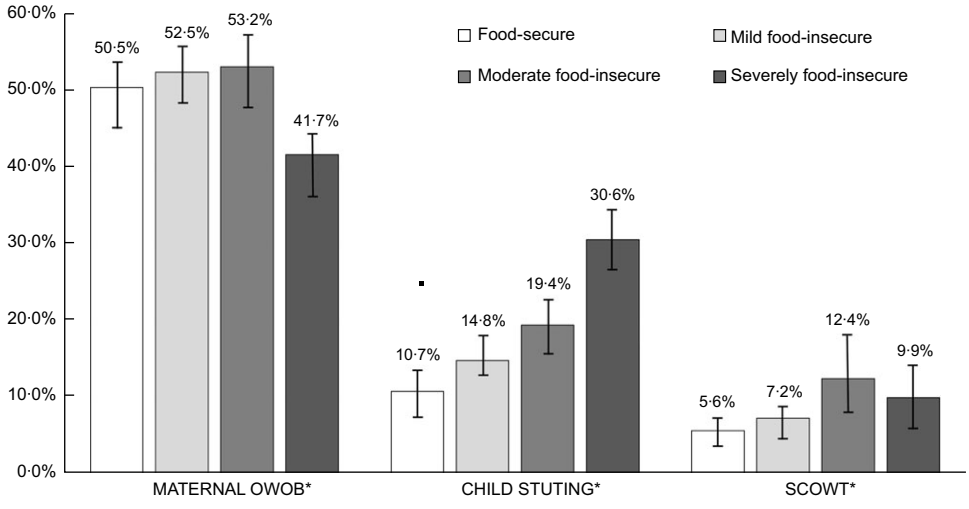
Table 3 Prevalence of food insecurity (by severity levels) across covariates

