

## The concept of Zero waste fashion and macramé technique to boost up the innovation of women garments designs inspired by Nubian motifs

**Dr. Wafaa Abd Elradi**

Lecturer of Fashion Design, Apparel Department, Faculty of Applied Arts, Helwan, University, Egypt.

### Abstract:

Through the capacious prevalence of fast fashion culture in our community, which has accelerate consumers desire to follow the latest trends and pushing them for shopping than wear, we notice that it necessarily leads to increase clothing consumption, waste production and gradual loss of our Egyptian identity.

So this research has been to explore the Zero-waste techniques in designing and producing women clothes that express Egyptian identity. It aims to find out which technique is the best through inspiring Nubian motives and applying macramé technique. the experimental work of the researcher primary done through, created 20 designs by using zero waste methods and macramé techniques inspired from Nubian motives ,then the designs evaluated by questioner .the statistical results identified the best designs that have produced by using zero waste and macramé techniques expressing Egyptian identity were no (10, 11, 6, 15) they get the higher scores, where they based on (Geo- cut) technique. And design no. (9) was competitor for designs no (10, 11, 6, 15) in their scores which is the only design from left over scraps group.

### Keywords

- *Textile industry*
- *Fashion design,*
- *Zero – waste fashion,*
- *Fast fashion,*
- *Macramé techniques.*

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### 1 .Introduction:

Fashion is a part of cultural industries and identity of countries, it express our personal and social relationships linked how we live and see ourselves within society and it is considered as one of the world's largest industries, it also one of the world's most polluting that leads to an increasing worse impact with environment especially with appearance of fast fashion clothing collection which based on quickly designing ,manufacturing and cheaply to allow the consumers to buy current clothing styles at lower price, so the amount of clothing in circulation has grown from 2000 to 2006. The consumers have responded with growing total consumption by over 20% since 2000 (Eder, 2013).

These cause some bad side effects such as increasing the consumption of water, sources of energy and pollution. as a result of production and manufacturing clothes or after consumption that 73% of clothes are thrown away end up in landfills for that fast fashion movement is accused as not sustainable habit. (Rissan,2013)

There are attempt to extend mitigation the harmful side effects of fashion production focused on product or result changes, the product focused strategies by using more sustainable materials and renewable source energy. Results focused strategies emphasize how product are marketed, distributed, eco chic design, textile recycling, clothing reuse options and zero-waste fashion, ... etc. these strategies help manage production, pollution and textile waste so the challenge now is to find ways to celebrate fashion as a significant

part of our culture keeping our identity while divorcing it from tremendous material consumption by improving sustainability.

### Problem statement :

The research problem can be summarized as follows:

- Ability to use zero- waste techniques in designing and producing women clothes expressing Egyptian identity.
- What is the best Zero waste techniques that can be used in designing and producing women clothes through scraps of fabric?
- For how extend macramé techniques express the Egyptian identity?

### Research objective:

- Using zero- waste in designing, producing and accessing the best technique .
- Evaluating macramé techniques to access the express the Egyptian identity.

### Research limitation:

Design and produce women's clothes by using Zero waste methods and macramé strips for age group (30-40).

### methodology:

Research follows the descriptive analytical method and application study.

### Research tools :

A questionnaire for evaluating the design, followed by statistical analysis.

### 1.1 Zero Waste Fashion:

Zero Waste Fashion can de defined as the production of clothes that generate little or no

textile waste considered to be a part of the broader sustainable fashion movement. It divided into two general approaches. (Miinimaki, 2013)

**1.1.1 Pre-Consumer Zero- Waste Fashion:**

It eliminates waste during a garment's initial production. Two general approaches fall under this category.

**1.1.1.1 The Fash Pre- Consumer Zero – Waste Design:**

In this approach the designer creates a garment through the pattern cutting process working within the space of fabric width. It directly influences the design of the final garment as the pattern cutting process is a primary design step.

**1.1.1.2 Zero- Waste Manufacture:**

Approaches can include the use of technology such as whole garment knitting and the relatively new D Pol. The waste is eliminated by reusing the off cuts in other products.

**1.1.2 Post – consumer Zero – Waste:**

This design approach utilizes the remnants of the fashion cycle to produce new garments from second hand or surplus goods.

**1.2 Zero Waste Fashion Techniques:**

Zero – waste fashion design refers to methods that particularly aim to eliminate fabric waste from garment production through design. Crucial to this approach is the integration of pattern making and fashion design processes, in contrast to conventional practice where pattern making typically follows a predetermined design. Garments created through zero – waste fashion design methods consuming all of the fabric needed for that garment and thus leave literally zero fabric waste. In its larger sense, the concept of zero-waste fashion refers to a fashion system where waste is eliminated through all stages of garment design, production chain and the use phase (Rissanen, 2013).

