

Anemia in recyclable waste pickers using human driven pushcarts in the city of Santos, southeastern Brazil

Anemia em catadores de material reciclável que utilizam carrinho de propulsão humana no município de Santos

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Resumo

Objetivo: Estimar a prevalência de anemia e analisar os fatores de risco a ela associados nos catadores de material reciclável que utilizam carrinho de propulsão humana do município de Santos - São Paulo.

Método: Estudo transversal com 253 catadores foi realizado em julho de 2005. A coleta de informações foi feita por meio de questionário com informações sobre características individuais, ocupacionais e dietéticas. Foi realizada avaliação antropométrica e coletado sangue venoso para hemograma completo e sorologias de HIV, HCV, HBV e sífilis.

A análise estatística foi feita pela análise uni e multivariada (regressão logística), relacionando a anemia aos fatores de risco.

Resultados: A prevalência de anemia foi de 38,3%. As variáveis que mostraram associação independente com anemia no modelo multivariado foram: sexo (OR 2,8; IC95%: 1,25-6,25), infecção pelo HIV (OR 6,45; IC95%: 2,11-21,06), IMC (χ^2 de tendência $p < 0,01$), anos de trabalho como catador (χ^2 de tendência $p < 0,01$), consumo de leite (χ^2 de tendência $p < 0,01$) e de proteína animal (OR 0,30; IC95%: 0,13-0,68).

Conclusão: A prevalência de anemia entre catadores de material reciclável é elevada mesmo após a obrigatoriedade de adição de ferro nas farinhas de trigo e milho. Os catadores são excluídos das ações de proteção à saúde do trabalhador, previstas na legislação. Ações de saúde dirigidas a essa categoria profissional devem ser implementadas, garantindo a acessibilidade aos serviços de saúde.

Palavras-chave: anemia; dieta; catadores de material reciclável

Abstract

Objective: To estimate anemia prevalence and describe risk factors associated in recyclable waste pickers using pushcarts in the city of Santos.

Methods: A cross-sectional study including 253 recyclable waste pickers was conducted in the city of Santos, southeastern Brazil, in July 2005. A questionnaire was used to collect information about individual, occupational, and dietary factors. All subjects underwent an anthropometric evaluation and venous blood was drawn for complete blood count and serological testing for HIV, HCV, HBV, and syphilis.

Statistical analysis included univariate and multivariate (logistic regression) analyses testing for the association between anemia and risk factors.

Results: The prevalence of anemia was 38.3%. The variables independently associated to anemia in the multivariate model were: gender (OR 2.8; 95% CI: 1.25–6.5), HIV infection (OR 6.45; 95% CI: 2.11–21.06), BMI (χ^2 for trend, $p < 0.01$), length of time working as a picker (χ^2 for trend, $p < 0.01$), and consumption of milk (χ^2 for trend, $p < 0.01$) and animal protein (OR 0.30; 95% CI: 0.13–0.68).

Conclusions: The prevalence of anemia among recyclable waste pickers is high even after compulsory addition of iron to wheat and corn flours. Waste pickers have not benefited from actions for worker's health protection established by the law. Health actions targeting this occupational category should be implemented to ensure their access to health services.

Key words: Anemia; Diet; solid waste segregator

Introduction

Anemia is a very common condition affecting nearly two billion people, a third of the world's population.¹ The decrease in hemoglobin concentration increases the risk of maternal and infant mortality, and can impair physical and cognitive development in children and affect work capacity in adults.^{2,3}

Over 50% of anemia cases are due to deficient iron intake, and this type of anemia is the most common deficiency disease worldwide.⁴

Most studies on iron deficiency anemia investigate the prevalence, treatment and prevention strategies⁵ in the most vulnerable populations: children^{6,7} and pregnant women.⁸ There are few studies in adult men in Brazil.