		Severe insecurity			Moderate insecurity			Mild insecurity			Food security			
Variables	Categories	*n*	Row %	95 % CI	*n*	Row %	95 % CI	*n*	Row %	95 % CI	*n*	Row %	95 % CI	*P*-value
Total		360	9·2	7·7, 10·8	435	15·7	13·6, 18·0	860	37·6	34·6, 40·7	695	37·6	34·6, 40·7	
Region	Atlántico	204	24·3	21·6, 27·3	170	22	18·2, 26·5	266	38	34·1, 42·1	140	15·6	12·7, 19·0	<0·001
	Oriental	12	3·2	1·7, 5·8	67	12·8	8·9, 18·2	177	39·4	32·8, 46·4	158	44·6	38·7, 50·6	
	Orinoquía and Amazonía	6	9	9·0, 9·0	10	18·7	18·7, 18·7	22	42·9	42·9, 42·9	16	29·5	29·5, 29·5	
	Central	39	7·4	5·3, 10·1	87	15·3	12·0, 19·4	202	33·9	30·4, 37·6	251	43·4	37·2, 49·7	
	Pacífica	99	12·3	7·2, 20·4	101	17·2	13·4, 21·8	192	38·3	31·6, 45·6	129	32·1	24·8, 40·5	
Head of household economic activity	Unemployed	8	10	5·6, 17·2	11	41·2	23·6, 61·4	9	45·6	29·7, 62·4	1	3·2	0·4, 19·4	<0·001
	Formally employed	18	3·5	2·7, 4·5	34	6·9	5·0, 9·5	139	36·8	33·2, 40·6	144	52·7	48·5, 56·9	
	Informally employed	222	9·4	7·5, 11·7	299	17·1	14·6, 20·0	550	40·1	36·2, 44·2	433	33·4	29·2, 37·8	
Size of the household	2 to 4 members	98	6·3	4·7, 8·2	185	13·8	11·4, 16·7	410	35·8	32·0, 39·7	386	44·1	39·5, 48·8	<0·001
	5 to 6 members	150	9·2	7·6, 11·1	156	16·6	13·4, 20·5	299	41·1	35·9, 46·5	227	33·1	27·7, 39·0	
	7 or more members	112	18·7	14·4, 24·0	94	19·5	15·4, 24·4	151	34·9	29·3, 40·9	82	26·9	21·1, 33·6	
Toilet with sewer connection	Yes	151	5·8	4·8, 7·0	283	14·4	12·1, 17·0	680	38·9	35·6, 42·2	597	41	37·6, 44·4	<0·001
	No	209	29·2	24·0, 35·1	152	23·7	20·0, 27·8	180	29·8	24·1, 36·1	98	17·3	13·4, 22·1	
Wealth index	Below the mean	278	19·2	16·1, 22·8	260	21·9	18·4, 25·8	388	35·1	30·3, 40·3	251	23·8	20·2, 27·9	<0·001
	Above the mean	82	4	3·1, 5·2	175	12·6	10·2, 15·3	472	38·8	34·5, 43·4	444	44·6	40·6, 48·6	
Educational level head of household	Less than complete primary school	226	14·9	11·7, 18·7	215	20·3	16·2, 25·2	345	34·4	30·4, 38·6	253	30·3	24·0, 37·6	<0·001
	Incomplete secondary school	90	5·8	4·2, 7·9	144	13·8	10·7, 17·6	327	40·3	35·4, 45·3	275	40·2	35·1, 45·5	
	Complete secondary and more	42	3·4	2·2, 5·1	73	9·9	7·7, 12·8	180	39·2	32·4, 46·5	162	47·5	40·4, 54·7	
Educational level mothers	Less than complete primary school	158	23·7	19·4, 28·6	98	20·8	16·3, 26·2	151	34·1	27·4, 41·5	108	21·4	16·7, 27·0	<0·001
