



The use of artisanal popping machines in Andean countries causes lead contamination of expanded grain products

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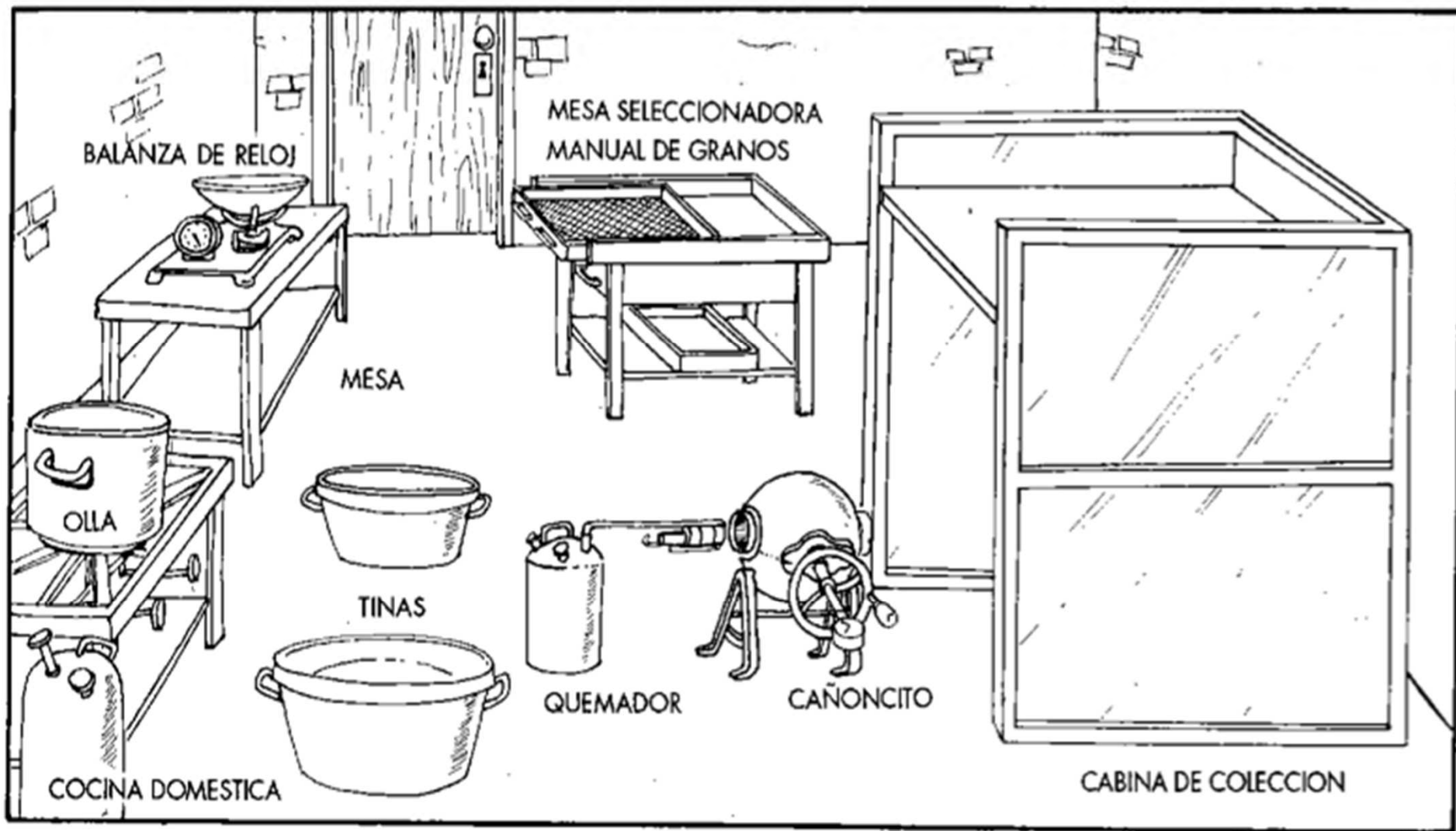
