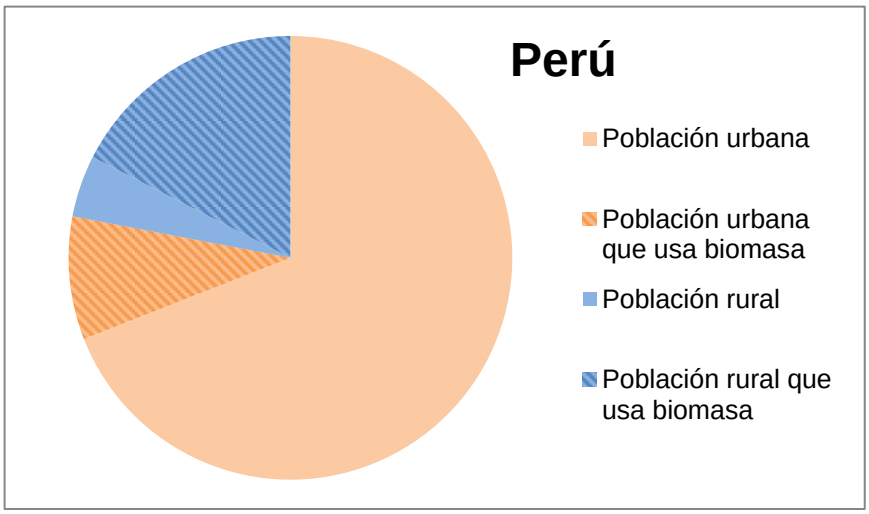
Perú

Población total*	**30,376,000**
Urbana (%)	**78**
Rural (%)	**22**
% Población que usa biomasa*	**34**
% de la población urbana	**11.5**
% de la población rural	**79.6**
% Población con acceso a GLP y electricidad**	**58**
Número de hogares que usan biomasa**	**2,798,258**
Número de muertes en 2012 por CAH*	**6,549**
Número de muertes de niños en 2012 por CAH*	**443**
Precio del GLP (tanque de 25 lb)***	**15 USD**
Precio de la electricidad (Kw/h)***	**0.13 USD**
Precio de la Leña	**nd**

CAH: Contaminación del aire en los hogares
*Datos de la OMS para el 2012
** Datos GACC (Global Alliance for Clean Cookstoves) página web consultada en mayo del 2015
*** Septiembre 2015



Programa de distribución de estufas de biomasa con chimenea

Número de estufas de Biomasa distribuidas hasta el momento	**301,088 Inkawasi hasta 2013 y 60,000 desde 2013 491,817 GLP desde 2013**
Costo de la estufa de biomasa:	**300 soles en promedio (Aprox. 85 USD)**

Desempeño de la tecnología: ¿Dónde se evaluó? **Laboratorio El Zamorano**	Tipo de estufa	**Inkawasi**
	Concentración de PM en la cocina	**182 µg/m^3**
	Concentración de CO en la cocina	**2.2 ppm**

Programa Nacional

¿Tiene un Programa Nacional? **Sí**	¿Desde Cuándo? **2009**	Meta del gobierno: **MINEM 1 millón de estufas de GLP en 5 años y 80,000 estufas a leña al 2016.**
Ministerio Responsable: **MINEM hasta 2014, MIDIS al presente**		
Otros Ministerios involucrados: **MINEDU, MIDIS, VIVIENDA, MINSA, MIMP, MINED, MINAM, SENCICO**		
Actores no Gubernamentales	**GIZ, Vision Mundial, Care, ADRA, Caritas, ProPerú, Neoandina, Prisma, ITYF, Kusi Warma, AIDESEP, BID, Minera Barrick, Alac, Microsol**	
Universidades involucradas	**Universidad Cayetano Heredia, Pontificia Universidad Católica del Perú, Centro de Energías Renovables de la Universidad Nacional de Ingeniería**	

Información adicional[1]

Hasta el momento se han distribuido cerca de 301,000 estufas de construcción in situ (estufas que cuentan con una cámara de combustión y una chimenea para sacar el humo al exterior de la vivienda). Los modelos que se han distribuido han sido principalmente distintas versiones de la estufa Inkawasi [1] a través del programa del gobierno Campaña Nacional de Cocinas Mejoradas "por un Perú sin Humo" (anteriormente el proyecto NINA) y de los Gobiernos Regionales de Tacna, Moquegua, Arequipa, La Libertad y Gobiernos Locales, que han contado con el apoyo de GIZ. Asimismo, algunas ONGs han implementado cocinas, entre ellas ADRA, Caritas, Instituto Trabajo y Familia - Programa Sembrando, Prisma, entre otras.