	Incomplete secondary school	136	8·8	6·7, 11·4	202	18·3	15·5, 21·5	385	36·7	33·6, 40·0	310	36·2	32·5, 40·1	
	Incomplete undergraduate	62	3·3	2·4, 4·5	130	11·2	8·8, 14·1	315	41·4	35·9, 47·1	260	44·2	38·3, 50·3	
	Complete undergraduate and more	3	1·2	0·6, 2·1	2	0·6	0·1, 3·0	9	14·1	4·5, 36·1	14	84·2	63·7, 94·2	
Women as the head of the household	No	233	7·1	5·6, 9·1	341	15·3	13·1, 17·8	666	37·8	34·4, 41·4	567	39·7	35·5, 44·1	0·001
	Yes	127	15·3	12·6, 18·5	94	16·9	13·5, 20·9	194	36·8	31·3, 42·5	128	31·1	25·1, 37·8	
Number of children under 5 years of age	1	253	7·9	6·5, 9·5	356	14·9	12·7, 17·5	728	38·2	34·9, 41·6	594	39	35·7, 42·4	<0·001
	2	95	15·5	12·1, 19·7	71	19·4	15·1, 24·5	125	35·1	29·6, 41·0	94	30·1	23·9, 37·0	
	3 or more	12	29·6	19·1, 42·9	8	27·8	11·2, 54·1	7	14·9	5·8, 33·3	7	27·6	12·4, 50·5	
Self-reported ethnicity head of household	Afro-Colombian	87	26·5	22·2, 31·3	65	21·9	17·7, 26·7	97	40·1	33·1, 47·6	28	11·5	7·6, 17·1	<0·001
	Indigenous	134	36	30·4, 41·9	67	20·4	14·4, 28·2	89	25·6	17·7, 35·6	60	18	13·3, 23·8	
	None of the above	138	4·9	3·8, 6·1	300	14·7	12·3, 17·4	662	38·8	35·5, 42·3	595	41·6	38·2, 45·1	
Multiple births	No	358	9·2	7·8, 10·9	429	15·7	13·6, 18·0	845	37·6	34·5, 40·8	685	37·5	34·4, 40·6	0·818
	Yes	2	5	1·0, 22·2	3	19·9	4·2, 58·4	8	29·6	10·6, 59·9	7	45·5	17·8, 76·2	
Mothers' age at birth	13 to 17 years	30	10·7	5·9, 18·6	58	15·5	11·2, 21·1	114	33·1	26·4, 40·6	89	40·6	32·7, 49·1	0·115
	18 to 34 years	276	8·4	7·2, 9·7	318	15·7	13·3, 18·4	645	37·6	34·0, 41·4	533	38·4	35·2, 41·6	
	35 to 49 years	54	14	10·1, 19·1	55	15·8	10·5, 23·2	93	42·5	33·7, 51·8	70	27·7	20·4, 36·5	
Pre-term birth	Yes	69	18·2	13·3, 24·3	46	11·5	7·6, 17·1	95	33·6	26·4, 41·8	78	36·6	28·2, 45·9	<0·001
	No	283	8	6·6, 9·5	374	16	13·8, 18·5	741	38·3	35·1, 41·6	599	37·7	34·8, 40·7	
Birth spacing	< 24	63	15·4	10·6, 21·7	47	24·8	18·6, 32·1	84	37·1	29·5, 45·3	58	22·8	16·7, 30·3	<0·001
	>=24	227	10·5	9·1, 12·0	248	15·7	13·1, 18·7	470	39	34·4, 43·8	352	34·8	30·2, 39·6	
	Unique child	69	6·1	4·1, 8·8	137	13·6	10·9, 16·9	299	35·6	30·4, 41·1	282	44·7	38·2, 51·5	
Mothers' height	< 145	45	25·3	16·0, 37·5	24	17	9·9, 27·5	45	36·4	23·8, 51·1	29	21·3	13·9, 31·4	<0·001
	>= 145	315	8·3	7·0, 9·8	411	15·6	13·5, 18·0	815	37·6	34·6, 40·8	666	38·5	35·3, 41·7	



