# Ethiopian *Ankelba*: An Attempt to Modernize the Cultural Leather Artifact

by

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## Abstract

Ethiopia has many cultural artifacts made of traditionally processed leathers. *Ankelba* is one of them and utilized in most part of Ethiopia to carry baby. Here, we report salient features of *ankelba* and its value in Ethiopia region, demerits of the product and strategies to enhance the design feature of cultural *ankelba* while maintaining its cultural value. Data were collected through interview guided questionaries' to analyze the causes for the reduced usage of the product. We identified that the traditionally processed cow leathers are heavy with poor color fastness. Further, we recognized that cultural *ankelba* has flawed design features such as fixed size, improperly placed *zagols* (sea shell) and uncomfortable strap construction to hold the baby. Here, we present an efficiently designed *ankelba* overcoming the key deficiencies while preserving the cultural value of local people. This study would pave way for restoration of several cultural artifacts available across the globe.

## Introduction

Ethiopia is an ancient country with a remarkable cultural diversity. This diversity includes tangible and intangible heritage with both traditional and modern cultural expressions, language, and practice in artifact production.[1] Artifact is an individual's expression of identity, typically an object, which people assign meaning to express their aspirations and present to the world. Based on these shared meanings, individuals impress their appearance to express their desired identities in social contexts.[2] *Ankelba* is one of the artifacts produced by Ethiopian rural society at home. In Ethiopia, rural area mothers used *ankelba* often to carry their babies.[3] Baby wearing is the culturally borrowed practice of carrying an infant on the body using a sling or cloth carrier.[4] Prior to the 19th Century, worldwide parents used a variety of long cloths, shawls, scarves and even bed sheets to snuggle up their babies and get the chores done.[5-7] Cultural baby wearing is one of the historic artifacts practiced by most civilizations around the world. The main reason for popularity of baby wearing is due to better attachment of baby to parent.[5] Even today, traditional types of baby carriers are still used in developing countries, where each region has its own traditional design to meet their particular needs such as climate, type of work of mothers and cultural baby wearing positions.[6]

In Mexico, *rebozo* has been used to cover, carry and transport infants with different colors, materials, patterns and usage from region to region.[8] In some parts of Africa, mothers use a short piece of cloth tied around the chest called *khanga* to carry baby. Similarly, Ethiopia has long history of using good cultural tradition of carrying baby using *ankelba*. *Ankelba* is baby wearing product made up of traditionally processed cow hides tied over both shoulder with baby usually on the back. *Ankelba* allow mothers for continuous holding, carrying of baby and walking long distance or working. Leather used for *ankelba* production processed by household traditional tanners. They utilize natural plants locally available for dyeing of *ankelba*.[9] There are more than 6722 household traditional leather processing tanners in Ethiopia. They process hides to generate leather that can be used for bags, wallets, belts, musical instruments, traditional kitchen goods as well as *ankelba*.[10] Even though a*nkelba* is used as a traditional leather product to carry baby, it has its own problems related to design, material and manufacturing methods. *Ankelba* lost its popularity in modern generations due to certain design and material related drawbacks. However, rural people still use *ankelba* in spite of its drawbacks. Not much work has been done to understand the techniques used for either traditional Ethiopian hides and skin processing, its drawbacks and methods to improve it or *ankelba* production, its drawbacks and methods to sustain.

The purpose of this study is to explore the history, significance, and meaning of traditional Ethiopian *ankelba* and answer the following questions: What factors contributed to the decline in percentage utilization of *ankelba* in Ethiopian rural areas? How leather used for *ankelba* was processed? What are the techniques and procedures adopted for manufacturing *ankelba*? What are the ways to increase the use of *ankelba* in Ethiopia and how to sustain it? The present study also aims to investigate the Ethiopian cultural *ankelba* design, materials and the key drawbacks that contribute to the reduction in utilization of the precious cultural article. Additionally, we made an attempt to substitute the traditionally processed heavy cow leather with a suitable alternative leather and improve the design of *Ankelba*.