Perú cuenta con un laboratorio de certificación de estufas del gobierno, implementado por Decreto Supremo del Ministerio de Vivienda (DS 015-2009) por el Servicio Nacional de Capacitación para la Industria y la Construcción SENCICO, que además de medir el desempeño de las distintas tecnologías y contabilizar sus emisiones, establece límites mínimos de desempeño, evalúa y certifica las cocinas mejoradas, y cuenta en su oferta educativa con el curso corto de construcción de los modelos de cocinas mejoradas certificadas.

[1] Proporcionada por GIZ Perú, SENCICO y la Dirección Gral. de Salud Ambiental DIGESA del Ministerio de Salud del Perú.

AMAZONAS	5,182
ANCASH	1,687
APURIMAC	18,179
AREQUIPA	14,404
AYACUCHO	17,695
CAJAMARCA	45,673
CUSCO	41,904
HUANCAVELICA	34,770
HUANUCO	6,086
ICA	624
JUNIN	2,168
LA LIBERTAD	58,732
LAMBAYEQUE	1,949
LIMA	3,183
LORETO	3,509
MOQUEGUA	4,073
PASCO	4,983
PIURA	20,652
PUNO	1,154
SAN MARTIN	4,159
TACNA	9,802
UCAYALI	520

Distribución de estufas mejoradas de leña en el Perú

Estufa Incawasi

El programa de gobierno de distribución de estufas mejoradas está registrado ante el Gold Standard para recibir pago por bonos de carbono.

La distribución de estufas también se puede consultar en www.cocinasmejoradasperu.org.pe

El Estado Peruano consciente de que la carencia de fuentes energéticas va en detrimento del desarrollo humano, creo mediante Ley en 2012 el Fondo de Inclusión Social Energético (FISE), y el año siguiente aprobó el Plan de Acceso Universal a la Energía 2013-2022[2]. En ese contexto, este fondo es administrado por el Organismo Supervisor de la Inversión en Energía y Minas (Osinergmin) el cual diseñó el planteamiento técnico metodológico como una propuesta de política pública para mitigar la pobreza energética en Perú. El FISE es un mecanismo de la política de inclusión social orientado a expandir la frontera energética en los segmentos vulnerables de la población y lo hace a través de la masificación del gas natural en los sectores vulnerables, la ampliación de la frontera energética utilizando energías renovables y la promoción del acceso al GLP en los sectores urbanos y rurales. El gobierno se planteó la meta de distribuir 1 ,000,000 estufas a GLP e instalar 80,000 estufas mejoradas al 2016 en las zonas donde no hay mercado para el GLP o gas natural. Hasta el momento se han distribuido 491,817 estufas de GLP. Se proporciona vales de 32 soles para compra de GLP (9.15 dólares al 15 de febrero del 2016). El MINEM transfirió al MIDIS los fondos para la distribución de 60,000 estufas de construcción in situ para el año 2015.

DEPARTAMENTO	NRO. DE BENEFICIADOS
AMAZONAS	15 091
ANCASH	37 965
APURIMAC	29670
AREQUIPA	6 748
AYACUCHO	19 962
CAJAMARCA	71 326
CUSCO	46 494
HUANCAVELICA	18 020
HUANUCO	24 719
ICA	9 718
JUNIN	24 517
LA LIBERTAD	25 141
LAMBAYEQUE	8 345
LIMA	4
LORETO	2 418
MADRE DE DIOS	737
MOQUEGUA	1 136
PASCO	10 625
PIURA	55 541
PUNO	35 699
SAN MARTIN	33 904
TACNA	1 134
TUMBES	1 166
UCAYALI	11 737
TOTAL	491 817