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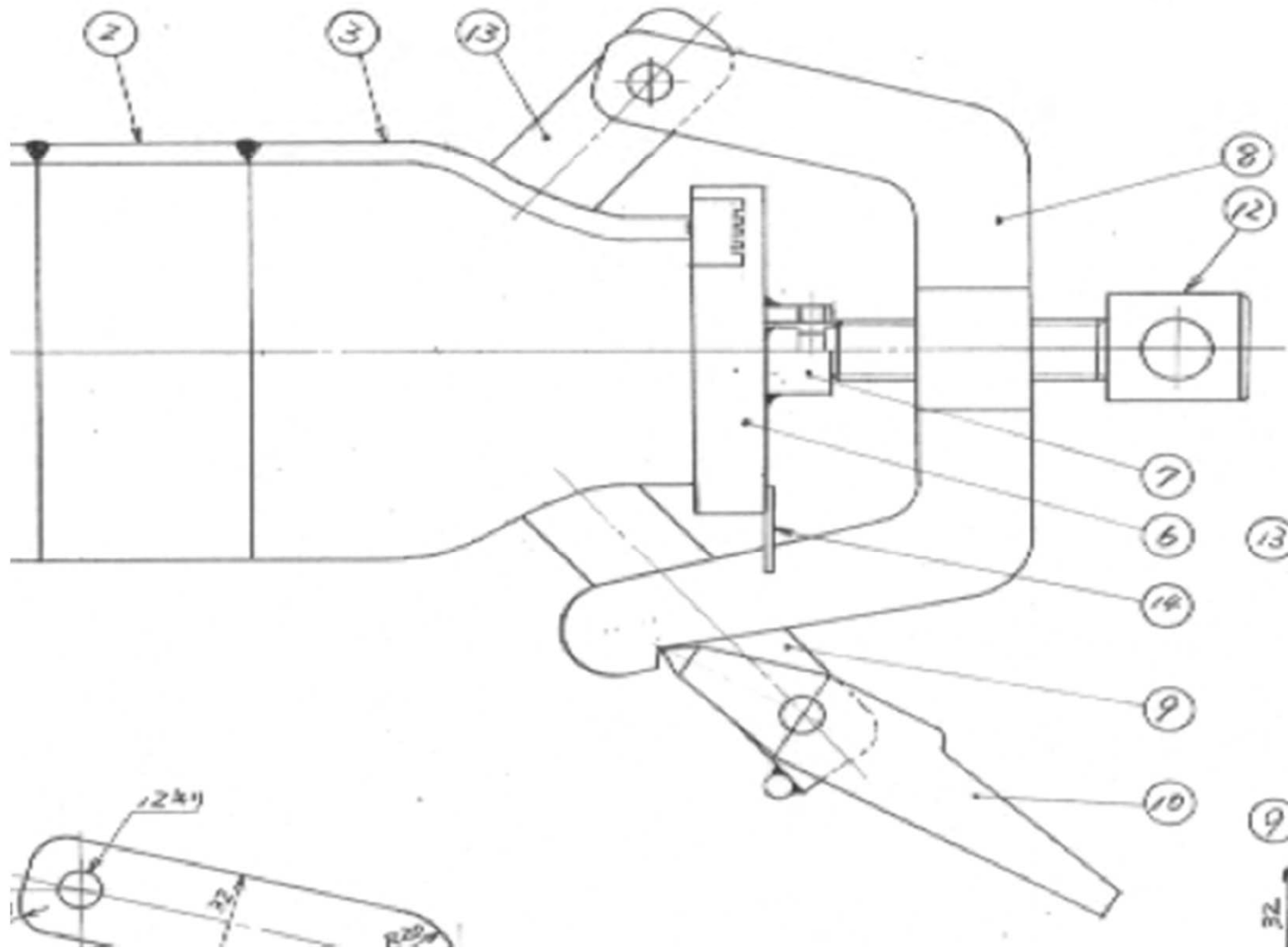
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CATALOGO DE FUNCIONAMIENTO DEL **CAÑÓN EXPANSOR**