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## Materials and Methods

### Methods

Research about historical cultural artifacts aims to create an account of people assets, values and events of the past in an effort to create a foundation of knowledge for the future. Cultural artifacts research has customarily made use of interpretive approaches that rely upon the analysis of qualitative data.[11] However, in recent years, historic cultural artifact researchers have begun to apply statistical approaches to analyze qualitative data, and/or to collect and analyze quantitative data.[12] Here, we used both qualitative as well as quantitative data for collecting facts related to Ethiopian traditional *ankelba*.

### Data Collection and Sampling

Data were collected through interview guided questionaries from regions where *ankelba* was highly utilized in the past and present in order to identify the value of utilizing this product and the main problems existing with traditional *ankelba*. Interviews were conducted face-to-face in Ethiopia in the homes or working place of the interviewees. The duration of the interview differed from interviewee to interviewee. All interviews were conducted in Amharic, translated into English, and reviewed by three readers fluent in Amharic and English. Extra attention was given to the cultural tones of these personal conversations in order to make the translations as precise as possible.

Data were collected from 25 traditional leather processing artisan, 6 *ankelba* producers and 372 *ankelba* user family members. Furthermore, picture and measurements of traditional *ankelba* were taken to understand the design related problems.

### Geographical Domain for the Research

Data were collected from different geographical locations of Ethiopia where *ankelba* was highly utilized such as *Adet*, *Merawi*, *Qoqa* and *Hamusit* districts of Amhara region. These districts were selected based on the time required for data collection, expenditure involved for travel and data collection and also the utilization rate of *ankelba* products. Data were collected from three focus groups namely the user, producer and traditional leather processing artisans that process cow hides as shown in Table I.

### Data Analysis

Fishbone diagram was used to identify the causes for un-comfortable cultural *ankelba* problems. Anonymous rating was used to identify the causes that need priority to tackle and ranked by experienced expert by interviewing the local users. The problems associated with the material and design of *ankelba* were listed in the questionnaire with the scores of 1 to 3, where low score means the least important problem while high score means the most important problem. The material related problems were bad smell, huge weight, color fading, oil removal and unwashability, while design related problems were fixed size, many *zagols* (sea shell) per *ankelba*, many button per *ankelba*, narrow strap width, un-comfortable neck construction and absence of lining and pad.

Following explanation by experienced expert to all members individually, the expert ranked the problems with the scores of 1 to 3. The expert raised single question at a time about the problems. After they understood the respondent's view, they gave the scores. Finally, the total score for each problem was calculated by multiplying each score with the respective number of total respondents followed by summing up all the scores.

### Characterization

Tensile strength of the traditionally tanned cow leathers and modern tanned sheep garment leathers was evaluated according to ISO 3376:2011/IUP 6/ SATRA TM 43 method.[13] The test specimens were conditioned at 20±2°C and 65±5% relative humidity in accordance with ISO 2419:2012 method. Tearing strength of leather was measured according to SATRA TM 162 /ISO 3377-2:2011 test method after conditioning the specimens as described above.[14] Both traditionally and modern tanned leathers were also analyzed for bulk properties such as softness, grain smoothness, surface color uniformity and general appearance by an experienced tanner by hand and visual evaluation in a scale of 0 to 10 points. Higher numbers indicate better property. Rubbing fastness (dry and wet) of the samples was carried out according to ISO 11640:2012 test method.[15] Samples were obtained according to ISO 2418:2002 procedure[16] and conditioned at 20±2°C and 65±5% relative humidity as per ISO 2419:2012.[17]

**Table I**

**Area of data collection and number of participants for data collection**

| | Total number of populations | | Number of participants in the study | | |
|---|---|---|---|---|---|
| Area of data collection | Total number of families | Number of families having *ankelba* | Cow hide processors | *Ankelba* producers | Users |
| Adet | 20117 | 5113 | 8 | 2 | 127 |
| Merawi | 16405 | 3096 | 4 | 2 | 73 |
| Qoqa | 5671 | 1171 | 6 | 1 | 97 |
| Hamusit | 4325 | 2043 | 7 | 1 | 75 |