Estufas de GLP distribuidas hasta el momento por región

[2] Fuente : Ministerio de Energía y Minas (MINEM)

Artículos acerca de estudios realizados en el Perú

1. Agurto-Adrianzen M (2009). The role of social capital in the adoption of firewood efficient stoves in northern Peruvian Andes. MPRA Paper No. 15918. Munich: Munich Personal RePEc Archive.

http://mpra.ub.uni-muenchen.de/15918/1/MPRA_paper_15918.pdf

Abstract

This paper explores rural households' adoption of a new cooking technology in the Northern Peruvian Andes. It exploits a development intervention which distributed and installed, at no cost, firewood efficient stoves in the rural communities of Chalaco District. Using first hand data, collected from the beneficiary villages, this research investigates how village technology adoption patterns and village social capital mutually interact and influence the individual household's adoption decision. The results in this paper indicate that the effect of village adoption patterns on the household's adoption decision is significantly higher in villages with stronger social capital and that the marginal impact of social capital may be negative if village success in adoption is relatively low. It is also shown that only the proportion of adopters that did not experience problems with their own stoves has a positive impact on individual household adoption through its interaction with social capital, while the reverse is true for the village proportion of adopters experiencing problems with the new cooking technology. In this study measures of social capital were collected prior to the intervention; therefore, reverse causality should not be a critical issue in identifying the effects of this social variable. Village unobservable factors are not likely to drive the observed patterns in the data; this paper also shows that village success in adoption has a negative effect on the decision to uninstall the stove among beneficiary non users and that this effect is also increasing in village social capital. The results point to the importance of village social structures in the success of development interventions.

2. USAID/Winrock (2008) Peru healthy kitchen/healthy stove pilot project. Washington, DC: United States Agency for International Development.

http://pdf.usaid.gov/pdf_docs/PDACN009.pdf

Abstract

In August 2005 and 15 months later, data were collected by survey and breathing tests in adults from 44 households that initially used indoor open fires to cook. Levels of respirable particulates and carbon monoxide in the cooking areas of the households were also measured before and after installation of "rocket" stoves with chimneys. Symptomatic lung disease was common in these subjects despite tobacco smoking not being a significant issue. At baseline, virtually all respondents reported a chronic cough. Many had sufficient symptoms to be classified as having chronic bronchitis. Repeated survey the next year showed nearly complete resolution of all symptoms. By analogy to the improvement in breathing environment that occurs with tobacco smoking cessation or reduction of high level exposure to second-hand smoke, lower amounts of kitchen pollution should also reverse rates of decline in

breathing obstruction (FEV1% measured by spirometry) as it does with cessation of cigarette smoke exposures. By an extrapolation from the literature on cessation of tobacco smoke exposure, the reduction in the airway damage associated with indoor air pollution (IAP) from cooking fire smoke should have led to a 2.78% average increase in FEV1% over the follow-up period.

Some problems occurred with our data collection, largely due to loss to follow-up and spirometric tests that did not meet clinical reproducibility criteria. In the 15 subjects with fully valid tests in both years, there was an overall decrease in FEV1% of –1.38% (95% confidence interval was clearly different from the 2.78% improvement expected). This might have meant that the project failed to achieve meaningful reductions in lower respiratory tract consequences of biomass smoke exposure. However, there were large differences in the degree of reduction of biomass smoke pollution as indicated in the monitoring data for breathable particulates and carbon monoxide. An examination of this data set showed that combined cut-points of both “>100 mcg per meter squared” and “>64%” reduction in particulates discriminated between groups with better and worse spirometry results but this did not reach significance at the traditional $p< 0.05$. However, one of these subjects wasn’t cooking initially but was at follow-up. Another subject was an outlier with an FEV1% increase of 8.82%; this is consistent with this subject having asthma. The analysis was repeated with just the other 13 individuals. The difference between groups was then significant at $p < 0.01$.

The difference between groups with better and worse reductions in particulate pollution was significant at $p < 0.05$. The confidence interval for the average FEV1% change in the group with better reductions in particulates was –0.88 to 2.35% improvement. While this is not quite as good as hoped for by analogy to cessation of high-level tobacco smoke exposure, it is still reassuring that this amount of reduction in cooking smoke exposure can make a difference in the rate of progression of chronic obstructive lung disease.

