Water fetching aid for rural women

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Current Scenario

- No direct water supply at homes.
- Most households have women fetch water daily.
- Neighbouring women go together in a group
- A woman brings approximately 50 litres of potable water for a family.
- For this, she must make 3-4 trips to the well/tap.
- Often she has a baby that she must carry along with her.

- Per trip: 20 litres of water.
- Weight of this water: 20 Kg.
- Total distance walked: 10 Km.
NEED

- Socio-economic problems
- Heavy weight
- Physiological problems
- Neck pain, poor muscular strength
- Problems from young age
- Safety issues
- Lack of time
- Loss of valuable time for education
Design Objective

To reduce the effort and minimize the difficulties associated with fetching water by rural women.
Secondary Research

Modes of carrying water filled matkas

Fig 1: Head mode
Fig 2: Hip mode
Fig 3: Head and hip
Fig 4: Hand and hip
Fig 5: Shoulder mode
Parallel product study

**Fig 6: Q drum**
- Volume: 50-80 litres
- Cost: Rs. 4500/-
- Can be rolled on flat ground

**Fig 7: Wello Water wheel**
- Volume: 20 litres
- Cost: Rs.1500/-
- Carried on the back or slung on the side

**Fig 8: H₂O water packs**
- Load carried 3 ways for ease
- Caster wheels for trolley like function
- Bamboo frame

**Fig 9: Load carrier for labour**
- Rigid structure, difficult to move head
- Adjustments to change orientations
- Caster wheels would not work in rough terrain

**Problems**
- Drinking water rolled on ground
- Rough terrain
- Up-slope
- Cleaning
- Very large load only for back
- Difficult to fill, clean
- Rigid structure, difficult to move head
- Adjustments to change orientations
- Caster wheels would not work in rough terrain
Learnings from secondary research

- Should be applicable on different terrains
- Should suit different houses
- The whole process from home to the well and back has to be considered
- Minimum quantity of water that the product allows to carry must be 18 litres.
- It must be cost effective
- It has to be acceptable to the users
Field Study

Village: Dengachimat, Jawhar
Primary occupation: Subsistence farming, temporary labour work

Primary users:
Women, age group - 30 to 45
Family of 5-6.
Occupation: Farming, labourers
No. of trips made: 3-4
Total time: 40 mins - 1 hour
Discomfort or pain: temporary sore-ness in the back and neck.
They say they are used to it, so don't mind.
Terrain

- Slope: 15° - 20°
- Rough terrain
- Stones, bushes
- Narrow path to walk on
Activity analysis
Inferences from field study

- Volume of water for a family of 5: 45 litres
- No. of trips made per day: 3-4 (for a family of 5)
- Terrain: Rough, narrow with stones and bushes

About Process:
- They carry an additional sieve and jerrycan attached to a rope.
- Loading of water is the toughest task.
- Keeping the matkas on the well wall first since lifting up the filled matkas is most difficult.
- Unloading of water is done with help from family members
- Usage of water at home must be considered.
Physiological problems:
- Pain
- Balance and position the matkas – restriction in movement
- Strain in neck muscles while walking with the water.
- Pregnant women carry large quantities of water throughout the pregnancy.
- Durability
- Cost
Design Brief

To design an aid for rural women, to increase efficiency of fetching water

1. Should allow to carry 45 litres of water in 2-3 trips
2. Should reduce the effort required to fetch equal amount of water.
3. Should be carried ergonomically by one woman
4. Should allow easy loading and unloading of water
5. Should store water in a hygienic manner
6. Should minimize wastage of water on commute
7. Should be usable over different terrains of different villages.
8. Should allow easy pouring/transfer of water.
9. Easy to clean and maintain
Mind Map

Carrying water

Modes of carrying
- Head mode
- Hand
- Head + Hip
- Hip mode
- Hand + Head

Container
- Existing container
- Plastic
- Fabric
- Storage
- Expand/Collapse
- Soft

Analogy
- Cycle
- Trolley
- Brace
- Skates
- Foldable
- Metal
- Haversack

Carrying water
- Shoulder
- Back

General
- Spoke wheel
- Tanks
- Trailer
- Sleigh
- Army Vest
- Bamboo
Ideation: Concept clusters

Individual - Wearable

Fig 1: Vest design for water bags

Fig 2: Hand held

Fig 3: Shoulder brace
Individual - Ground supported

Fig 4: Spring loaded sled

Fig 5: Back load with wheel

Fig 6: Flexi-wheels
Fig 7: Drum on wheels for two people

Fig 7: Big flexi bag, shoulder strapped

Fig 9: Suspended matkas

Fig 10: Drum on trolley
Going back to the field...