The study of the Xavante Brazilian Native population of the village of São José, Sangradouro Indigenous Land, Volta Grande, in the state of Mato Grosso, found a 28.6% prevalence of anemia in adults aged 20 years or more, of which 50.0% among women and 8.3% among men.⁹ In a health examination before employment of male workers in the city of Salvador the prevalence of anemia found was 12.8%.¹⁰ A population-based study in women aged 20–60 years carried out in the city of São Leopoldo, state of Rio Grande do Sul, showed a prevalence of 19.2%.¹¹

The above mentioned studies show prevalences before the implementation by the Brazilian Ministry of Health policy aimed at reducing the prevalence of anemia – the Brazilian Social Commitment for Reduction of Iron Deficiency Anemia.¹² The main action of this policy was the compulsory addition of iron (30% of the recommended daily ingestion [RDI] or 4.2 mg/100 g) and folic acid (70% RDI or 150 µg/100 g) to corn and wheat flours. It intended to increase the availability of foods rich in these micronutrients to all population segments. As of June 2004, all wheat and corn flours either produced in Brazil or imported have to be enriched.¹³

There have been a growing number of recyclable waste pickers in recent years.

The Business Commitment for Recycling (CEMPRE), a business organization for the promotion of recycling and integrated waste management, estimated that the number of waste pickers increased sharply between 1999 and 2004, from 150,000 to 500,000.¹⁴

Studies have reported poor health and living conditions among waste pickers.^{15,16} A study conducted with waste pickers of the city's landfill in Rio de Janeiro assessed their reported morbidity and concluded these workers are exposed to highly unhealthy and dangerous environments.¹⁷

There are few studies assessing health conditions of recyclable waste pickers using pushcarts.

Objective

To estimate anemia prevalence and describe risk factors associated in recyclable waste pickers using pushcarts.

Methods

Recyclable waste pickers were approached in July 2005 when they attended the local office for licensing their pushcarts, which is compulsory every year in the city of Santos under penalty of having them impounded. On that occasion, they were asked to give their informed consent and those who agreed were interviewed by employees of the local Division of Social Services. All interviewers had college education and were trained by the university faculty. The study questionnaire consisted of questions on living and working conditions and qualitative food frequency¹⁸ based on food groups adapted to the Brazilian population.¹⁹ Subjects also underwent an anthropometric assessment carried out by trained nutrition students, supervised by their teacher, including weight measures using a mechanical scale (Welmy®), 150-kg capacity and 100-g division, and height measurements were taken using the scale's anthropometric ruler with 200-cm capacity and 0.5-cm division. These measurements were used for the calculation of body mass index (BMI) and

BMI classification according to World Health Organization (WHO) criteria.²⁰ Venous blood was drawn for complete blood count (CBC), HIV, hepatitis B and C virus and syphilis serological tests. Blood samples were obtained by venipuncture using the Vacutainer® System. Approximately 14 mL of blood were collected from each subject: 10 mL in a tube with no anticoagulant for serological tests and 4 mL in an EDTA tube for CBC.

Anemia was defined according to WHO criteria: hemoglobin level lower than 13 g/dL and 12 g/dL²¹ in men and women, respectively.

To assess a potential association between the selected variables and anemia, odds ratios (OR) and their related 95% confidence intervals were estimated, considering anemia as the dependent variable and multiple exposures as independent variables. For variables grouped into more than two categories, we calculated the χ^2 for trend.

The variables with p-value <0.3 in univariate analysis were tested in the multivariate analysis using a non-conditional logistic regression model. The final explanatory model included those variables independently associated with anemia.

The present study was approved by the Research Ethics Committee of the Universidade Católica de Santos.

Results

A total of 253 subjects, both males and females, participated in the study. The sample comprised mostly male pickers (86.2%), aged 35 years or more (70.0%) with low schooling and income (Table 1). They worked on average 8.32 hours/day and 78.7% of them worked six or seven days a week. The prevalence of anemia was 38.3%. The variables gender and length of time working as a picker (shown in Table 1) were statistically associated with anemia.