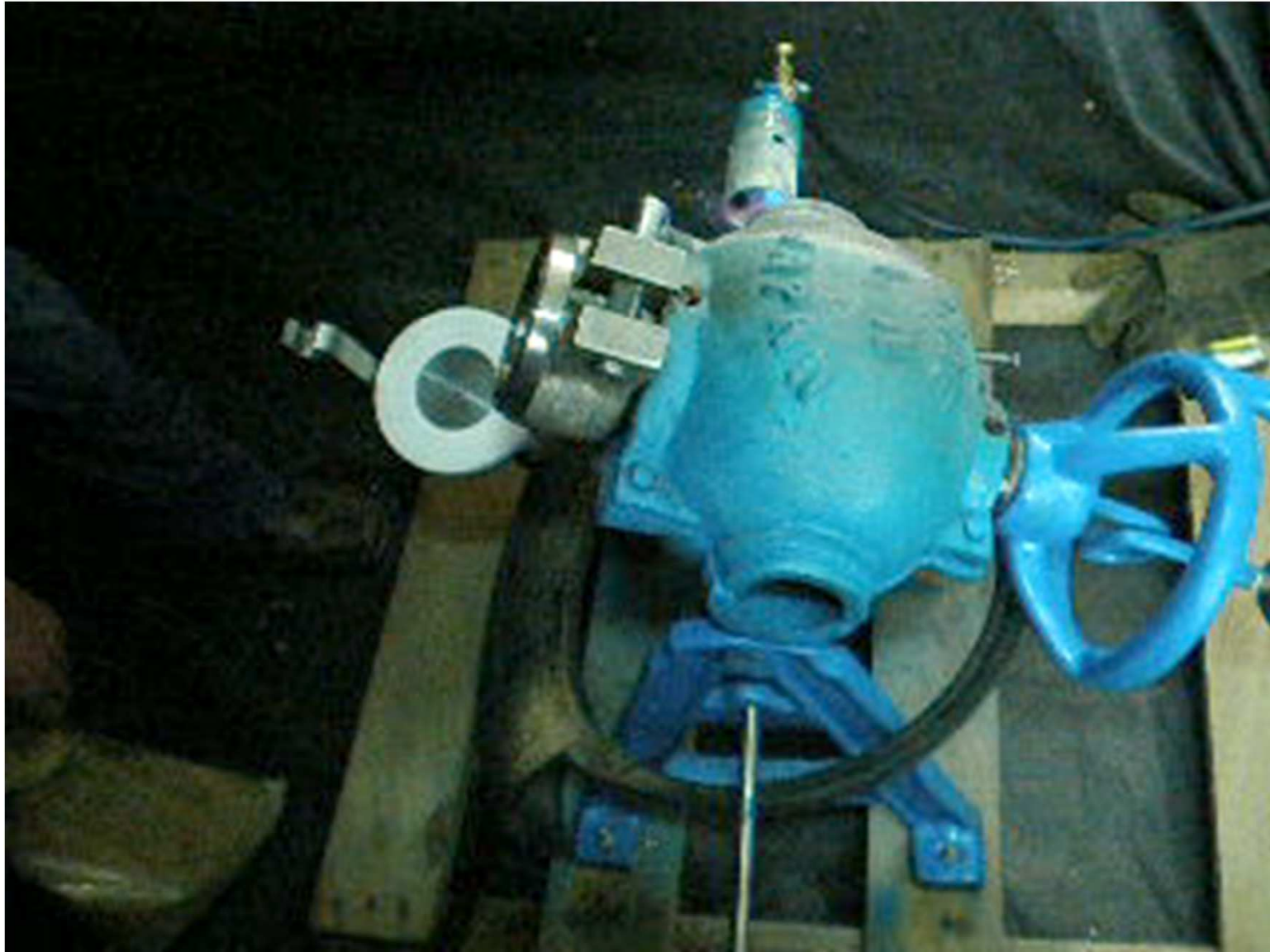




American Cereal's popular confection booth at the St. Louis World's Fair, 1904 (Anderson stands at far right)



Loading grain





Tightly closing machine



Heating over gas flame





Explosive release of popped grain





Conventional, wide-spread design of “cannon”





Improved design with teflon fitting





Materials - Sampling

Type of samples	Origin	Quinoa	Maize	Rice	Wheat
Raw grains	Empresa El Altiplano SAC, Juliaca (San Román)	4	-	-	-
	Mercado Manco Capac, Juliaca (San Román)	-	2	2	2
Popped grains elaborated with an artisanal batch expander	Empresa El Altiplano SAC, Juliaca (San Román)	1	-	-	-
	Empresa INCA SUR, Cusco (Cusco)	2	-	-	-
	Empresa TIC-PAC, Puno (Puno)	1	-	-	-
	Mercado local de Huancané (Huancané)	1	1	1	1
	Mercado local de Ilave (El Collao)	1	1	1	1
	Mercado local de Juliaca (San Román)	-	1	1	1
	Mercado local de Melgar (Melgar)	1	1	1	1
	Mercado local de Puno (Puno)	-	1	1	1
	Mercado local de Yunguyo (Yunguyo)	1	1	1	1
Popped grains elaborated with a redesigned prototype	Empresa El Altiplano SAC, Juliaca (San Román)	4	2	2	2