## Results and Discussion

### Traditional Leather Processing in Ethiopia

As seen in Figure 1a, traditional leather processing in Ethiopia starts by soaking cow hides in small pond or in part of rivers that have dip height. Small-dammed river helps traditional leather processors to soak large amount of hides in single process. The soaking operation normally takes 3 to 5 days. The purpose of soaking operation is to soften the hides and make ready for the fleshing operations. During soaking solid and liquid wastes such as hide dust, blood, fleshing and hair may be released to local rivers. This has its own impact on people living in downstream that utilize the river. Then fleshing process carried out by local artesian using a knife and small axe to remove the flesh and waste from the hides as shown in Figure 1b. Small amount of water is sprayed all over the hides for softening the hides. After fleshing operation, unhairing process proceeds using mixture of cow urine, grinded *Solanum incanum* fruit (*Embuay*) and water. This solution was prepared by mixing approximately 1 kg of *Solanum incanum* in 10 liters of cow urine. Hides are immersed in this solution for 24 h up to 3 days and after removal from solution the hides are piled and kept in a place where it gets some heat and is ready for manual unhairing operation as seen in Figure 1c. The solution acts as surfactant and helps to clean the hides and make easy to remove the hair. After unhairing, oiling process is carried out using grinded castor bean (*kachma*, Figure 1e) for softening the processed cow hides as shown in Figure 1d. The amount of oil applied on the leather depends on the size of the hides. The oil was spread on the surface of leather and treated leathers were kept for a day in sun light. Extra oil was swept by brush. "*Faki*" is the name commonly given for the artisan processing such traditional leathers.

Traditionally processed leathers have been used for different purposes such as *kurbet* (sleeping mat), musical instruments, *mecagna* (rope), *ankelba* (baby wearing), *doniya* (bags for grain transportation), package for praying book pocket and traditional leather goods production.[10]

### Traditional *Ankelba* Production

Ethiopia has different artifacts that have been used for a long time, which express Ethiopian society, culture, history and traditions. Among various artifacts that differentiate Ethiopian society from other parts of the world, baby carrying methods and materials used for preparing *ankelba* is one of them. In most parts of Amhara region, some parts of Tegria region, some parts of Oromia and Southern Nations Nationalities and People (SNNPR) regions have long history of using leather *ankelba* for carrying babies. The design of *ankelba* in each region has its own unique features. Leather *ankelba* used in different regions have different designs especially in the placement of accessories although the function is the same.

In the Amhara region, *ankelba* has especial value among society and expresses the wealth of individuals in addition to its basic function. High number of *zagol* attached at the end of *ankelba* expresses high wealth of *ankelba* owners. *Ankelba* is designed and manufactured by local artisans and sold to rural society by themselves or through local traders (local community). The art and technology are transferred through family legacy.


**Figure 1.** Traditional leather processing in Ethiopia. **(a)** Hide soaking in damped river, **(b)** fleshing, **(c)** cow hides preparation for unhairing, **(d)** oiling and inset **(e)** oil used for softening leather.

**Table II**

***Ankelba* size measurements**

| Components | In arm measurement | Converted measurement (average) |
|---|---|---|
| Main Body | | |
| Length | 3 cubit | 150 cm |
| Width | 2 cubit | 100 cm |
| Straps | | |
| Length | Guess | 150 cm |
| Width | Guess | 3 cm |
| Strap insertion | | |
| Length | Guess | 30 cm |
| Width | Guess | 3 cm |

The leathers used for *ankelba* production are processed cowhides, which have better area utilization with less stitching requirements. The manufacturing of *ankelba* starts by purchasing of processed hides from household traditional leather processor in dyed or undyed form. The price of the leathers is agreed between the seller and purchaser depending on the guesstimate area of the leather. There is no scientific measurement of the surface area of the leather like modern practices. Leathers were sold only in full thickness form and split leathers are not possible to purchase. Undyed leather was colored by *ankelba* producers as shown in Figure 2a after cut (Table II) into 3×2 cubit (ancient unit of length based on the length of the forearm from the elbow to the tip of the middle finger). Waste engine oil and locally available '*Alela kelem*' dye were used for coloring the leathers. Mill oil may be used for further softening of purchased leather. After dyeing, the leathers were cut into straps that hold *zagols* as shown in Figure 2b.