Table 2 shows that waste pickers had high prevalence of HIV and hepatitis B and C virus infection (8.9%, 34.4% and 12.4% respectively). Among the study subjects, 22.4% reported daily alcohol intake and

50.6% smoked regularly. HIV infection was the single variable in this group of variables that was significantly associated with anemia (OR 6.45, 95% CI: 2.11–21.06).

Overweight or obesity was seen in 29.5% of the population studied, and there was a small proportion with BMI below normal (Table 3). When BMI was regrouped to make

the number of individuals in each stratum closer, there was seen a statistically significant trend with decreasing prevalence of anemia as BMI increased ($p < 0.01$).

Table 4 shows the analysis of the association between dietary habits and anemia. The variables that showed a statistically significant association with anemia were

Tabela 1 – Prevalência de anemia em catadores de materiais recicláveis segundo variáveis demográficas.

Table 1 – Prevalence of anemia among recyclable waste pickers according to demographic variables.

Variable	No anemia n (%)	Anemia n (%)	OR (95% CI)
Gender (n=253)*			
Male	142 (65.1)	76 (34.9)	1.0
Female	14 (40.0)	21 (60.0)	2.8 (1.25–6.25)
Total	156 (61.7)	97 (38.3)	
Age groups+ (n=253)*			
17-35	48 (63.2)	28 (36.8)	1.0
36-45	46 (55.4)	37 (44.6)	1.38 (0.73–2.60)
46-90	62 (66.0)	32 (34.0)	0.88 (0.47–1.66)
Skin color (n=249)*			
White	61 (67.8)	29 (32.2)	1.0
Black	25 (52.1)	23 (47.9)	1.94 (0.94–3.97)
Mixed	61 (61.1)	38 (38.4)	1.31 (0.72–2.39)
Natives and Asians	5 (45.5)	7 (54.5)	2.94 (0.75–11.89)
Schooling++ (n=252)*			
Illiterate	20 (74.1)	7 (25.9)	1.0
Elementary school	118 (58.7)	83 (41.3)	2.01 (0.81–4.97)
Middle and high school	14 (73.7)	5 (26.3)	1.02 (0.27–3.88)
College/university	3 (60)	2 (40.0)	1.90 (0.26–3.87)
Income+++ (n=242)*			
< 1 MMW	71 (59.2)	49 (40.8)	1.0
1–2 MMWs	60 (65.9)	31 (34.1)	0.75 (0.43–1.32)
≥ 3 MMWs	21 (67.7)	10 (32.2)	0.69 (0.30–1.59)
Length of time as a picker++++ (n= 249)*			
≤ 1 year	48 (67.6)	23 (32.4)	1.0
1.1–5.0 years	55 (67.9)	26 (32.1)	1.01 (0.40–2.54)
5.1–10.0 years	29 (55.8)	23 (44.2)	1.54 (0.58–4.11)
>10.1 years	21 (46.7)	24 (53.3)	2.68 (1.01–7.17)

* n=number of answers among the 253 participants. MMWs: monthly minimum wages

* tendency χ^2 : $p = 0.65$

** tendency χ^2 : $p = 0.76$

*** tendency χ^2 : $p = 0.26$

**** tendency χ^2 : $p = 0.01$

consumption of animal protein and milk (OR 0.30, 95% CI 0.13–0.68). The higher the consumption of animal protein and milk, the lower the prevalence of anemia.

Multivariate analysis

The variables with p-value lower than 0.30 were gender, income, length of time working as a picker, HIV infection, HCV infection, BMI, and consumption of animal protein, eggs, milk, coffee and tea. These variables were tested in multivariate models.

Table 5 shows the variables that contributed to the explanatory model of the occurrence of anemia, adjusted by age.

Discussion

The present study found a high preva-

lence of anemia in recyclable waste pickers in 2005. The WHO considers anemia a serious public health problem when its prevalence is greater than or equal to 40%.^{1,4} Thus, in the sample studied, anemia can be considered overall a moderate problem but seriously concerning among females.

