

Designing And Development of Multi-Functional Kid's Bed Net to Protect from Various Insects

Agmasie Bantie Kassa, Dr. Chandra Shekar K E

Ethiopian Institute of Textile and Fashion Technology (EiTEX), Bahir Dar University, Bahir Dar, Ethiopia

ABSTRACT

Before the development of insecticide treated kids' bed nets as a new product development, people in many countries were already using adult nets, mainly to protect their kids against biting insects. It was only recently appreciated that a net treated with insecticide offers much greater protection against mosquitoes to keep away from the diseases like malaria, dengue, etc. Not only does the net act as a barrier to prevent mosquitoes biting, but also the insecticide repels, inhibits, or kills any mosquitoes attracted to feed. The main objective of this study is to assess adherence to the use of kids' bed nets in malaria and other insect prevention. The study is about designing and development of appropriate kids' bed net design. This is done by designing appropriate kids' bed net to capture the specific objectives of this research and included both male and female bellows five years age children with papoose product combination. It is a new product which has many salient features such as, Easy to remove and move, easy to find manufacturing facility, will have Appropriate Size and weight, easily accessible manufacturing Materials. The Performance of the bed net should be having average 25.806 Newton force tear strength. The bed net has to carry out a mesh size approximately equal to 25 holes/ cm². This kind of bed nets are very much essential to fulfill the health needs of the mother and child for the developing countries like Ethiopia, Egypt, India, etc. hence the study gives significant information about the health concerns of the child .

Keywords : mosquito net, kid's health, mosquitoes, net and papoose design, kids' bed net and papoose development.

I. INTRODUCTION

1.1. Background

Mosquito bed nets provide protection against mosquitoes, other dangerous insects and thus against the diseases they may carry. (Abdulla S, Schellenberg JA, Nathan R, Mukasa O, Marchant T, Smith T, et al. ,2001). Malaria remains a leading cause of death among children under five years. Old consistent use of bed nets provides low-cost, effective protection against contracting the disease. The use of nets treated with insecticides, as they are significantly more effective in preventing disease, and reducing mosquito population.(Foundation, 2012). Majority of malaria deaths occur among young children(Zuradam, October, 2012).

Reductions in child mortality are associated both with improved coverage of effective interventions to prevent

or treat the most important causes of child mortality in particular essential immunizations, malaria prevention and treatment.(ETHIOPIA Ministry of Health, 2015). Mosquito nets have been in use for protection from mosquitoes and prevention of malaria since centuries. ITNs have both a personal protective effect to the individual user, as well as a community-wide effect because the occupied nets act like baited traps for mosquitoes (Bikila Lencha & Wakgari Deressa, 2015). Insecticide Treated Nets (ITNs) are becoming increasingly available to vulnerable populations at risk of malaria (Gemade E I. and EarlandJ, 2013).

Laboratory and field trials with untreated and treated mosquito nets have shown that treated mosquito nets show better protection as compared to untreated nets. In Africa alone, over 1 million children die from malaria every year(A. Tyagi, May 2010). Bed nets are an efficacious strategy of malaria control in selected areas. Insecticide impregnated bed nets significantly reduce mortality and morbidity.(Nuwaha, 2001)

A bed net is a net that hangs above a sleeping space, usually a bed or matt, and provides a physical barrier between the malaria-carrying mosquito and the person at risk of getting the disease. An insecticide-treated bed net protects the person sleeping under the net even if the net has small holes in it, because the insecticide kills mosquitoes that do get through the net before they reach the sleeping person. Since insecticide-treated nets kill the mosquitoes, they help reduce malaria transmission community-wide. Bed nets have been shown to greatly reduce malaria morbidity and mortality, especially in children under 5 years of age. (WHO, 2001)

There have been great efforts in Africa to estimate the public health impact of malaria control interventions such as insecticide treated nets (ITNs). Little is known, however, on the effectiveness of ITN in areas of Africa that support low transmission.(Noor, 2008)



Figure1: Current Bed net

Polyester does have many advantages over cotton. It is more durable, gives more ventilation and there is less insecticide loss within the fibers. (WHO, 2001)

Bed net length determination

This is direct related with the physical development of kids. Height for normal growing kid's Average length of term born is 50cm. and at one year, they have got 75cm height. From 2years till 12 year height of child /kids are calculated as:

For example 5 year child height is:

$$\text{Height} = (\text{Age in years} * 6) + 77\text{cm}$$

$$\text{Height} = (5*6) + 77\text{cm} = 107\text{cm}$$

$$\text{Height} = 107\text{cm}$$

Most nets are made of polyester but nets are also available in cotton, polyethylene or poly propylene.(Lindblade, 2015).