Button attaching to body of *ankelba* is carried out as shown in the Figure 2c. Local producers believe buttons are accessories, which enhance the aesthetic value of the product. Buttons used for *ankelba* are white in color and the number of buttons varies from product to product. To reduce complication during stitching they prepare holes before attaching buttons to *ankelba*. They use an awl called '*wesfa*' and thread called '*chinga*' for attaching the buttons. *Zagols* (inset Figure 2e) are other accessories, which enhances aesthetic value of the product and inserted to all straps at the end of *ankelba* as seen in Figure 2d. *Zagol* provides sound during movement and the people believe that it entertains the baby. More number of *zagols* in single *ankelba* also indicates the wealth of that *ankelba* user. *Ankelba* can also be made without *zagol* attachments. As shown in Figure 2f, the edge is folded approximately by 5 cm and stitched. Finally, strap and other decorative neck terry leathers were also attached to *ankelba*.

**Major Causes for the Declined Use of Traditional *Ankelba***

Various causes for un-comfortability of cultural *ankelba* are categorized in fishbone diagram as shown in Figure 3.

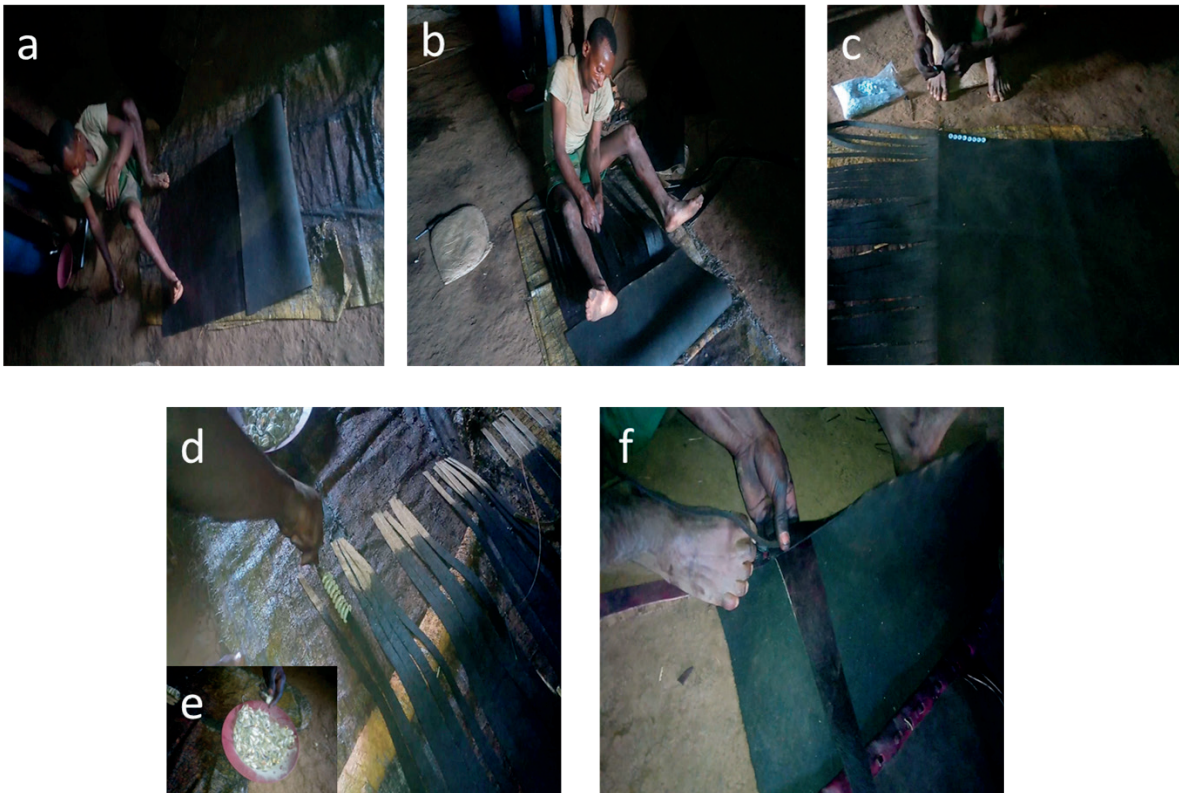


**Figure 2.** *Ankelba* leather preparation steps. **(a)** Leather cutting and dyeing, **(b)** leather strap making, **(c)** button attaching, **(d)** *zagol* inserting and **(f)** strap stitching. Inset in **(e)** shows *zagols*.