The analysis of data regarding personal habits and living conditions of waste pickers showed a statistically significant association between anemia and gender (OR 2.8, 95% CI: 1.25–6.25). This finding is consistent with the literature that show women as the second group of higher risk of anemia, after children.^{1,21} In nonpregnant women of childbearing age, excessive menstrual bleeding (hypermenorrhea), that may go unnoticed or untreated, is the leading cause of iron deficiency anemia.^{21,22}

The association between schooling and

Tabela 2 – Prevalência de anemia em catadores de material reciclável segundo infecções detectadas na sorologia e hábitos de fumar e consumir bebidas alcoólicas.

Table 2 – Prevalence of anemia in recyclable waste pickers according to positive viral infections, smoking and drinking.

Variable	No anemia n (%)	Anemia n (%)	OR (95% CI)
HIV (n=248)*			
Negative	148 (65,5)	78 (34,5)	1,0
Positive	5 (22,7)	17 (77,3)	6,45 (2,11–21,06)
HBV (n=250)*			
Negative	100 (61)	64 (39)	1,0
Positive	53 (61,6)	33 (38,4)	0,97 (0,55–1,73)
HCV (n=250)*			
Negative	136(62,1)	83 (37,9)	1,0
Positive	17(54,8)	14 (45,2)	1,35 (0,59–3,09)
Alcohol intake habits+ (n=246)*			
Does not drink	56 (60,9)	36 (39,1)	1,0
Sometimes	67 (67,7)	32 (32,3)	0,74 (0,41–1,35)
Daily	28 (50,9)	27 (49,1)	1,50 (0,76–2,94)
Smoking habit++ (n=247)*			
Does not smoke or quit smoking	60 (62,5)	36 (37,5)	1,0
Sometimes	14 (53,8)	12 (46,2)	1,0 (0,58–1,74)
Regularly	78 (62,4)	47 (37,6)	1,43 (0,60–3,43)

* n=number of answers among the 253 participants

+ trend χ^2 : p = 0.36

** trend χ^2 : p = 0.55

Tabela 3 – Prevalência de anemia em catadores de material reciclável segundo medidas antropométricas.

Table 3 – Prevalence of anemia in recyclable waste pickers according to anthropometric measures.

Variable	No anemia n (%)	Anemia n (%)	OR (95% CI)
BMI+ (n=237)*			
Underweight	5 (55,6)	4 (44,4)	1,0
Normal weight	92 (58,2)	66 (41,8)	0,90 (0,23–3,47)
Overweight	36 (72,0)	14 (28,0)	0,49 (0,11–2,08)
Obesity	14 (70,0)	6 (30,0)	0,53 (0,11–2,72)
Regrouped BMI++ (n=237)*			
≤20	11 (40,7)	16 (59,3)	1,0
20–21.9	29 (52,7)	26 (47,3)	0,61 (0,24–1,57)
22–24.9	57 (67,1)	28 (32,9)	0,34 (0,14–0,82)
≥25	50 (71,4)	20 (28,6)	0,29 (0,12–0,74)
Waist circumference (n=237)*			
Normal	121 (61,7)	75 (38,3)	1,0
Risk	35 (61,4)	22 (38,6)	1,01 (0,53–1,95)

* n=number of answers among the 253 participants

* trend χ^2 : $p = 0.12$

** trend χ^2 : $p = 0.01$

income and anemia could not be assessed as waste pickers comprise a very homogeneous population and very few individuals have high schooling or income, making it difficult to detect differences. However, the variable length of time working as a picker was associated with anemia: the longer a subject worked as a picker (χ^2 for trend: $p < 0.01$), which reflects greater exposure to low income and poor housing, living, and working conditions, the higher the risk of anemia.

It is also well-established the association between alcohol intake and anemia.^{23,24,25} Several hypotheses have been formulated to explain this association such as reduced hemoglobin due to bleeding or hemolysis, usually associated with liver disease and folic acid deficiency due to inadequate intake as energy is provided by alcohol.²³ However, the present study did not find any association between alcohol intake and anemia.