OWOB, overweight or obesity; SCOWT, stunted child and overweight or obese mother.
* Chi-squared test: p < 0·05.

Fig. 1 Maternal OWOB, child stunting and SCOWT by food insecurity severity levels. OWOB, overweight or obesity; SCOWT, stunted child and overweight or obese mother. Chi-squared test: $P < 0{\cdot}05$

finding is higher than a previously reported national prevalence of SCOWT of 5·1 %[38], and in line with evidence showing that in countries such as Colombia, the rural areas have a higher prevalence of SCOWT[39].

The existence of SCOWT in the rural areas could be explained by the persistent prevalence of stunting. Although stunting has historically been higher than in the urban areas, the increasing presence of overweight/obesity in rural areas has reduced the gap between urban and rural areas[6,23,24]. This gap reduction is supported by published data from the ENSIN (2015) which showed that in the adult population the difference in the prevalence of OWOB between the urban and the rural areas decreased from 6·5 % in 2005 to 4·8 % in 2015[6]. More concerning is that by 2015, in women of childbearing age, OWOB was 0·9 % higher in rural than in urban areas[6]. Jaakcs *et al.*[23] found that the OWOB prevalence was increasing at a higher rate in rural women aged 19–49 years than in their urban counterparts in most low- and middle-income countries, including Colombia. In the present study, rural maternal OWOB was found in almost half (49·8 %) of the households. The current research findings provide further support for rising OWOB rates among rural Colombian women, which needs to be urgently addressed.

According to Dieffenbach and Stein[40], the coexistence of an OWOB mother and a stunted child is the result of their independent existence in the general population, which can be attributed to the increasing rate of maternal OWOB. This phenomenon was previously hypothesised by Jehn and Brewis[41] who suggested that SCOWT, overweight and undernutrition shared the same determinants. It is important to point out, however, that the rising rates of maternal OWOB do not appear to occur evenly across the whole population[23]. Thus, there seem to be factors that increased the occurrence of SCOWT, which do not show an association solely with overweight and stunting. As such, moderate food insecurity in the present study showed an association with SCOWT but not with stunting and overweight alone.

After controlling for various covariates, the results of the present research support the hypothesis that food insecurity is associated with the double burden of malnutrition in Colombian rural households. The positive association between these two phenomena was also found in Brazil[29] and in Indonesia[30]. The Brazilian study, however, found this association only with severe food-insecure households, whereas the Indonesian study showed the association with all severity levels of food insecurity. Such discrepancies regarding the severity level of food insecurity with respect to SCOWT might be explained by a variety of factors. For instance, Gubert *et al.*[29] analysed nationally representative data of both urban and rural areas in Brazil, while Mahmudiono *et al.*[30] used a sample from Indonesian urban settings with high prevalence of underweight. Taken together, the above findings suggest that the coping mechanisms adopted to deal with food insecurity and its consequences might be due to the differences between urban and rural environments. In rural Colombia, the lack of an association between severe food-insecure households and SCOWT could be accounted for by the lower prevalence of maternal OWOB among this severity level. Conversely, the Brazilian study reported that severe food-insecure households had a slightly higher prevalence of maternal OWOB than all other food security categories[29]. Similar results in Brazil were reported by Conde and Monteiro[42] who found that both the lowest and the highest household income quintiles had the highest prevalence of obesity. Furthermore, evidence indicates that women with lower socio-economic status had a higher occurrence of obesity in countries with a higher gross national product[43]. Thus, one factor that could explain the lower prevalence of