This analysis focused on particulates but all of these households also had analyses of CO levels in both years. Scattering either the change in CO or its percentage drop from baseline against the change in FEV1% (or adding them to a regression model along with the change in particulates) shows no correlation so it is clear that the lung function results are associated primarily with the ability of the “rocket” stove installations to markedly reduce particulate pollution when installed and used properly.

Using the larger data set, it was also possible to check whether results varied by gender or by presence or absence of baseline obstruction. For the 17 men, there was no significant difference in FEV1% change between groups with more or less particulate reduction in the kitchens of their households. For the 15 women, there was a difference that was significant at $p < 0.05$. Although the mean changes were similar for both genders, the higher variance among the men may reflect wider variation in time spent in the kitchen. Although the majority of men in this sample cooked at least once a week, the women were the primary cooks in all these households so this result is consistent with women having had more chance of benefiting from reduction in kitchen smoke.

Comparing those with evidence of obstruction at baseline showed them to have improved FEV1%; those without didn’t seem to benefit ($p < 0.0005$). Linear regression that included this variable did not negate

the statistical significance of the reduction in particulate exposure. Having the statistical program (STATA 8.2) pick predictors of improvement (by backwards, stepwise exclusion) showed that just these two variables are significant. These results are especially striking because baseline obstruction does not predict achieving better particulate reduction (8 did and 9 didn't). Those without baseline obstruction also showed nearly equal levels of better reduction (6 did and 9 didn't). So reducing particulates by this amount has real benefit. In this sample, the impact seems to only be measurable for those already damaged by many years of smoke inhalation.

3. Accinelli R.A., Llanos O., Lopez L.M., Matayoshi S., Oros Y.P., Kheirandish-Gozal L., Gozal D. Caregiver perception of sleep-disordered breathing-associated symptoms in children of rural Andean communities above 4000 masl with chronic exposure to biomass fuel

http://www.sciencedirect.com/science/article/pii/S1389945715006498

Abstract

Previous studies have uncovered a very high prevalence of sleep disorders in general, and of sleep-disordered breathing in particular among children exposed to indoor biomass fuel pollution. However, despite the significant symptomatology, parents are unlikely to report these issues during health-care visits.

The objective of this study was to determine whether reduced caregiver perception of sleep disorders may account for the infrequent diagnosis and treatment of such problems in children residing at high altitudes and exposed to high biomass pollution.

Parents of children aged 9–15 years of three communities residing in the Pasco region in Peru located between 3800 and 4200 meters above sea level were surveyed using a validated questionnaire instrument focused on symptoms associated with sleep-disordered breathing as well as whether caregivers perceived that their child suffered from a sleep disorder.

Among the 77 children included, 48.1% had nocturnal awakenings and 46.8% had repetitive movements and restless sleep. Habitual snoring was present in 33.8% of all children. However, only 10.4% of mothers considered that their children had sleep problems, and all of their children had positive answers for ≥4 sleep symptoms.

Children residing at high altitudes and exposed to traditional biomass-fueled stoves exhibit an extremely high frequency of sleep symptoms that are misperceived by their mothers as being "normal." Interventions aimed at increasing parental recognition and awareness of sleep problems will be essential to foster improved diagnosis and treatment.

4. Kucerova I., Banout J., Lojka B., Polesny Z. Evaluation of Improved Wood-burning Cookstoves for Rural Areas Near Pucallpa, Peru.

Abstract

The rural areas near Pucallpa city in Peruvian Amazon are without access to electricity. The main source of energy is fuelwood, used in a open fire stove which has very low efficiency. The performance of two improved cook stoves (Ceramic Stove - CS and Rocket Stove – RS) constructed by the indigenous tribe Shipibo- Conibo near Pucallpa city, based on their traditional ceramic knowledge; has been compared with locally traditional cooking methods (Traditional Cocina - TC). Further, three different tree species Guaba (*Inga spp.*), Capirona (*Calycophyllum spruceanum* Benth.) and Citrus (*Citrus spp.*) were selected as most commonly used fuelwoods based on a local survey. The lab-based water boiling tests (WBTs) and controlled cooking tests (CCTs), which combined parts of lab and field based tests were used to assess the stove performance in this study. In average the thermal efficiencies of CS and RS were approximately about 8% higher during all WBT phases as compared to TC. Conversely specific fuel consumption and firepower during all WBT phases was about 98 $g.kg^{-1}$ and 1.9 kW higher in case of TC as compared to CS and RS. The results of CCT shows significant energy savings in case of CS (37%) and RS (39%) comparing to traditional methods. As a conclusion we consider improved cook stoves to be facilities that can save significant amount of energy as compared to traditional cooking methods in rural areas near Pucallpa city.