Most subjects studied worked as pickers for at least five years. Many worked from 8 to 12 hours or more a day and often did not have a weekly rest. Working as a picker

is physically demanding and requires a considerable intake of energy, proteins and micronutrients as they go over long distances pushing their carts loaded with waste materials.

Iron deficiency is associated not only to the amount of iron ingested and absorbed but also its bioavailability, which is dependent on interfering dietary factors: the consumption of ascorbic acid, meat, fish and fermented products may promote the absorption of iron,^{26,27} while beans (phytates),^{28,29} vegetables (phytates and oxalates),³⁰ teas and coffee (polyphenols), dairy products (calcium)²⁷ and eggs (albumin)³¹ can inhibit iron absorption.^{26,32}

The study showed an association between low consumption of meat and anemia. The inverse relationship between consumption of animal protein and anemia is explained by the fact that meat has proteins of high biological value and high iron bioavailability found in hemoglobin and myoglobin, especially in red meat.^{26,27}

No association was found between consumption of rice, beans, eggs, vegetables

Tabela 4 – Prevalência de anemia em catadores de material reciclável segundo hábitos alimentares.

Table 4 – Prevalence of anemia in recyclable waste pickers according to eating habits.

Variable/anemia	No anemia n (%)	Anemia n (%)	OR (95% CI)
No. meals/day+(n=242)*			
1	27 (58,7)	19 (41,3)	1,0
2	51 (60,7)	33 (39,3)	0,92 (0,44–1,91)
3	42 (40,9)	27 (39,1)	0,91 (0,43–1,95)
4	21 (65,6)	11 (34,4)	0,74 (0,29–1,90)
5 or more	9 (81,8)	2 (18,2)	0,32 (0,04–1,87)
Rice and beans (n=242)*			
≤ 6 times/week	38 (64,4)	21 (35,6)	1,0
Daily	112 (61,2)	71 (38,8)	1,15 (0,59–2,22)
Animal protein (n=243)*			
≤ 1 time/week	12 (36,4)	21 (63,6)	1,0
≥ 2 times/week	138 (65,7)	72 (34,3)	0,30 (0,13–0,68)
Eggs++ (n=241)*			
Never	42 (56,8)	32 (43,2)	1,0
1 time/week	25 (56,8)	19 (43,2)	0,99 (0,47–2,12)
2 to 3 times/week	64 (68,1)	30 (31,9)	0,62 (0,33–1,16)
Daily	18 (62,1)	11 (37,9)	0,80 (0,33–1,93)
Vegetables (n=239)*			
≤ 1 time/week	36 (60,0)	24 (40,0)	1,0
≥ 2 times/week	111 (62,0)	68 (38,0)	0,92 (0,48–1,76)
Fruits (n=243)*			
≤ 1 time/week	49 (62,8)	29 (37,2)	1,0
≥ 2 times/week	101 (61,2)	64 (38,8)	1,07 (0,59–1,95)
Milk+++ (n=243)*			
Never or <1 time/month	46 (51,1)	44 (48,9)	1,0
1 to 3 times/month	17 (63)	10 (37)	0,61 (0,25–1,49)
2 to 6 times/week	30 (71,4)	12 (28,6)	0,42 (0,19–0,92)
Daily	57 (67,9)	27 (32,1)	0,50 (0,27–0,92)
Tea and coffee (n=243)*			
Never or seldom	23 (50,0)	23 (50,0)	1,0
Daily	127 (64,5)	70 (35,5)	0,55 (0,27–1,11)

* n=number of answers among the 253 participants

* trend χ^2 : $p = 0,64$

** trend χ^2 : $p = 0,21$

*** trend χ^2 : $p = 0,01$

and fruits and anemia. Despite high protein quality of eggs and rice/beans mixture, they are not good food sources of bioavailable iron as they contain inhibitory factors as mentioned before.^{28,29}

Excessive consumption of tea and coffee (rich in polyphenols) and milk (rich in calcium and casein phosphopeptides)²⁷ can negatively affect iron absorption by forming insoluble complexes and competing for

Tabela 5 – Odds ratio e intervalo de 95% de confiança de variáveis independentemente associados à anemia na análise multivariada.