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Table 4 Maternal OWOB, child stunting and SCOWT according to covariates

		SCOWT			Maternal OWOB			Child stunting		
Variables	Categories	Yes (%)	95 % CI	*P*-value	Yes (%)	95 % CI	*P*-value	Yes (%)	95 % CI	*P*-value
Region	Atlántico	7·6	6·0, 9·5	0·473	41·2	36·9, 45·6	<0·001	21·2	18·5, 24·1	0·003
	Oriental	6·7	3·8, 11·4		50	45·5, 54·5		11·9	8·5, 16·6	
	Orinoquía and Amazonía	5·6	5·6, 5·6		49·2	49·2, 49·2		21·5	21·5, 21·5	
	Central	9·3	7·4, 11·6		55·4	52·1, 58·6		16·5	13·9, 19·4	
	Pacífica	8	5·7, 11·0		54·2	49·6, 58·9		13·5	9·8, 18·4	
Head of household economic activity	Formally employed	3·5	2·1, 5·8	0·003	50·3	45·5, 55·0	0·886	8·4	6·6, 10·7	<0·001
	Informally employed	7·7	6·4, 9·2		50	47·5, 52·5		16	13·9, 18·4	
	Unemployed	5·8	1·4, 20·6		53·8	39·8, 67·3		25·7	17·6, 35·8	
Size of the household	2 to 4 members	4·9	3·4, 6·9	<0·001	49·4	46·2, 52·7	0·115	12·2	10·0, 14·8	<0·001
	5 to 6 members	9·8	7·9, 12·1		52·2	48·8, 55·5		18	15·9, 20·2	
	7 or more members	12·5	10·2, 15·1		45·9	41·7, 50·1		23·2	19·9, 27·0	
Toilet with sewer connection	Yes	7·7	6·4, 9·3	0·591	52·4	49·8, 54·9	<0·001	14	12·3, 15·8	<0·001
	No	8·4	6·4, 10·9		39·6	35·5, 43·9		24·8	21·6, 28·3	
Wealth index	Below the mean	8·4	6·9, 10·0	0·465	43·5	40·8, 46·3	<0·001	21·6	18·9, 24·6	<0·001
	Above the mean	7·5	5·9, 9·5		54·2	51·0, 57·4		12·3	10·4, 14·6	
Educational level head of household	Less than complete primary school	8·9	7·0, 11·1	0·134	45·5	42·8, 48·2	0·018	18·9	16·5, 21·5	0·009
	Incomplete secondary school	8·5	6·3, 11·5		54·5	51·0, 57·9		14·8	12·1, 18·1	
	Complete secondary and more	4·9	2·8, 8·7		51·5	44·7, 58·4		12·2	9·1, 16·2	
Educational level mothers	Less than complete primary school	12·5	10·3, 15·1	<0·001	53	49·3, 56·6	0·673	25·6	22·2, 29·2	<0·001
	Incomplete secondary school	8·7	7·0, 10·9		48·8	46·0, 51·7		16·2	13·8, 18·9	
	Incomplete undergraduate	4·5	2·8, 7·0		49·3	45·8, 52·8		11·1	8·9, 13·7	
	Complete undergraduate and more	4·8	1·0, 20·2		44·5	8·5, 87·4		4·8	1·0, 20·2	
Women as the head of the household	No	6·6	5·4, 8·1	0·002	49·1	46·6, 51·5	0·321	14·4	12·5, 16·6	0·001
	Yes	11·5	8·7, 15·0		51·8	47·4, 56·2		20·9	18·0, 24·2	
Self-reported ethnicity head of household	Afro-Colombian	6·7	3·8, 11·4	0·001	53·8	48·4, 59·1	0·001	11·1	7·9, 15·2	<0·001
	Indigenous	13·7	10·8, 17·1		39·6	33·7, 45·8		35	30·2, 40·1	
	None of the above	7·1	5·8, 8·6		51·1	48·8, 53·3		13·7	12·0, 15·5	
Multiple births	No	7·6	6·4, 9·0	<0·001	49·5	47·5, 51·4	0·163	15·8	14·1, 17·6	<0·001
	Yes	38·7	16, 67·6		65·7	42·0, 83·5		54·4	30·3, 76·7	
Sex	Female	6·5	4·9, 8·6	0·049				13·5	11·2, 16·1	0·005
	Male	9·2	7·6, 11·1					18·5	16·3, 20·9	
Mothers' age at birth	13 to 17 years	6·3	3·9, 10·1	0·159	30·2	25·4, 35·5	<0·001	18·2	14·0, 23·3	0·41
	18 to 34 years	7·7	6·3, 9·3		50·9	48·6, 53·2		15·4	13·7, 17·3	
	35 to 49 years	10·6	7·6, 14·7		66·4	61·2, 71·2		17·3	12·6, 23·3	
Pre-term birth	Yes	11·5	8·1, 16·1	0·025	45·6	40·5, 50·7	0·105	25·5	21·2, 30·2	<0·001
	No	7·2	5·9, 8·7		50·2	48·0, 52·5		14·5	12·7, 16·4	
Birth spacing	Unique child	3·7	2·5, 5·5	<0·001	39·6	36·3, 42·9	<0·001	10·5	8·6, 12·8	<0·001
	>=24	9·4	7·7, 11·6		58·6	56·2, 60·9		17·1	14·8, 19·8	
	< 24	15·2	11·9, 19·3		42·1	37·5, 47·0		33	27·7, 38·8	
Mothers' height	< 145	23·3	18·4, 29·1	<0·001	56·4	49·1, 63·4	0·064	41·1	35·2, 47·2	<0·001
	>= 145	6·9	5·8, 8·3		49·4	47·4, 51·4		14·6	13·1, 16·3	
Number of children under 5 years of age	1	6·3	5·0, 7·9	<0·001	50·7	48·1, 53·3	0·075	12·4	10·7, 14·3	<0·001
	2	14·9	12·2, 18·0		44·4	40·1, 48·7		33·3	29·0, 37·8	
	3	31·1	17·4, 49·1		57	36·9, 75·1		63·1	46·8, 76·8	