As noted by McQuillan (2011, pp. 87-96) and Rissanen (2013, pp. 45-57) there are several ways to approach the aim of zero-waste fashion design through.

- 1) Planned Chaos.
- 2) Geo Cut.
- 3) Cut and Drape.
- 4) Reusing of scraps of cloth and yarns. (Ciabailey,2014) (Miinimaki, 2013).

**1.2.1 Planned Chaos:**

In planned chaos traditional garment blocks are unified so that they create the body of the garment and all pieces are not separately, so that technique requires understanding the rules of tradition pattern cutting but being willing to break them. So that will eliminate the textile waste that occurs in garment production there are two ways of pattern

cutting, Jigsaw cutting, Subtraction cutting. (Miinimali, 2012)

**1.2.1.1 A jigsaw cutting:**

This method created by designer Mark Lui that he could eliminate waste by cutting from a single piece of fabric in order to create all of the small component (pockets- collar- trims....) and fit all together like a puzzle so that every single scrape is utilized this technique is an eco-efficient that has completely over looked in the industry, Fig.1. (Rosenbloom, 2010)



Figure. 1. Example of jigsaw cutting

**1.2.1.2 Subtraction cutting:**

This method created by designer Julian Robert In that technique the pattern are not cut to present the outward shapes instead they represent the negative space within the garment.

The garment these results in garment constructed from huge sheets of cloth with unusual shaped holes that the body passes through. This approach incorporates adventure and chance discovery and the ability to cut fast and in accurately without using complex numerical mathematics. (Roberts, 2011)

Subtraction cutting technique often allowing the form of fabric to dictate the design rather than confining the fabric to the shape of predetermined patterns. The garment can be formed by threading the fabric through openings or by threading the body through the openings in different ways another option is to add additional sections of fabric to the holes and cuts in the initial piece of fabric (inspiration images of subtraction pattern cutting, Fig.2. (Robert, 2012)

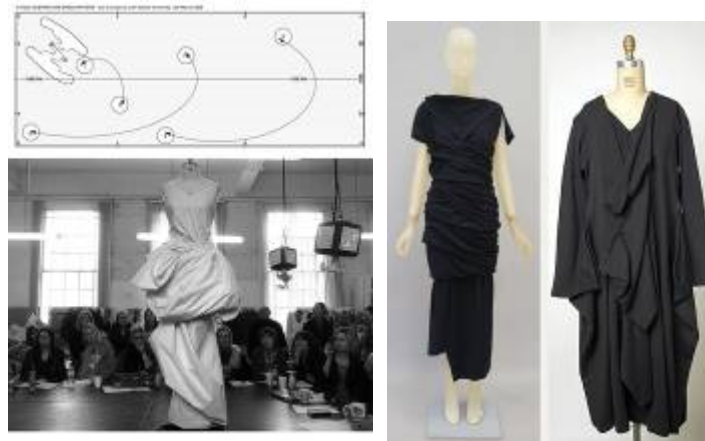


Figure2. Example of Subtraction cutting

**1.2.2 Zero – Waste Geometric Cutting "Geo Cut":**

This method based on using geometrical shapes as squares, triangles and circles this method has historical roots in, for example, kimono designs (Miinimaki,2012) ( Elena,2014)

As designer Ada Zanditon , She used zero – waste geometric cutting for origami – inspired to present final garments have 3d form (photo.....) she took two squares and cut a line through them, and then joined the lines together and used buttons to fix the points of dress into folds, Fig.3. (Redress,

2013) (Mikashen, 2014)

**1.2.3 Cut and Drape:**

"Cut and drape " is very exploratory, it is based on fluid cutting and draping it, where a fashion designer can play with the way fabric falls to create new designs, As designer Carlos Villami: His clothes are designed / built with innovative construction concept the pieces in this collection were made using a mix of techniques: cutting, draping, folding, steam molding and machine and hand – stitching, Fig.4. (Carlos, 2010) (Miinimaki, 2012).



Figure3. Example of Geometric Cutting

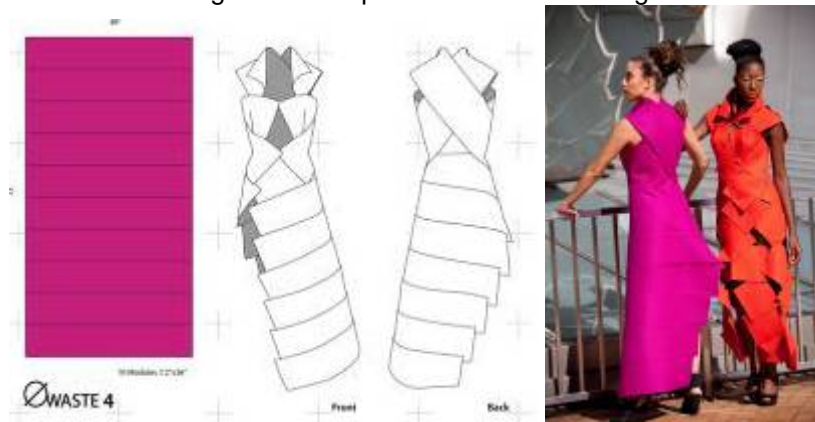


Figure 4. Example of Cut and Drape

**1.2.4 Re using Scraps of Cloth and Yarns :**

This method based on deal with off cuts of leftover material after finishing product manufacturing; there are different ways to reuse

scraps.