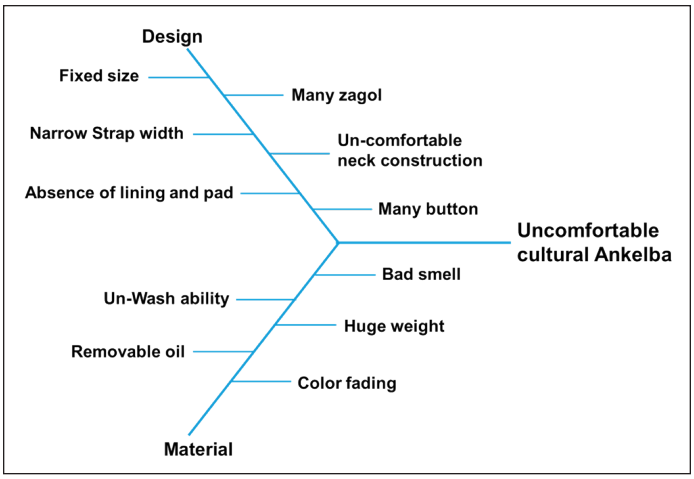


**Figure 3.** Major causes for the declined use of traditional *ankelba*

As seen from diagram, un-comfortability of cultural *ankelba* is mainly caused by poor design and material selection. Further, these two major causes are sub-divided into different small problems. Design related problems are caused due to fixed size of *ankelba*, many *zagols*, narrow strap width, un-comfortable neck construction, absence of lining and pad and many buttons. On the other hand, material related problems are caused by bad smell, un-washability, huge weight, oil removal and color fading of traditionally processed leathers.

### Problems Associated with the Use of Traditional Leathers for *Ankelba* Production

Table III shows a compilation of the scores for the material related problems associated with the *ankelba* through communication with 372 users of *ankelba* and ranked by experienced experts. As seen in Table III, 21% of respondents said *ankelba* leather has bad smell. The smell is the result of the use of oil that used to treat leathers and also due to the urination by the baby on *ankelba* where cultural *ankelba* design did not have material that can absorb the urine. Moreover, user of *ankelba* applies butter, oil and suet to soften the *ankelba* during utilization that inherits additional smell to the leather. Traditional leather is not washable and lining was not included in cultural *ankelba*, which can absorb baby urine. Baby's urine also causes puckering of *ankelba* that makes *ankelba* uncomfortable for baby to sit. The respondents almost equally ranked all the other problems. According to about 20% of the respondents, un-washability of *ankelba* leather is one of the material problems that need improvements. In rural areas, babies do not use underwear or any diapers that can absorb baby urine and protect *ankelba* from spoiling. Additionally, this increases the friction between baby and *ankelba*, which causes physical and other problems on babies. Cultural *ankelba* is heavy in weight owing to the thickness of the material used for *ankelba* production (> 1.4 mm), which was ranked by 1/5th of the respondents. Furthermore, accessories attached to *ankelba* such as *zagol* and buttons increase the weight of *ankelba*. This causes health problems on mothers. Further, *ankelba* leather fades after rubbing according to 19.5% of the respondents as seen in Table III. Almost equal respondents also indicate oil removal as other issue hindering the continued utilization of *ankelba*.

**Table III**

**Leather related problems and their ranking in cultural *ankelba***

| Material problems | Score=3 | Score=2 | Score=1 | Total score | Percentage (%) |
|---|---|---|---|---|---|
| Bad smell | 202 | 134 | 36 | 910 | 21.0 |
| Huge weight | 187 | 97 | 88 | 843 | 19.4 |
| Color fading | 178 | 118 | 76 | 846 | 19.5 |
| Oil removal | 183 | 134 | 55 | 872 | 20.0 |
| Un-washability | 197 | 112 | 63 | 878 | 20.1 |

Where a score of 3 means the most important problem, 2 means moderate important problem and 1 means least important problem.

