ADEQUACY OF SOLAR ENERGY TO KEEP BABIES WARM

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Objective: *Solar energy could be used as an alternate energy source for keeping neonates warm especially in tropical countries. The present study investigated the efficacy of solar powered room heating system.* ***Setting****: Referral center for neonatal care.* ***Intervention:*** *A fluid system heated by solar panels and circulated into a room was used to maintain room temperature. A servo-controlled heating device was used to regulate and maintain desired room temperature.* ***Main outcome measures:*** *Neonatal rectal temperature and room temperature.* ***Result:*** *Infants between 1750-2250 g were observed to require a mean room temperature of 32.5°* C to *maintain normothermia. In 85 infants less than 1500 g, of the 5050 infant temperature records, only 3% showed a record less than 36°C.* ***Conclusions:*** *Solar powered room heating is effective in maintaining infant temperature and is cost-effective as compared to the existing warming devices.*

Key words: *Solar energy, Temperature, Neonate, Hypothermia.*

ADEQUATE temperature control is an important component of modern neonatal care. Provision of optimal warmth leads to improved neonatal survival(l,2). We have been using graded warm rooms to provide thermal needs of babies of different weights and gestational ages(3). These rooms were heated by electrical room heaters. Conservation of electrical energy is important in developing countries like India since demand often exceeds supply. Therefore, the use of alternate energy source is of particular importance. Abundant and perennial sunlight in a tropical country like India is an obvious alternative for this purpose. Our center started using the solar energy-heated incubator room since June 1990. The present communication shares our experience in maintaining warmth in low birth weight infants, especially those less than 1500 g using solar energy.

Material and Methods

Design of Solar Heated Incubator Room

The room was heated by using a system where hot water was circulated through heat exchangers fitted inside the room. The fluid is allowed to flow through the solar plate collectors and the heated fluid is pumped into an insulated storage tank. The surface area of the solar collectors was determined based on heat load calculations. The energy delivery loop pumps the heated fluid in the storage tank through a forced heat exchanger of a radiant panel situated in the incubator room. The system has a differential temperature control mechanism wherein one sensor measures temperature at the outlet of the solar collectors and the other at the bottom of the storage tank. An electronic circuit compares the two temperatures and logic circuits provide appropriate signal to the circulating pump. A thermocouple placed inside the room determines the need for extra heat to maintain the incubator room temperature. A fall in the room temperature below the set point activates the pump which delivers heated fluid to the exchanger. The pump is in operation till the set temperature is reached. If sufficient solar energy has not been collected, a separate sensor activates the auxiliary heater which works till solar heated water reaches the desired temperature needed to warm the room to the set temperature. A digital electronic and multipoint temperature indicator in the incubator room helps monitoring the room temperature *(Fig. 1).*

Rectal temperatures (after normalisation if they were low on admission), in babies less than 1500 g at birth, were categorized into less than 36°, 36°-36.5° and more than 36.5°C. Temperature was recorded every 2 hr; only the first week temperatures were included in this study.

Results

Eighty five babies weighing less than 1500 g at birth were managed in the solar incubator room. At any given time, there were 3-4 babies in the room. Out of 5050 rectal temperature readings, 4383 (86.8%) Were more than 36.5°C, 515 (10.2%) between 36 and 36.5°C and 152 (3%) were less than 36" C ($p < 0.0001$).

Discussion

As an initial step, two hr record of room temperature was obtained at set points of 32°, 33° and 34°C to verify the precision to which the room temperature could be maintained using the solar heaters. The room temperature was always close to the set point. Subsequently, babies between 35 and 37 weeks of gestation, weighing between 1.75 and 2.25 kg were cared for in the solar room. These neonates did not have respiratory distress and did not require supplemental oxygen. Room temperature of 32.5°C was necessary to maintain rectal temperature between 36.5-37.2°C. Gradually, smaller and smaller babies with increasing number of risk factors were managed successfully in the solar room. For babies between 1000-1250 g with respiratory distress and requiring oxygen, 33.5°-34°C of environmental temperature was needed to maintain normal rectal temperature. The babies were covered by single layered cotton wrapper and heads were uncovered.

During the three years in use, the system has functioned without any significant breakdown and has been capable of maintaining rectal temperature above 36.5°C in a significantly large proportions of babies. The initial cost of the system was Rs. 1,75,000 with minimal maintenance

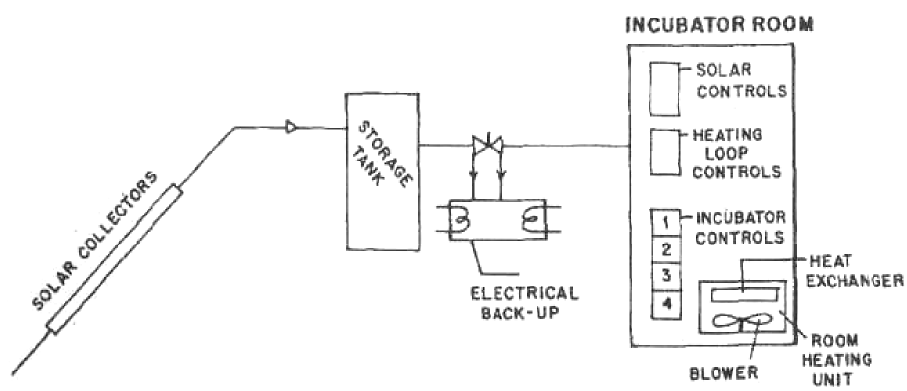

Fig. 1. Schematic diagram of the solar incubator room.

expenditure. In contrast, one servo-controlled incubator costs a similar amount, has a higher maintenance cost and can care for one baby at a time only. Thus, solar powered room heating is an efficient, cost-effective system that can be recommended for use especially in the tropics.

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