1.2. Justification

Insecticide treated bed net to ensure that healthy of the kids. It is also important to create awareness in the farmstead peoples. Besides the advantage of the kids to

protect them from disease, it is important to use simply. It is also important to reducing under-five mortality rate; this is a major concern for countries especially the developing countries. The functional and performance features of the materials are enhancing serviceability of the farmstead bed net. It is used to improved child well-being as well as the coverage and success of child survival intervention programmers. This study used to ensure the protection of infants from various insect diseases by developing appropriate kids bed net design for those venerable groups who are affected by insects. Because these venerable groups have low immunity and have not capacity to resist the disease so, we first take care for children and pregnant women's.

Mosquito nets provide protection against mosquitoes, other dangerous insects and thus against the diseases they may carry. (Abdulla S, Schellenberg JA, Nathan R, Mukasa O, Marchant T, Smith T, et al. ,2001)

1.3. Objective

Designing and Development of multi-functional unique kid's Bed Net to protect from various insects. This objective is very important to non-develop country like Ethiopian, Egypt, etc. in order to save the life of the venerable group of the populations. In Ethiopian malaria is the common disease that include under the list of top ten disease of country. Especially children and pregnant women are most vulnerable group of population.

II. METHODS AND MATERIAL

2.1 Materials

Insecticide treated net(polyester),Fabric – cotton and polyester blended (60/40), Zipper- Plastic (non toxic vislon zipper) (ASTM- D2050), Mosquitoes net stand holder , Sewing machine with its accessories, Buckle , Velcro fasteners, and Fastener.

2.2. Methods

The problem of this study was to protect kids from various insects by providing appropriate kid's bed net design with a combination of papoose products. The methods are carried out in two ways. These are material experimental works and product design.

Product design

Table 1: Bed Net design specification

No.	Name	Quantity	Dimension
1	Metal	-	10mm(diameter)
2	Vertical frame	4	60cm
3	Horizontal frame	4	110cm
4	Parabolic frame	2	-
5	Entry & exit	1	80cmx60cm
6	Velcro	2	4cmx4cm
7	Rival	-	10cmx15cm
8	Net (white color)	-	25holes/cm ²

Table 2: Papoose design specification

No.	Name	Quantity	Dimension
1	Main body	3	80cmx110cm
2	Pocket	1	60cmx80cm
3	Kid's head supporter	1	50cmx15cm
4	Shoulder band	2	4cmx60cm
5	Waist band	2	4cmx300cm
6	Back support	2	4cmx30cm
7	Buckle	6	2cmx4.5cm

3.2 Experimental

The ability of mosquito's net fabric and woven fabric to withstand different force is determined by its mechanical properties. These mechanical properties include bursting strength, tear strength; seam strength, abrasion resistance and tensile strength are the main. In this study, mechanical properties such as burst strength, tensile and tear strength are studied on mosquito's net fabric and papoose fabric.

Identification and confirmation of material of construction of mosquito bed net and papoose. The material of construction of the mosquito bed net and papoose was identified by solubility testing methods. For this, one mosquito net sample was taken and inserts with solubility test of -75% Sulphuric Acid. The test was carried out till the fabric is dissolved

III. RESULTS AND DISCUSSION

The studying results of the findings are reported in this chapter. The kid's bed net design and fabric experimental tests were done to kids to protect them from various insects and other fabric case infection diseases. The design is designed in terms of its ergonomically compatibility and kids' health issue consideration.

3.1 Experimental Results

Identification and confirmation of material of construction of mosquito bed net and papoose. The fabric identification of the mosquito's net and papoose sample was done by using solubility testing methods.



Figure 2 : Solubility Test

Table 3: Solubility test result

Fabric name	Chemical name	Result
Cotton	75% Sulphuric Acid	Cotton
Polyester	Meta cresol or Chloro Phenol	Polyester

3.3 Mechanical Tests

The fabric properties of the mosquito bed net sample and papoose was done by using differential mechanical tests. The results of mechanical tests for the mosquito bed net fabric and papoose fabrics are in table 5,6, 7, 8.

Table 5: Burst strength of mosquito net fabric test by diaphragm burst tester

Fabric types	Sample No.	Burst strength(Bar)										Mean
		1	2	3	4	5	6	7	8	9	10	
Mosquito net	Mn1	4.33	4.30	4.12	4.04	4.28	4.79	4.38	4.33	4.14	4.27	4.298

Table 6: Tear strength of mosquito net fabric test by tear tester

Fabric types	Sample number	Tear strength(Newton)	Mean					
			1	2	3	4	5	
Mosquito net	Mn1	Load (N)	38.16	40.61	39.77	42.03	43.12	40.738
		Range (%)	59	63	62	65	67	72
		Tear force(L*R)	22.51	25.60	24.70	27.32	28.90	25.806