### Problems Associated with the Traditional Design Features of *Ankelba*

Sizing plays a big role in every fitting requirement. There are large number of standard sizing systems for various garments such as dress, tops, skirts, and trousers.[18] Hence, appropriate sizing and fitting of *ankelba* to the body of baby and mother is important. Traditional *ankelba* is one of the products used in rural area by all the families. *Ankelba* product measurements were passed through generation to generation without changing. Measurements carried out by cubit even though forearms are different from one person to the other. As seen in Table IV, about 20% of the respondents said size of *ankelba* is fixed and un-adjustable and not suitable to carry baby by other members of the family. *Ankelba* is culturally produced by ready-to-wear sizing styles and there is no grading system. The size of *ankelba* is fixed to 3×2 cubit (length by width) and this not comfortable to carry all age babies.

Another major drawback of *ankelba* design is *zagol* number and placement. As seen in Table IV, 18.4% of the respondents indicate *zagol* number makes the product heavier, even though the number of *zagol* used per *ankelba* is an indicator of the wealth level of the user. *Ankelba* has 0 to 20 *zagols* per strap. On average, one *ankelba* has about 39 straps with 14 zagols per strap. In other words, an *ankelba* has about 546 *zagols*. Because of these reasons, *ankelba* is not suitable for movement and long walk and causes calf problems.

The strap is used to tight the baby on mother's back. However, the width of the strap is not sufficient to hold the weight of the baby and distribute the baby load. This causes irritation and sometimes wound on mother's shoulder and 19% of respondents believe this is one of the main issues hindering *ankelba* usage. Another major problem highlighted by the respondents (17.7%) was the absence of

**Table IV**

**Design related problems and their ranking in cultural *ankelba***

| *Ankelba* design problems | Score=3 | Score=2 | Score=1 | Total score | Percentage (%) |
|---|---|---|---|---|---|
| Fixed size of *ankelba* | 228 | 132 | 12 | 960 | 19.7 |
| Many *zagols* per *ankelba* | 207 | 112 | 53 | 898 | 18.4 |
| Many buttons per *ankelba* | 52 | 83 | 237 | 559 | 11.5 |
| Narrow Strap width | 234 | 92 | 46 | 932 | 19.1 |
| Un-comfortable neck construction | 63 | 167 | 142 | 665 | 13.6 |
| Absence of lining and pad | 167 | 158 | 47 | 864 | 17.7 |

Where a score of 3 means the most important problem, 2 means moderate important problem and 1 means least important problem.

lining and pad. The presence of pad is expected to absorb the urine of the baby thereby not only maintaining the hygienics but also reducing the bad smell. Lining may help in avoiding the transfer of urine to the leather thereby improving the washability as well as maintaining the properties of the leather.

About 25% of respondents replied cultural *ankelba* has many buttons per *ankelba* and un-comfortable neck construction, although these problems were recognized by fewer number of respondents. Neck construction did not support baby head and caused scratches on baby neck due to improper stitching as seen in Figure 4. As seen, there are many *zagols* and buttons per *ankelba*, narrow strap width and un-comfortable neck construction and other problems associated with the design of traditional *ankelba*. To support and protect a baby's developing spine and hips, it is important that the carrier can support the baby's back, hips and back of the head. However, as seen in Figure 4, Ethiopian cultural *ankelba* did not fulfill baby wearing safety features.