5. Rhodes E.L., Dreibelbis R., Klasen E., Naithani N., Baliddawa J., menya D., Khatry S., Levy S., Tielsch J. M., Miranda J. Kennedy C., Checkley W. *Behavioral Attitudes and Preferences in Cooking Practices with Traditional Open-Fire Stoves in Peru, Nepal, and Kenya: Implications for Improved Cookstove Interventions.* Int. J. Environ. Res. Public Health **2014**, 11, 10310-10326; doi:10.3390/ijerph111010310

http://www.mdpi.com/1660-4601/11/10/10310

Abstract: Global efforts are underway to develop and promote improved cookstoves which may reduce the negative health and environmental effects of burning solid fuels on health and the environment. Behavioral studies have considered cookstove user practices, needs and preferences in the design and implementation of cookstove projects; however, these studies have not examined the implications of the traditional stove use and design across multiple resource-poor settings in the implementation and promotion of improved cookstove projects that utilize a single, standardized stove design. We conducted in-depth interviews and direct observations of meal preparation and traditional, open-fire stove use of 137 women aged 20–49 years in Kenya, Peru and Nepal prior in the four-month period preceding installation of an improved cookstove as part of a field intervention trial. Despite general similarities in cooking practices across sites, we identified locally distinct practices and norms regarding traditional stove use and desired stove improvements. Traditional stoves are designed to accommodate specific cooking styles, types of fuel, and available resources for maintenance and renovation. The tailored stoves allow users to cook and repair their stoves easily. Women in each setting expressed their desire for a new stove, but they articulated distinct specific alterations that would meet their needs and preferences. Improved cookstove designs need to consider the diversity of values and needs held by potential users, presenting a significant challenge in identifying a “one size fits all” improved cookstove design. Our data show that a single stove design for use with locally available biomass fuels will not meet the cooking demands and resources available across the three sites. Moreover, locally produced or adapted improved cookstoves may be needed to meet the cooking needs of diverse populations while addressing health and environmental concerns of traditional stoves.

6. Pollard S.L., Williams D.L., Breysse P.N., Baron P.A., Grajeda L.M., Gilman R.H., Miranda J.J., Checkley W. *A cross-sectional study of determinants of indoor environmental exposures in households with and without chronic exposure to biomass fuel smoke.* Environmental Health. 2014 Mar 24;13(1):21. doi: 10.1186/1476-069X-13-21

http://www.hopkinsglobalhealth.org/news-events/publications/a-cross-sectional-study-of-determinants-of-indoor-environmental-exposures-/

Abstract

BACKGROUND: Burning biomass fuels indoors for cooking is associated with high concentrations of particulate matter (PM) and carbon monoxide (CO). More efficient biomass-burning stoves and chimneys for ventilation have been proposed as solutions to reduce indoor pollution. We sought to quantify indoor PM and CO exposures in urban and rural households and determine factors associated with higher exposures. A secondary objective was to identify chronic vs. acute changes in cardiopulmonary biomarkers associated with exposure to biomass smoke.

METHODS: We conducted a census survey followed by a cross-sectional study of indoor environmental exposures and cardiopulmonary biomarkers in the main household cook in Puno, Peru. We measured 24-hour indoor PM and CO concentrations in 86 households. We also measured PM2.5 and PM10 concentrations gravimetrically for 24 hours in urban households and during cook times in rural households, and generated a calibration equation using PM2.5 measurements.