**Likes:**
- Volume
- 2 persons

**Dislikes:**
- Wheels will wear off
- Atleast two persons will be needed
- Too heavy
- Added work of transferring water

**Likes:**
- Safety straps
- Looks more comfortable
- Will avoid neck strains
- Something new to use

**Dislikes:**
- Cannot carry a large volume of water like in the drum
Further explorations

- Stackable drums
- Weight testing
- Flexible bag
### Concept evaluation

<table>
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<tr>
<th>Criteria</th>
<th>Priority</th>
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<tr>
<td>Reduction in effort</td>
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<tr>
<td>Ease of loading, unloading</td>
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<tr>
<td>Volume of water per trip</td>
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<td>Ease of use</td>
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<td>Easy transferring</td>
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<td>Ease of cleaning</td>
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<td>Level of acceptance</td>
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<td>Criteria</td>
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<td>Rank</td>
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Testing the weight using a mock-up

- Weight distribution around the trunk of the body
- Engage hands using a scarf or dupatta
Final Concept
Mock up for testing was made of:
- A modified backpack
- 10 litre jerry can
- Two 5 litre jerry cans
- Cotton cloth

Terrain: Narrow path, rough, with stones, pebbles and gets muddy during the monsoons
Activity analysis
Inferences

- The dupatta should be made more hassle free, and secured properly
- A provision to carry the sieve and rope must be available or must be incorporated
- Bigger mouth of the jerry can is necessary for easier pouring of water
- The side containers must be lifted easily in one step
- The bag when put down should be stable.
- Reduction in material
- Container must not wear off soon
Refined concept

The back frame passes through the waist support strap. [So, it does not hurt the body]

- Backpack straps
  - Looped around the frame.
  - All straps are secured by stitching.

- Adjusters
- Buckles
- Side frame
  - For
    - Small side container
      - Used for drawing water from a well too

- Joint
- Frame structure
  - For

Big container
  - (12 litres)
Full frame with support straps

- Frame for big container
- Backpack straps
- Support straps at waist
- Side container frame
Containers

Big container: 12 litres
Tap
Small container: 5 litres
Full render
Prototyping
User evaluation
User Evaluation results

- Loading is easy as the steps are reduced
- Users found it more comfortable for walking up slope.
- Users felt like they could look down, and even turn behind if needed very easily
- Unloading is the back container is slightly problematic as it feels like the container will fall off

- Jerrycan with tap is was considered a good option.
- One metal member touching the body causes pain over time
- Volume of water is good, but they think they can carry more.
- The frame harness size was too big
- Harness may need to be cleaned as the area around the well may be muddy during rainy season.
- The cap of the small jerrycan may get lost.
## Comparative study

<table>
<thead>
<tr>
<th></th>
<th>Existing method</th>
<th>Proposed method</th>
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<tr>
<td><strong>Volume of water</strong></td>
<td>20 litres approx.</td>
<td>20 litres</td>
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<tr>
<td><strong>Terrains</strong></td>
<td>Difficult to use over hilly, rough terrain</td>
<td>Can be used over different terrain</td>
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<tr>
<td><strong>Weight</strong></td>
<td>2 Kg</td>
<td>1.8 Kg</td>
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<tr>
<td><strong>Usability</strong></td>
<td>Loading the matkas onto the head is difficult</td>
<td>Loading, and walking is easy</td>
</tr>
<tr>
<td><strong>Ergonomic considerations</strong></td>
<td>Causes strain on neck muscles</td>
<td>Reduces strain on neck muscles</td>
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<tr>
<td><strong>Maintainability</strong></td>
<td>Repair-work is difficult</td>
<td>Repair-work is easy</td>
</tr>
<tr>
<td><strong>Cleaning</strong></td>
<td>Cleaning the matkas is simple with hand</td>
<td>Cleaning the jerrycans is difficult due to smaller mouth</td>
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</table>
Recommendations

- Removable harness for cleaning
- Funnel like sieve for small mouth
- Slider cap for small jerrycan
System level intervention

- Increase awareness about postural problems
- Campaign about the harmful affects of load carrying for pregnant women
- Install a platform like addition along the wall of the well. This can be done by cementing bricks to the wall of the well.
- It will give the women a platform to keep their things on.
References

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Thank you