Grey areas represent not analysed data due to irrelevance with dependent variable.

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Table 5 Crude and fully adjusted model for maternal OWOB, child stunting and SCOWT

		SCOWT				Maternal OWOB				Child stunting			
Variables	Categories	OR	95 % CI*	aOR	95 % CI†	OR	95 % CI*	aOR	95 % CI‡	OR	95 % CI*	aOR	95 % CI§
Food security levels	Food-secure	1		1		1		1		1		1	
	Mild food-insecure	1·31	0·74, 2·31	1·12	0·60, 2·10	1·07	0·90, 1·28	1·10	0·88, 1·38	1·45	1·02, 2·06	1·26	0·88, 1·82
	Moderate food-insecure	2·39	1·36, 4·21	2·41	1·24, 4·68	1·08	0·84, 1·39	1·17	0·88, 1·55	2·02	1·39, 2·94	1·41	0·86, 2·33
	Severely food-insecure	1·86	1·10, 3·15	1·11	0·54, 2·30	0·60	0·47, 0·78	0·80	0·55, 1·15	3·70	2·64, 5·17	1·44	0·80, 2·62
Region	Atlántico	1		1		1		1		1		1	
	Oriental	0·87	0·46, 1·65	1·07	0·48, 2·38	1·43	1·11, 1·84	0·99	0·75, 1·31	0·50	0·33, 0·76	1·08	0·64, 1·82
	Orinoquía and Amazonía	0·72	0·56, 0·92	1·05	0·58, 1·10	1·38	1·16, 1·66	1·05	0·83, 1·31	1·02	0·86, 1·21	1·21	0·89, 1·66
	Central	1·25	0·88, 1·77	1·22	0·68, 2·18	1·77	1·42, 2·21	1·48	1·15, 1·89	0·73	0·56, 0·95	1·19	0·83, 1·68
	Pacífica	1·05	0·68, 1·62	0·80	0·35, 1·80	1·69	1·31, 2·19	1·32	0·97, 1·79	0·58	0·39, 0·87	0·81	0·46, 1·41
Head of household economic activity	Formally employed	1		1		1				1		1	
	Informally employed	2·30	1·38, 3·81	1·59	0·92, 2·76	0·99	0·79, 1·24			2·09	1·54, 2·82	1·36	0·98, 1·89
	Unemployed	1·70	0·39, 7·37	1·39	0·30, 6·48	1·15	0·65, 2·05			3·77	2·29, 6·21	2·92	1·74, 4·89
Size of the household	2 to 4 members	1		1		1		1		1		1	
	5 to 6 members	2·11	1·42, 3·14	2·49	1·50, 4·13	1·12	0·91, 1·37	1·02	0·83, 1·25	1·57	1·24, 1·99	1·81	1·29, 2·53
	7 or more members	2·77	1·80, 4·25	3·00	1·67, 5·41	0·87	0·72, 1·05	0·97	0·78, 1·20	2·17	1·65, 2·86	1·72	1·16, 2·54
Toilet with sewer connection	Yes	1		1		1		1		1		1	
	No	1·10	0·77, 1·57	0·62	·35, 1·10	0·60	0·48, 0·75	0·70	0·53, 0·93	2·03	1·64, 2·52	1·23	0·85, 1·77
Wealth index	Above the mean	1				1		1		1		1	
	Below the mean	1·13	0·81, 1·56			0·65	0·54, 0·78	0·77	0·61, 0·96	1·96	1·49, 2·57	1·21	0·79, 1·84
Educational level head of household	Complete secondary and more	1		1		1		1		1		1	
	Incomplete secondary school	1·79	0·91, 3·55	1·82	1·05, 3·17	1·12	0·80, 1·58	1·12	0·76, 1·65	1·26	0·84, 1·88	0·89	0·54, 1·47
	Less than complete primary school	1·87	1·01, 3·44	1·25	0·60, 2·60	0·79	0·58, 1·07	0·83	0·55, 1·26	1·679	1·20, 2·34	0·83	0·50, 1·37
Educational level mothers	Complete undergraduate and more	1		1		1		1		1		1	
	Incomplete undergraduate	0·93	0·16, 5·22	0·24	0·03, 1·80	1·22	0·14, 10·47	1·32	0·20, 8·95	2·47	0·46, 13·13	0·69	0·09, 5·29
	Incomplete secondary school	1·90	0·36, 10·04	0·48	0·06, 4·07	1·19	0·14, 10·39	1·52	0·24, 9·66	3·83	0·74, 19·71	1·23	0·16, 9·56
	Less than complete primary school	2·85	0·55, 14·71	0·37	0·04, 3·21	1·41	0·16, 12·20	1·87	0·30, 11·50	6·82	1·34, 34·80	0·10	0·12, 8·23
Women as the head of the household	No	1		1		1				1		1	
	Yes	1·82	1·25, 2·65	2·11	1·22, 3·64	1·12	0·90, 1·39			1·57	1·22, 2·02	1·98	1·43, 2·76
Number of children under 5 years of age	1	1		1		1		1		1		1	
	2	2·60	1·85, 3·67	2·71	1·57, 4·68	0·78	0·61, 0·98	0·7	0·53, 0·93	3·53	2·68, 4·65	3·61	2·40, 5·45
	3	6·72	2·944, 15·34	3·42	1·28, 9·12	1·29	0·55, 2·99	1·28	0·50, 3·23	12·08	5·87, 24·87	4·66	1·53, 14·21
Self-reported ethnicity head of household	Reference category‖	1		1		1		1		1		1	
	Afro-Colombian	0·93	0·50, 1·75	1·02	0·54, 1·96	1·12	0·89, 1·40	1·23	0·93, 1·65	0·79	0·53, 1·16	0·68	0·41, 1·13
	Indigenous	2·07	1·48, 2·90	1·53	1·01, 2·32	0·63	0·48, 0·82	0·69	0·51, 0·92	3·39	2·61, 4·40	1·96	1·30, 2·96
Multiple births	No	1		1		1		1		1		1	
	Yes	7·67	2·28, 25·77	3·42	1·07, 10·89	1·96	0·74, 5·13	2·00	0·78, 5·10	6·38	2·27, 17·91	2·87	0·10, 8·25
Sex	Female	1		1						1		1	
	Male	1·46	0·10, 2·14	1·45	0·98, 2·15					1·45	1·12, 1·89	1·45	1·11, 1·88
Mothers' age at birth	18 to 34	1				1		1		1			
	13 to 17	0·81	0·49, 1·33			0·42	0·32, 0·54	0·55	0·38, 0·79	1·22	0·89, 1·68		
	35 to 49	1·43	0·92, 2·23			1·9	1·53, 2·37	1·54	1·19, 1·98	1·15	0·79, 1·67		
Pre-term birth	No	1		1		1		1		1		1	
	Yes	1·69	1·06, 2·70	1·64	0·99, 2·71	0·83	0·66, 1·04	0·89	0·72, 1·11	2·02	1·52, 2·68	1·64	1·15, 2·35