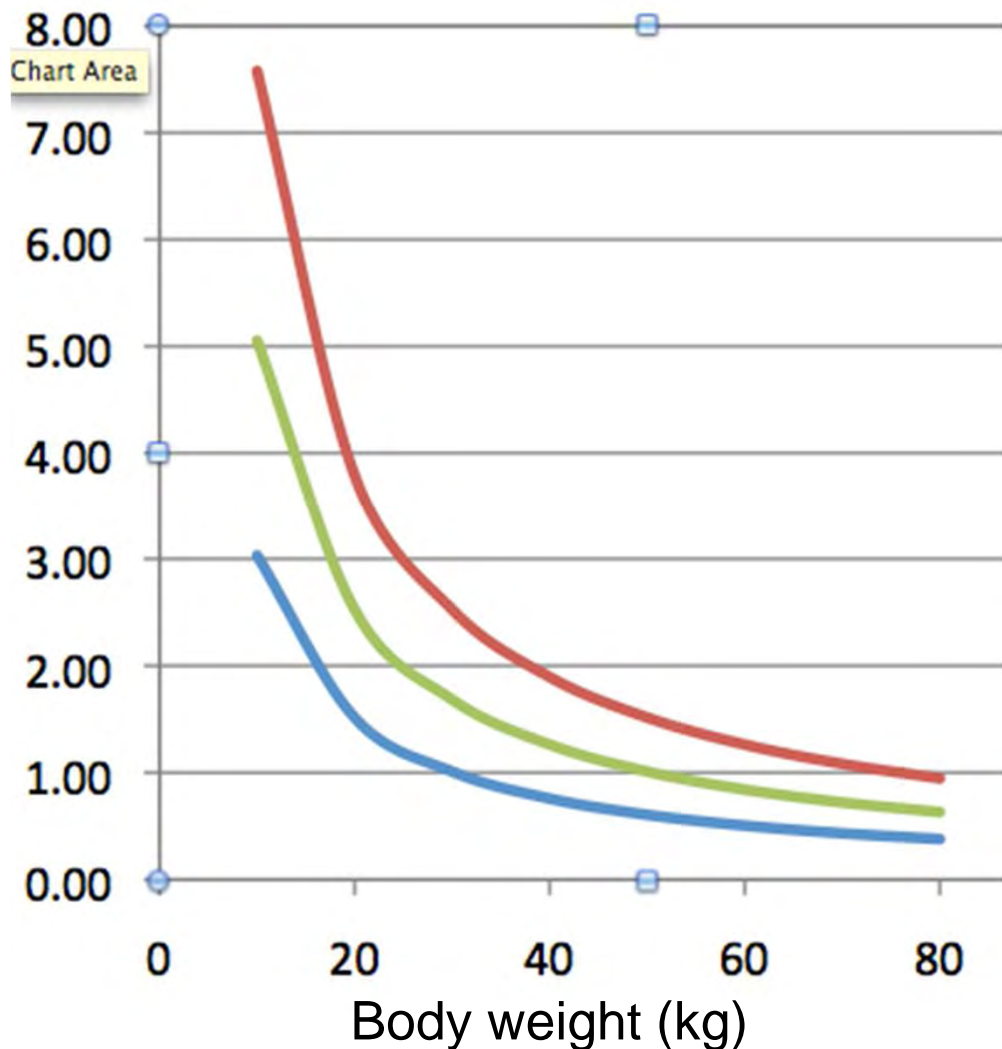


Lead content in raw and popped grain (mg/kg)

Type of samples	Origin	Quinoa	Maize	Rice	Wheat
Raw grains	Empresa El Altiplano SAC, Juliaca (San Román)	< 0.1			
		< 0.1			
		< 0.1*			
		< 0.1*			
Raw grains	Mercado Manco Capac, Juliaca (San Román)	-	< 0.1	< 0.1	< 0.1
		-	< 0.1	< 0.1	< 0.1
Popped grains elaborated with an artisanal batch type expander	Empresa El Altiplano SAC, Juliaca (San Román)	0.41	-	-	-
	Empresa INCA SUR, Cusco (Cusco)	0.31	-	-	-
		0.85	-	-	-
	Empresa TIC-PAC, Puno (Puno)	4.4	-	-	-
	Mercado local de Huancané (Huancané)	4.9	6.3	3.9	4.5
	Mercado local de Ilave (El Collao)	4.6	4.5	4.5	4.6
	Mercado local de Juliaca (San Román)	-	1.3	1.0	2.3
	Mercado local de Melgar (Melgar)	< 0.1	3.2	2.9	1.1
	Mercado local de Puno (Puno)	-	1.7	7.3	1.1
	Mercado local de Yunguyo (Yunguyo)	5.4	1.4	7.5	3.3
Popped grains elaborated with a redesigned prototype	Empresa El Altiplano SAC, Juliaca (San Román)	< 0.1	0.82	< 0.1	< 0.1
		0.2	0.14	< 0.1	0.35
		< 0.1*	-	-	-
		< 0.1*	-	-	-



Hypothetical lead intake expressed as multiples of Provisional Tolerated Weekly Intake (PTWI) as a function of body weight



Assumptions

- Average monthly consumption of popped grain: 1000g per capita
- Lead content in popped grain 3.3 ppm (mean found in this study)

PTWI (mg/kg body weight):

=0.010 (FAO-WHO 2010)

=0.015 (Peru)

=0.025 (FAO-WHO 2001)



Conclusions

- Consumption of popped grains from informally operated cottage industries in Andean countries leads to lead intake far exceeding accepted limits
- Children are at particular risk
- Unawareness of processors and regulatory bodies
- Small isn't always beautiful!



Policy implications

- Need for regulators to pay greater attention to food safety issues in informal sector
- Need to enhance awareness of consumers, producers and extension agents
- More emphasis in food technology research on low-cost and safe processing technology



Thank you
for your attention