**Strategy for Improving the Materials and Design of *Ankelba***

All problems associated with the material are predominantly due to the choice of heavy cow hides and the traditional way of processing them. This can be solved by selecting lighter sheep skins as raw material and utilizing vegetable or chrome tanning based modern techniques. Here, we have developed a sample *ankelba* for babies aged 6 to 24 months old by solving the design and material oriented problems observed in cultural *ankelba*. Sheep garment leather of Ethiopian origin with 0.8 mm thickness processed through modern chrome tanning based technique was selected to solve material related problems. As shown in Figure 5, the size of *ankelba* for selected age group was fixed at 40×22 inch length by width according to the standard sizing system followed for modern baby wearing products.[18-20] It is possible to employ a standard grading system for other age groups. Adjustable straps are designed to ensure all members of the family can utilize one *ankelba*. The weight of the newly designed *ankelba* is just about 50% of the cultural *ankelba*. The lower weight was due to low thickness of leather (0.8 mm) and


**Figure 4.** Drawbacks of Ethiopian cultural *ankelba*. **(a)** Inappropriate size and many *zagols* and **(b)** un-comfortable neck construction and many buttons.

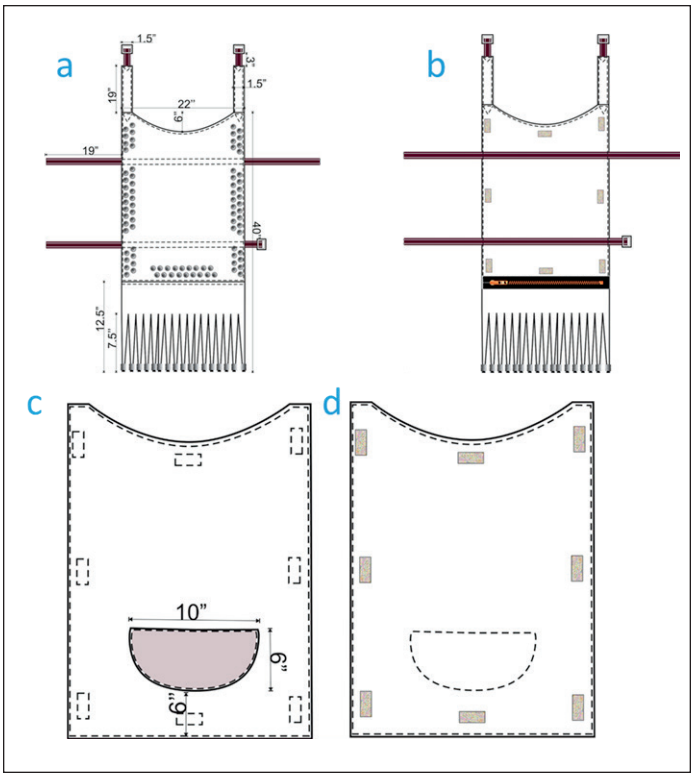


**Figure 5.** New strategic design for *ankelba* overcoming the key deficiencies. **(a)** Leather body exterior view, **(b)** leather body interior view, **(c)** lining exterior view and **(d)** lining interior view.

reduced number of *zagols* and buttons. Number of *zagols* can be reduced without affecting cultural values. Society did not count the number of *zagols* on *ankelba* but they see the aesthetic values, the sound *zagols* produce during walking and the fit.

Hence, the sound can be achieved by changing the design of *zagol* placement and by reducing the number. Newly designed *ankelba* has 17 straps and 5 *zagols* per strap, which mean the total number of *zagols* used is 85. Number of *zagols* per strap reduced almost by 3 folds and total number of *zagols* per *ankelba* reduced by more than 6 folds. Similarly, number of buttons reduced by half.

Lining made up of cotton and foam inserted into newly designed *ankelba* can easily prevent baby urine passing to leather and enhance the comfort, as seen in Figure 5. Further, it is possible to diminish the bad smell by providing an economically viable waterproof post-tanning and finishing system during the manufacture of sheep garment leather, which can reduce the absorption of urine. Adjustable shoulder straps and waist straps, having 19 inch length and 1.5 inch width, ending with Velcro attachment were selected to prevent problems related to tightness of cultural *ankelba*. The size of the straps was based on the standard measurements of shoulder straps and waist straps and it would help to balance the weight distribution. The actual *ankelba* product produced using modern sheep garment leather with improvised design is shown in Figure 6.