RESULTS: In a census of 4903 households, 93% vs. 16% of rural vs. urban households used an open-fire stove; 22% of rural households had a homemade chimney; and <3% of rural households participated in a national program encouraging installation of a chimney. Median 24-hour indoor PM2.5 and CO concentrations were 130 vs. 22 µg/m3 and 5.8 vs. 0.4 ppm (all p<0.001) in rural vs. urban households. Having a chimney did not significantly reduce median concentrations in 24-hour indoor PM2.5 (119 vs. 137 µg/m3; p=0.40) or CO (4.6 vs. 7.2 ppm; p=0.23) among rural households with and without chimneys. Having a chimney did not significantly reduce median cook-time PM2.5 (360 vs. 298 µg/m3, p=0.45) or cook-time CO concentrations (15.2 vs. 9.4 ppm, p=0.23). Having a thatched roof (p=0.007) and hours spent cooking (p=0.02) were associated with higher 24-hour average PM concentrations. Rural participants had higher median exhaled CO (10 vs. 6 ppm; p=0.01) and exhaled carboxyhemoglobin (1.6% vs. 1.0%; p=0.04) than urban participants.

CONCLUSIONS: Indoor air concentrations associated with biomass smoke were six-fold greater in rural vs. urban households. Having a homemade chimney did not reduce environmental exposures significantly. Measures of exhaled CO provide useful cardiopulmonary biomarkers for chronic exposure to biomass smoke.

7. Miranda J.J., Bernabe-Ortíz A., Smeeth L., Gilman R.H., Checkley W. *Addressing geographical variation in the progression of non-communicable diseases in Peru: the CRONICAS cohort study protocol*. *BMJ Open* 2012;**2**:e000610 doi:10.1136/bmjopen-2011-000610

http://bmjopen.bmj.com/content/2/1/e000610.full

Abstract

Background The rise in non-communicable diseases in developing countries has gained increased attention. Given that around 80% of deaths related to non-communicable diseases occur in low- and middle-income countries, there is a need for local knowledge to address such problems. Longitudinal studies can provide valuable information about disease burden of non-communicable diseases in Latin America to inform both public health and clinical settings.

Methods The CRONICAS cohort is a longitudinal study performed in three Peruvian settings that differ by degree of urbanization, level of outdoor and indoor pollution and altitude. The author sought to enroll an age- and sex-stratified random sample of 1000 participants at each site. Study procedures include questionnaires on socio-demographics and well-known risk factors for cardiopulmonary disease, blood draw, anthropometry and body composition, blood pressure and spirometry before and after bronchodilators. All participants will be visited at baseline, at 20 and 40 months. A random sample of 100 households at each site will be assessed for 24 h particulate matter concentration. Primary outcomes include prevalence of risk factors for cardiopulmonary diseases, changes in blood pressure and blood glucose over time and decline in lung function.

Discussion There is an urgent need to characterize the prevalence and burden of non-communicable diseases in low- and middle-income countries. Peru is a middle-income country currently undergoing a rapid epidemiological transition. This longitudinal study will provide valuable information on cardiopulmonary outcomes in three different settings and will provide a platform to address potential interventions that are locally relevant or applicable to other similar settings in Latin America.

8. Klasen E., Miranda J.J., Khatry .S, Menya D., Gilman R.H., Tielsch J.M., Kennedy C., Dreibelbis R., Naithani N., Kimaiyo S., Chiang M., Carter E.J., Sherman C.B., Breysse P.N., Checkley W. *Feasibility intervention trial of two types of improved cookstoves in three resource-limited settings: study protocol for a randomized controlled trial.* Trials. 2013 Oct 10;14:327. doi: 10.1186/1745-6215-14-327

http://www.ncbi.nlm.nih.gov/pubmed/24112419

Abstract

BACKGROUND: Exposure to biomass fuel smoke is one of the leading risk factors for disease burden worldwide. International campaigns are currently promoting the widespread adoption of improved cookstoves in resource-limited settings, yet little is known about the cultural and social barriers to successful improved cookstove adoption and how these barriers affect environmental exposures and health outcomes.

DESIGN: We plan to conduct a one-year crossover, feasibility intervention trial in three resource-limited settings (Kenya, Nepal and Peru). We will enroll 40 to 46 female primary cooks aged 20 to 49 years in each site (total 120 to 138).