Table 5 *Continued*

Variables	Categories	SCOWT OR	SCOWT 95 % CI*	SCOWT aOR	SCOWT 95 % CI†	Maternal OWOB OR	Maternal OWOB 95 % CI*	Maternal OWOB aOR	Maternal OWOB 95 % CI‡	Child stunting OR	Child stunting 95 % CI*	Child stunting aOR	Child stunting 95 % CI§
Birth spacing	Unique child	1		1		1		1		1		1	
	>=24	2·68	1·71, 4·22	2·02	1·20, 3·38	2·16	1·84, 2·54	1·88	1·47, 2·40	1·76	1·32, 2·34	1·03	0·64, 1·68
	< 24	4·62	2·93, 7·29	0·98	0·50, 1·92	1·11	0·89, 1·38	1·31	0·94, 1·81	4·19	3·05, 5·75	0·10	0·52, 1·92
Mothers' height	>= 145	1		1		1		1		1		1	
	< 145	4·08	2·87, 5·81	3·92	2·25, 6·81	1·32	0·98, 1·78	1·50	0·97, 2·33	4·09	3·12, 5·36	3·31	1·94, 5·66

Grey areas represent independent variables not included in the adjusted model.
*This column presents the results from the bivariate analyses.
†SCOWT aOR were calculated adjusting for the variables: region, head of household economic activity, size of the household, toilet with sewer connection, wealth index, educational level head of household, educational level mothers, women as the head of the household, number of children under 5 years of age, self-reported ethnicity head of household, multiple births, sex, mothers' age at birth, pre-term birth, birth spacing and mothers' height.
‡Maternal OWOB aOR were calculated adjusting for the variables: region, size of the household, toilet with sewer connection, wealth index, educational level head of household, educational level mothers, number of children under 5 years of age, self-reported ethnicity head of household, multiple births, sex, mothers' age at birth, pre-term birth, birth spacing and mothers' height.
§Child stunting aOR were calculated adjusting for the variables: region, head of household economic activity, size of the household, toilet with sewer connection, wealth index, educational level head of household, educational level mothers, women as the head of the household, number of children under 5 years of age, self-reported ethnicity head of household, multiple births, sex, mothers' age at birth, pre-term birth, birth spacing and mothers' height.
||Reference category corresponds to: does not identify as Afro-Colombian or indigenous.

maternal overweight in severe food-insecure Colombian households when compared to their Brazilian counterparts is the higher gross national product in Brazil[44]. Consequently, it is conceivable that severe food-insecure households in rural Colombia are experiencing an early stage of the nutritional transition, whereby high energy-dense foods are not yet highly accessible.

Since severe food-insecure households experienced hunger, the present finding of higher prevalence of child stunting together with a lower prevalence of maternal overweight/obesity was expected. Despite lower prevalence of child stunting in mild food-insecure households, which experience impaired food quality, these households also showed high presence of maternal OWOB. Accordingly, it appears that SCOWT occurs in moderate food-insecure households as these households suffer from both impaired food quality and quantity. This observation is supported by the findings of Lee *et al.*[45] who found that the middle consumption quintile increased the likelihood of a household with SCOWT in Guatemala. In moderate food-insecure households, the occurrence of child stunting could be explained by a diet lacking in nutrient density and diversity and insufficient food consumption. Conversely, the presence of maternal OWOB might be due to excessive intake of highly available energy-dense foods specifically by the mothers as only 2 % of children were both stunted and overweight. Such differential intra-household food distribution has been observed previously to be associated with the double burden of malnutrition[46].

There are underlying factors that determine the consumption of unhealthy diets. For instance, food system transformations have been characterised by an increased production and access of energy-dense, ultra-processed foods including in rural areas[47]. It appears that such processed, high-fat and high-carbohydrate foods have become more available to small farmers in Colombian rural areas[24]. Moreover, such changes in food systems and industrialisation can also lead to universalisation of television and greater sedentarism[48], which can contribute to the increasing rates of overweight in rural areas.

Social conditions associated with SCOWT

Indigenous households, which had higher odds for SCOWT, were also significantly associated with an increasing occurrence of child stunting and a decreasing occurrence of maternal overweight. This observation, which is in line with findings by Lee *et al.*[45], could suggest that the occurrence of SCOWT is a reflection of nutritional transition, which not all indigenous households may be experiencing equally. Further research is needed within indigenous populations to identify specific factors involved for this possible nutritional transition.