**Physical and Bulk properties of Leathers Processed Using Traditional and Modern Techniques**

The physical and bulk properties of leathers vary significantly depending on the chemical treatments and processing strategy. Physical properties such as tensile strength, tear strength and percentage elongation and bulk properties such as softness, grain smoothness and general appearance, for example, can be influenced by the choice of tanning agent, re-tanning, fatliquoring and finishing chemicals. Hence, we tested tensile strength, tear strength and percentage elongation of traditionally tanned and modern tanned leathers and the results are shown in Table V. As can be seen, both the tensile and tearing strength of traditionally tanned and modern tanned leathers are not altered significantly. The variations seen in data are mostly due to the nature of leather in which properties change from leather to leather and within different parts of the same leather. Nevertheless, the percentage elongation of modern sheep


**Figure 6.** Newly designed sheep garment leather based *ankelba* product. **(a)** Exterior view and **(b)** interior view.

**Table V**

**Physical properties of traditionally tanned and modern tanned leathers**

| Sample | Tear strength (N/mm) | Tensile strength ($N/mm^2$) | Elongation at break (%) |
|---|---|---|---|
| Traditionally tanned cow leather | 177.2 | 29.0 | 58.5 |
| Modern sheep garment leather | 182.1 | 29.4 | 68.0 |

garment leathers is significantly higher than the traditionally tanned cow leathers. This could be due to the choice of the raw material as well as the modern processing technique.

The bulk properties of the traditionally tanned and modern tanned leathers are shown in Figure 7. Softness and color uniformity of the traditionally tanned leathers are significantly lower compared to the modern tanned leather indicating traditional tanned leathers are hard with uneven coloration. Further, the grain smoothness of the traditional tanned leather is not good, which indicates the leather is rough. Considering all the bulk properties including general appearance, the modern tanned sheep garment leather has better properties in comparison to traditionally tanned cow leathers.

### Dry and Wet Rub Color Fastness of Traditionally Tanned and Modern Tanned Leathers

Dyestuffs employed for coloring leathers should not be leached out easily on usage or when the leather is washed. The use of leather products with low color fastness to rubbing is not acceptable especially for casual products. Hence, color fastness of traditionally tanned and modern tanned leathers were analyzed and compared against standards. As seen in Table VI, the dry and wet rubbing fastness is below standard requirement for the traditionally tanned leather, which indicates that the traditionally tanned leather lose its color when it is rubbed.[21] This can cause fading of product in its color

**Table VI**

**Dry and wet rubbing fastness of traditionally tanned and modern tanned leathers**

| Samples | Rub fastness | | Standard requirement[21] | |
|---|---|---|---|---|
| | Dry | Wet | Dry | Wet |
| Traditionally tanned cow leather | 1 | 1 | 3 | 3 |
| Modern sheep garment leather | 5 | 4/5 | 3 | 3 |

appearance and may also cause damage on other wearable clothes. On the other hand, modern tanned sheep nappa leather has good dry and wet rub fastness comparable to the standard requirements. This is primarily due to the proper processing conditions, which included a step for fixing the dyestuffs with the chromium-collagen fibers present in the leather.

## Conclusion

Ethiopian cultural *ankelba* has been made of traditionally processed cow leathers and used for carrying baby. This traditional product has material related problems such as bad smell, heavy weight, un-washability and color fading as well as design related problems such as fixed size, number and placement of *zagol*, neck and strap construction, which resulted in the gradual disappearance of this prestigious product. In this study, the material and design related problems of cultural *ankelba* were overcome to revive the *ankelba* product usage. Traditionally processed cow leathers were replaced by sheep garment leather having less weight and thickness to solve material related problems. New and efficiently designed *ankelba* has lesser number of straps and *zagols*. Number of *zagols* per strap was reduced almost by 3 folds and total number of *zagols* per *ankelba* was reduced by more than 6 folds to make the new design appeal to the user. The adjustable strap provides overall size adjustments in the


**Figure 7.** Bulk properties of traditional tanned and modern tanned leathers.

newly designed *ankelba* such that it can be used for babies aged from 6 to 24 months. Further, the new design allows for grading, which will help to design and manufacture *ankelba* that can be used for toddlers aged more than 24 months. The results of this study would help to continue the usage of *ankelba* not only in rural areas but also amongst urban society. The strategy proposed in this study can be applied to the revival of any such traditional products around the world for their continued and effective usage.

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