Table 5 – Odds ratio and 95% confidence interval for variables independently associated with anemia in the multivariate analysis.

Variable	OR	(95% CI)
Age groups		
17-35	1,0	-
36-45	1,49	0,67–3,32
46-90	0,62	0,26–1,43
Gender		
Masculino	1,0	-
Feminino	4,11	1,56–10,87
HIV		
Negativo	1,0	-
Positivo	9,23	2,93–29,1
BMI		
≤ 20	1,0	-
20,1-21,9	0,50	0,16–1,59
22,0-24,9	0,26	0,09–0,76
≥ 25,0	0,21	0,07–0,64
Length of time as a picker		
≤ 1,0 ano	1,0	-
1,1 a 5,0 anos	1,14	0,35–3,71
5,1 a 10,0 anos	2,74	0,78–9,66
> 10,1 anos	4,54	1,29–16,0
Milk intake		
Nunca ou < 1 x/mês	1,0	-
De 1 a 3x/mês	0,42	0,15–1,20
De 2 a 6x/semana	0,40	0,15–1,02
Diariamente	0,36	0,16–0,81
Consumption of animal protein		
≤ 1 x/semana	1,0	-
Mais de 1 vez/semana	0,39	0,15–0,97

common intestinal absorption sites of iron and calcium, favoring the development of anemia.^{33,34} The present study showed no association between consumption of tea, coffee and anemia. Paradoxically, milk consumption had a protective effect against anemia. One possible explanation would be high intake of animal protein of high biological value as a source of substrate for hemoglobin synthesis and the fact that the inhibitory effect of milk on iron absorption in adults is apparently not relevant as the meals when food with the highest iron content (lunch and dinner) are consumed are taken separately from those with milk intake (breakfast).

The assessment of nutritional status ba-

sed on BMI, the most widely used parameter to assess the prevalence of overweight and obesity and risk factors associated,³⁵ showed that most subjects were normal weight. There was seen a statistically significant trend of increasing prevalence of anemia as BMI decreased, suggesting a possible relationship between nutritional factors and anemia.

According to Pedro Escudero dietary guiding principles established in 1937,³⁶ adequate quantity, harmony and adequacy of nutrients, and not only quality, are required for an adequate eating. It is possible that the intake of food required for red cell production in waste pickers is associated to more food in general.

There is a statistically significant association between HIV infection and anemia and it has been demonstrated in previous studies.^{37,38,39,40}

As recyclable waste pickers in the city of Santos are a low-income and low-schooling population, they may not have access to healthier foods and may not be familiar with hygienic and sanitary practices, which favors intestinal parasite infections^{41,42} that negatively affect the use of nutrients and/or cause disease.

Study limitations

Apart from the limitations intrinsic to the study design, it was difficult to identify risk factors of anemia.

As the population studied is very homogeneous, any differences between groups were minor and difficult to identify. For example, with respect to schooling and income, the vast majority was low income and schooling and very few were above the average for comparison.

No calculation of sample size was performed to identify explanatory factors of anemia since the entire population was included in the study. A larger sample of pickers would be required to identify some associations.

Anemias are categorized into different types and have different risk factors, and can be considered etiologically different diseases. The analysis of anemias as a whole reduces the strength of association between some variables and the disease and may explain why the association was not statistically significant in some cases.

Conclusion

Despite the study limitations, an association was found between anemia and living conditions, including eating habits, HIV infection and length of time working as a picker. Anemia adds further stress to their work, which is already quite demanding.

Unlike most workers in Brazil, recyclable waste pickers have not benefited from policies for workers' health protection as they do not undergo routine exams and health checks before employment.

This study was conducted after the implementation of iron supplementation in corn and wheat flour. Iron supplementation alone failed to prevent anemia in these workers, indicating a need to ensure access to health services. The inclusion of recyclable waste pickers in the workers' health program should be considered.

CONFLICT OF INTEREST: None.

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