





IMPROVING STRATEGIES FOR A SUSTAINABLE MANAGEMENT OF KITCHEN FIRES

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From the data provided by the World Health Organization (WHO) half of the world's population, especially in developing countries, cooks burning wood and charcoal in poor condition. It then generates toxic emissions that, in presence of poor air exchange, was estimated to kill every year on average 1.9 million women and children. From analytical measurements of polluting gases (CO-SO2) and coarse particulate matter (PM10) and fine (PM2.5) carried out in the African and Indian houses has in fact revealed the poor quality air of breathed in addition to the problem of environmental pollution. In some cases the contaminant levels are higher by two orders of magnitude with the limits laid down by European standards. The kitchen, living room frequented on average for at least two hours / meal especially by women and children, surely represents the most contaminated environment, exposing humans to higher risks of respiratory diseases as well as skin diseases and cataracts, making the air unbreathable as confirmed by a number of operators during the periodic visits in the area. From some surveys carried out in an environment with the presence of the improved fire (closed fire) not only efficiency appears to be improved (less wood consumed) but also in the particulate and carbon monoxide emissions, greatly reduced compared to the classic African fire, organized between three stones (open fire). Pending further analytical confirmations is possible to envisage some improvements in order to achieve more efficient burners, less polluting (environment) and dangerous (man) in order to contain the problem of deforestation.







Risky situation: not aerated

Three Stones African Fire (open)



Open air fire with no roof

Figure 1. African Fire

Given the numerous disadvantages mentioned above we recommend a complete replacement with improved fire. During the transitional period (transition from open fire to improved) two possible temporary strategies can be created.

Strategy 1 (less advised)

- maintaining the not improved fire in the houses, taking care to ventilate the room by opening windows and doors as much as possible (fig.1A)
- it is advisable to keep children away from the contaminated environment, especially in the most critical moments for emissions (during the lighting of fires and cooking food)

Strategy 2 (advised)

• Place the not improved fire outside the home, under a roof, protected from the weather. This will be the area where you cook the food (Fig.1B)



Improved indian fire (closed)



Hut made of flammable material



Compartment with non-flammable walls but no outlets to the outside to ventilate

Figure 2. Improved fire

Place the fires inside the cooking compartment to replace the traditional ones. Emissions even if below the traditional fire are still produced. For this reason it is recommended to keep the kitchen physically separated from the sleeping area and in an environment equipped with walls made of non-flammable material (Fig.2). To improve combustion efficiency by reducing consumption and emissions it's possible to build structures more and more similar to rudimentary stoves (Strategy 2)

Strategy 1: Application of cooker hoods in natural flow

Arrange over the fire a metal hood, closed on three sides and with a chimney ending outside, in order to remove by suction the almost totality of the fumes. The hood can be realized through the metal sheets, also used for the manufacture of silos (FAO model) for the conservation of grains (Fig.3). The hood will end with a fireplace (1-1.5 m hose with "roof") for the removal of fumes (Fig.3D).









Figure 3.-assembly of the laminae (A) necessary for the realization of the hood (B-C) and the chimney for the discharge of fumes (D)

The adoption of this kind of burners it is recommended only for the homes built with bricks and / or inert materials (clay, mud, silt, bricks) in order to exploit at least one wall for closing the burner, thus preventing possible domestic blazes.

Strategy 2: rudimentary stoves

The rudimentary fire can be greatly improved, with substantial amendments that make it similar to a home heater, with the additional advantage of being able to heat the surrounding environment as a result of a certain degree of irradiation. Therefore we recommend the following changes:



• closing the fireplace along all the walls with inert material (bricks, clay), leaving open the inlet areas (one / two) necessary for the fuel supply (Figure 4A), those for flame emission (Fig.4B) on which it will be placed the cookware and basal holes (1/2) for the air inlet (Fig.4E)



Figure 4. Prototypes of home-made stove on improved fire







PRODUCTION OF APPROPRIATE FOOD: sufficient, safe, sustainable • connect the distal end of the structure to a metal pipe (chimney) to convey the fumes outside the inhabited area (Fig.4C-D). The tube, by keeping at a certain distance from the outer wall, should be provided in part of a metal cone terminal (canopy) necessary for the protection from wind and rain (Fig.3D)



Figure 5. Prototype of home-made stove on fire improved

The structure, as shown in Figures 4 and 5 made over the fire improved, could be expanded in length to the advantage of:

- a greater surface area to be used for cooking / grilling / drying of the foods and / or products without a direct contact with the fire
- placement of a greater number of dishes and pans decreasing in dimensions from the combustion zone, by exploiting the flame residues other than the heat of exhaust smoke
- greater combustion efficiency (closed structure and potentially ventilated)
- lower emissions of harmful components
- a reduced consumption of wood (long term)







PRODUCTION OF APPROPRIATE FOOD: sufficient, safe, sustainable General considerations for improving the efficiency of household fires

during critical phases of fire management (power and cooking) try to ventilate the room, especially if you feel the presence of smoke (open windows and doors) (Figure 5). It 'still advised to ventilate the kitchen environment at least twice a day



Figure 5. sufficiently ventilated environment for the presence of windows and lights between the walls and the ceiling

- reduce cooking times through some common home practices (eg. Put beans to soak for a few hours before cooking, use a quantity of water strictly necessary for cooking food)
- use for combustion only really dry material, preferring the timber where possible the following materials or devices for reduced or zero levels of smokiness
 - \circ or coal
 - \circ or biogas
- if you can raise the height of the structure (eye level) using bricks (clay, silt, mud, lime), making cooking operations and reducing the exposure of operators and bystanders (Figure 6)
- the rudimentary stove must always be characterized by basal slits (1/2) to maintain efficient combustion (Fig.6)









Figure 6. housewives stoves equipped at the base of small holes