METHODS: At baseline, we will collect information on socio demographic characteristics and cooking practices, and measure respiratory health and blood pressure for all participating women. An initial observational period of four months while households use their traditional, open-fire design cookstoves will take place prior to randomization. All participants will then be randomized to receive one of two types of improved, ventilated cookstoves with a chimney: a commercially-constructed cookstove (Envirofit G3300/G3355) or a locally-constructed cookstove. After four months of observation, participants will crossover and receive the other improved cookstove design and be followed for another four months. During each of the three four-month study periods, we will collect monthly information on self-reported respiratory symptoms, cooking practices, compliance with cookstove use (intervention periods only), and measure peak expiratory flow, forced expiratory volume at 1 second, exhaled carbon monoxide and blood pressure. We will also measure pulmonary function testing in the women participants and 24-hour kitchen particulate matter and carbon monoxide levels at least once per period.

DISCUSSION: Findings from this study will help us better understand the behavioral, biological, and environmental changes that occur with a cookstove intervention. If this trial indicates that reducing indoor air pollution is feasible and effective in resource-limited settings like Peru, Kenya and Nepal, trials and programs to modify the open burning of biomass fuels by installation of low-cost ventilated cookstoves could significantly reduce the burden of illness and death worldwide.

9. Lopez M., Mongilardi N., Checkley W. *Enfermedad pulmonar obstructiva crónica por exposición al humo de biomasa.* Rev Peru Med Exp Salud Publica. 2014;31(1):94-9.

http://www.scielo.org.pe/scielo.php?pid=S1726-46342014000100014&script=sci_arttext

RESUMEN

En este artículo se discute la relación existente entre la enfermedad pulmonar obstructiva crónica (EPOC) y el humo de biomasa. Más de la mitad de la población utiliza biomasa como combustible principal, sobre todo en áreas rurales y en países en vías de desarrollo donde su uso llega hasta el 80%. La inhalación del humo de biomasa crea un estado inflamatorio crónico, que se acompaña de una activación de metaloproteinasas y una reducción de la movilidad mucociliar. Esto podría explicar la gran asociación existente entre la exposición a biomasa y EPOC, revelada por estudios observacionales y epidemiológicos provenientes de países en vías de desarrollo y de países desarrollados. En esta revisión exploramos también las diferencias entre la EPOC causada por tabaco y por biomasa, y encontramos que, a pesar de las diferencias fisiopatológicas, la mayoría de las características clínicas, calidad de vida y mortalidad fueron parecidas. En los últimos diez años se han realizado intervenciones para disminuir la exposición a biomasa mediante el uso de cocinas mejoradas y combustibles limpios, sin embargo, estas estrategias todavía no han sido exitosas debido a su incapacidad para reducir los niveles de contaminación a niveles recomendados por la Organización Mundial de la Salud, y por su falta de uso. Por lo tanto, hay una necesidad urgente de ensayos de campo aleatorios, cuidadosamente realizados, para determinar la verdadera gama de reducciones de contaminación potencialmente alcanzables, la probabilidad de su uso y los beneficios a largo plazo en la reducción de la gran carga mundial de EPOC.

Abstract

In this article, the relationship between chronic obstructive pulmonary disease (COPD) and biomass smoke will be discussed. More than half of the world population uses biomass for fuel, especially in rural areas and in developing countries where usage reaches 80%. Biomass smoke inhalation creates an inflammatory chronic state, which is accompanied by metalloproteinases activation and mucociliary mobility reduction. This could explain the existing association between biomass exposure and COPD, revealed by observational and epidemiological studies from developing and developed countries. In this review, the differences between COPD caused by tobacco and biomass were explored. It was found that despite the pathophysiological differences, most of the clinical characteristics, quality of life and mortality were similar. In the last ten years there have been interventions to reduce the biomass smoke exposure by using improved stoves and cleaner fuels. However, these strategies have not yet been successful due to inability to reduce contamination levels to those recommended by the World Health Organization as well as due to the lack of use. Therefore, there is an urgent need for carefully conducted, randomized field trials to determine the actual range of potentially reachable contamination reductions, the probability of use and the long term benefits of reducing the global burden of COPD.