Table 7: Table Tear strength of cotton & polyester fabric test by tear tester

Fabric types	Sample number	Tear strength(Newton)	Mean					
			1	2	3	4	5	
Cotton	Weft	Load (N)	20.23	20.54	20.56	20.14	20.35	20.36
		Range (%)	65	65	66	65	67	65.6
		Tear force(L*R)	13.15	13.35	13.57	13.09	13.63	13.36
warp	Load (N)	21.56	21.12	21.3	21.6	21.14	21.34	
		Range (%)	70	68	67	70	70	69
		Tear force(L*R)	15.09	14.36	14.27	15.12	14.8	14.72
P Polyester	weft	Load (N)	26.13	27.12	27.3	27.13	26.8	26.9
		Range (%)	72	70	69	70	70	70.2
		Tear force(L*R)	18.81	18.98	18.84	18.99	18.76	18.9
warp	Load (N)	28.45	28.99	28.34	27.56	29.1	28.49	
		Range (%)	75	76	72	75	75	74.6
		Tear force(L*R)	21.34	21.54	20.87	20.67	21.83	21.25

Table 8: Tensile strength of cotton & polyester fabric test by tensile tester

Fabric types	Sample number	Tensile strength(Newton)	Mean								
			1	2	3	4	5	6	7	8	
Cotton	weft	Max force(N)	138	121	127	167	130	125	123	131	132.8
		Max elongation (%)	12.3	11.7	11.5	12.5	12.2	12.1	12.2	11.5	12
	warp	Max force(N)	138	136	137	134	133	-	-	-	135.6
		Max elongation (%)	13.2	12.5	12.35	12.12	12.22	-	-	-	12.48
Polyester	weft	Max force(N)	150	160	140	156	165	170	155	162	157.3
		Max elongation (%)	14.5	15.2	14.1	14.5	15.1	15.6	14.1	15.3	14.79
	warp	Max force(N)	155	168	156	160	152	-	-	-	158.2
		Max elongation (%)	14.5	15.1	14.6	15.2	14.4	-	-	-	14.76

3.3 Design

Kid's mosquitoes bed net size folding net for protection from mosquitoes and insect bites. Net is made from insecticide net. It comes with frames which make it durable and safe to sleep in. For easy entry and exit net

comes with zipper. Ergonomic net design makes it easy to fold and unfold and it easily accommodates (one kid).It requires separate rods to hang the net, Ideal for on the go use too and can be easily stored away. The Dimensions is in cm (LxWxH): (110*80*1110) and It is a combination of bed net and papoose the means the sleeping area is used as papoose.

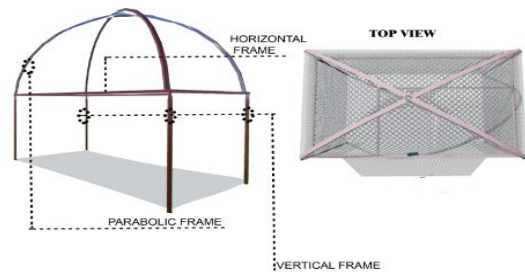


Figure 3: 3D kid's bed net design with its top view

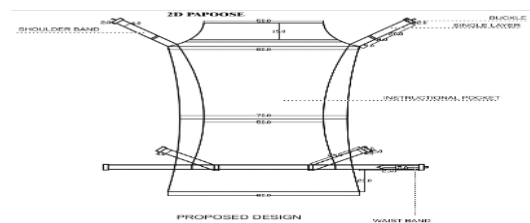


Figure 4: 2D Papoose design

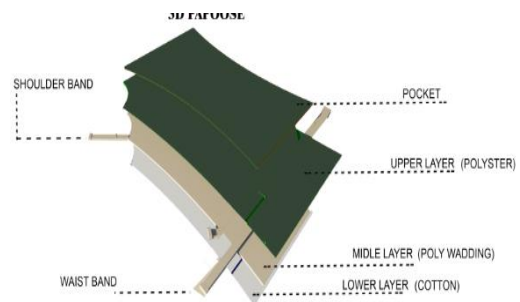


Figure 5: 3D papoose design

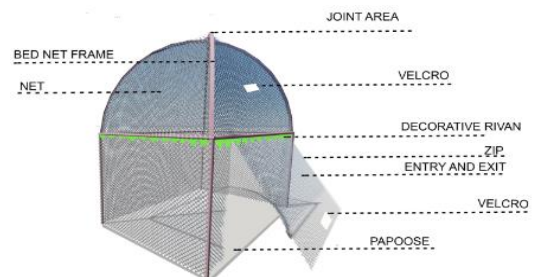


Figure 6: 3D Final design of bed net with papoose



Figure 7: Final papoose product back and Front view



Figure 8 : Bed net product

IV. CONCLUSION

The problem of this study was design and development of kid's bed net and papoose in order to protect kids from biting of various insects. To find the answer to this problem, research goals were established. They consisted of the following: test the fabrics characteristics which are more likely to comfortable to kids wear functionality, design appropriate size products are more likely to the felling of consumer comfort behavior and development of the actual product and addressed to consumer.

V. REFERENCES

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