Living and working conditions associated with SCOWT

In this study, households with low educational levels, with two or more children under 5 years of age, and with five or

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more members had an increased likelihood of SCOWT. These associations have been found in previous studies[29,45,49–51]. Likewise, we found that a female head of household increased the occurrence of this phenomenon, which to the best of our knowledge has not been previously reported. These results highlight the importance of education in promoting healthy growth in children and preventing excessive weight gain in mothers. Moreover, having more children and more household members might increase the difficulty for the parents to provide adequate care practices and could also lead to less available food per family member. On the other hand, where the woman was the head of the household, it is highly probable that, besides taking care of the usual domestic tasks, the woman needs to work to maintain the family, putting the mother and her child in a more vulnerable position. Taken together, all of the above factors can compromise the personal care practices of the mother, which might contribute to her increased risk of excessive weight gain.

Individual factors associated with SCOWT

Low mother's height was a significantly strong determinant for SCOWT, which is in line with previous literature[51,52]. The latter association might be driven by the significant relationship of lower maternal height with child stunting[53–58]. Such relationships are suggestive of intergenerational mother to child transmission of low height, which could be influenced by genetics, sharing the same poverty conditions, epigenetic and metabolic changes, and impaired fetal growth due to reduced intra-uterine space[59]. Moreover, the strong association of low mother´s height with SCOWT might be also due to the association of low height with overweight[55,60], which can be explained by the reduced energy requirements in these individuals that can easily be exceeded[61]. Furthermore, low maternal height is the outcome of chronic undernutrition in infancy, which is associated with overweight later in life, since stunted children seem to be more susceptible to gain more fat than lean mass[62].

The SCOWT pairs represent a concern due to their vulnerability to chronic diseases, as these are associated not only with excessive weight, but also with low height[27,55,63,64]. This phenomenon can place children at a higher health risk, since they are stunted and more likely to develop overweight, particularly if raised in an obesogenic environment. Consequently, special attention should be given to this demographic to promote adequate linear growth and avoid excessive weight gain, and so decrease chronic disease risk[65,66].

In the present study, another factor related to the occurrence of SCOWT was the birth spacing of the target child of above 24 months with siblings, which might be determined by the association of this factor with maternal overweight. Weight gain during and after pregnancy should be investigated among this population to better understand this association.

The findings of the present research reinforce the need for implementation of rural public health and food security programmes to address the social determinants of health as a means to reduce the presence of SCOWT. Moreover, all food security programmes should extend their scope, including double-duty actions, that is, those that simultaneously address undernutrition, obesity and diet-related noncommunicable diseases[67]. These actions are of paramount importance in developing countries and particularly in their rural areas, where food system transformations are rapidly occurring. Effectively addressing food insecurity will contribute to achieve the second Sustainable Development Goal (Zero Hunger) and so reduce all forms of malnutrition, provide opportunities for the countryside transformation and development, and sustain the Colombian peace. Moreover, additional longitudinal, experimental and qualitative studies are needed to better understand this association and its causality, including the role of diet to determine dietary patterns within households and taking into consideration intra-household food distribution. All efforts should be taken to avoid the growing prevalence of OWOB and its coexistence with undernutrition, especially in the rural areas, where access to adequate health care is limited.

Limitations

Although this research provides insight of an understudied issue, causality cannot be established. Moreover, the ELCSA scale questions referred to a period of 30 d, which might not reflect long-term interactions between variables. Furthermore, since the ELCSA scale is answered only by one member of the household, individual experiences were not contemplated.

Additionally, there were some variables that could not be included in this research as they were only present in a reduced number of pairs ($n < 1000$), such as breastfeeding, physical activity and dietary variables, which would have allowed amplifying the analysis of individual factors for the presence of SCOWT.

Conclusions

Colombian rural areas are highly vulnerable to food insecurity and its consequences, such as SCOWT. The association between different severity levels of food insecurity and SCOWT was significant in moderate food-insecure households. Other factors associated with SCOWT were low mother's height, mothers with multiple births, households with three or more children under 5 years of age, households with more than seven members, women as the head of the household, indigenous head of the household and child birth spacing of more than 24 months. There is an urgent need to address these factors and implement double-duty actions to prevent the increase in SCOWT in Colombian rural areas.

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