10. Burroughs Peña M., Romero K.M., Velazquez E.J., Davila-Roman V.G., Gilman R.H., Wise R.A., Miranda J.J., Checkley W . *Relationship between Daily Exposure to Biomass Fuel Smoke and Blood Pressure in High-Altitude Peru.* Hypertension, Mar 2015.

http://www.unboundmedicine.com/medline/citation/25753976/Relationship_Between_Daily_Exposure_to_Biomass_Fuel_Smoke_and_Blood_Pressure_in_High_Altitude_Peru_

Abstract

Household air pollution from biomass fuel use affects 3 billion people worldwide; however, few studies have examined the relationship between biomass fuel use and blood pressure. We sought to determine if daily biomass fuel use was associated with elevated blood pressure in high altitude Peru and if this relationship was affected by lung function. We analyzed baseline information from a population-based cohort study of adults aged ≥35 years in Puno, Peru. Daily biomass fuel use was self-reported. We used multivariable regression models to examine the relationship between daily exposure to biomass fuel smoke and blood pressure outcomes. Interactions with sex and quartiles of forced vital capacity were conducted to evaluate for effect modification. Data from 1004 individuals (mean age, 55.3 years; 51.7% women) were included.

We found an association between biomass fuel use with both prehypertension (adjusted relative risk ratio, 5.0; 95% confidence interval, 2.6–9.9) and hypertension (adjusted relative risk ratio, 3.5; 95% confidence interval, 1.7–7.0). Biomass fuel users had a higher systolic blood pressure (7.0 mm Hg; 95% confidence interval, 4.4–9.6) and a higher diastolic blood pressure (5.9 mm Hg; 95% confidence interval, 4.2–7.6) when compared with nonusers. We did not find interaction effects between daily biomass fuel use and sex or percent predicted forced vital capacity for either systolic blood pressure or diastolic blood pressure. Biomass fuel use was associated with a higher likelihood of having hypertension and

higher blood pressure in Peru. Reducing exposure to household air pollution from biomass fuel use represents an opportunity for cardiovascular prevention.

11. Jaganath D., Miranda J.J., Gilman R.H., Wise R.A., Diette G.B., Miele C.M., Bernabe-Ortiz A., Checkley W. Prevalence of chronic obstructive pulmonary disease and variation in risk factors across four geographically diverse resource-limited settings in Peru. 015 Jaganath *et al.*; licensee BioMed Central.

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Abstract

Background It is unclear how geographic and social diversity affects the prevalence of chronic obstructive pulmonary disease (COPD). We sought to characterize the prevalence of COPD and identify risk factors across four settings in Peru with varying degrees of urbanization, altitude, and biomass fuel use.

Methods We collected sociodemographics, clinical history, and post-bronchodilator spirometry in a randomly selected, age-, sex- and site-stratified, population-based sample of 2,957 adults aged ≥35 years (median age was 54.8 years and 49.3% were men) from four resource-poor settings: Lima, Tumbes, urban and rural Puno. We defined COPD as a post-bronchodilator FEV1/FVC < 70%.

Results Overall prevalence of COPD was 6.0% (95% CI 5.1%–6.8%) but with marked variation across sites: 3.6% in semi-urban Tumbes, 6.1% in urban Puno, 6.2% in Lima, and 9.9% in rural Puno ($p < 0.001$). Population attributable risks (PARs) of COPD due to smoking ≥10 pack-years were less than 10% for all sites, consistent with a low prevalence of daily smoking (3.3%). Rather, we found that PARs of COPD varied by setting. In Lima, for example, the highest PARs were attributed to post-treatment tuberculosis (16% and 22% for men and women, respectively). In rural Puno, daily biomass fuel for cooking among women was associated with COPD (prevalence ratio 2.22, 95% CI 1.02–4.81) and the PAR of COPD due to daily exposure to biomass fuel smoke was 55%.

Conclusions The burden of COPD in Peru was not uniform and, unlike other settings, was not predominantly explained by tobacco smoking. This study emphasizes the role of biomass fuel use, and highlights pulmonary tuberculosis as an often neglected risk factor in endemic areas.