**1.2.4.1 Knitting :** as designer Van Rees ,She created textile by using both remnant thread from knitting factories then wave directly the yarns in

the shape of the garment so the resulting pieces are completely seamless, no cut – offs or leftovers , Fig.5. (Rinehart,2012)



Figure 5. Example of Reusing Scraps (Knitting)

**1.2.4.2 Pleating:** as designer Angus Tsui Yat Sing, that he created zero – waste garment by pleating rectangular textile waste scraps, Fig.6. (Redress, 2013)

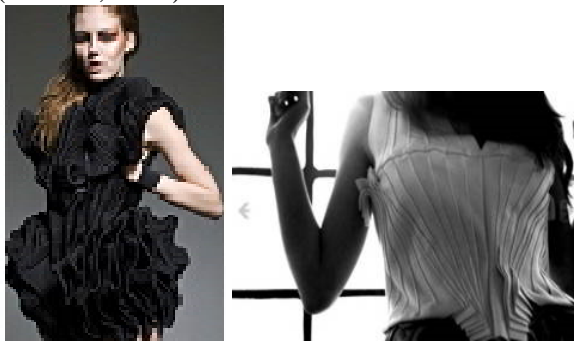


Figure 6. Example of Reusing Scraps (Pleating)

**1.2.4.3 Draping scraps of fabric:** as designer Franki Campbell where a fashion designer can play with scraps of fabric on Mannequin to create new designs , by using gathers, pleats, darts and the bias to create shaping without cut anything away, Fig.7. (Ross, 2014)



Figure 7. Example of draping scraps of fabric

### 1.3 Technical requirements for designing and producing zero waste fashion garment:

The zero- waste design techniques are an integrated design process so there are some essential points should be considered in designing and producing zero waste fashion as follows:

- (1) Knowing of textile dimensions.
- (2) Knowing of design dimensions.
- (3) Fabric choice it meaning fabric behavior when sewn up and that affect the results, softer fabrics will drape more and stiffer fabrics will hold their shape more.
- (4) Thinking about decorative items by trying to aim toward utilizing the whole of the fabric in a way that avoids decoration as a means of disposing of the waste.
- (5) Remember to consider seams – particularly for area such as (sleeve armholes/crowns) where it is extremely important especially in the zero- waste pattern cutting process. (McQuillan,2010)

### 1.4 The essential properties of zero-waste – fashion:

Zero waste is a goal, a process, away for thinking that propounding changes our approach to resources and production; it's not about recycling and diversion from landfills but about restructuring production and distribution systems to achieve some benefits:

#### 1.4.1 Saving cost

- (1) By prevent waste from being manufactured in the first place it has principle of economy in design, fabric and execution. (Gay,2011)
- (2) Reusing existed fibers and textiles, there is no need to make these textiles from raw materials such as (cotton, wool and synthetic fiber). This saves on the energy used and pollution caused during manufacturing processes like dyeing, washing and scouring (Recycling).
- (3) by reducing the number of seams used in the construction of garment this could enable faster garment manufacturing potentially reducing energy consumption and labor (Rissanen, 2013).

#### 1.4.2 Expanding creative and aesthetic values:

By exploring different possibilities of garment design and reusing remnant fabric (about 15% of waste fabric) to become a luxurious embellishment that add value to garments Mark Lui viewed. ( Donatelli, 2012)

#### 1.5 Macramé

It is derived from Arabic weavers’ word “migramah” meaning “Fringe” since the 13th Century. This refers to the decorative fringes on

camels and horses which help, amongst other things, to keep the flies off in the hot desert regions of northern Africa.

Another school of thought thinks that it comes from Turkish "makrama": "napkin," or "towel" and it was a way to secure the ends of pieces of weaving by using the excess thread and yarn along the top and bottom edges of loomed fabric into decorative fringes on bath towels, shawls, and veils.

It is a form of textile-making using knotting rather than weaving or knitting. Its primary knots are the square knot and forms of "hitching": Full hitch and double half hitches, known Macramé knots are: square knot, half knot, horizontal double half hitch, vertical double half hitch, Berry knot and Josephine knot. In this study Lake Knot and vertical double half hitch were used.

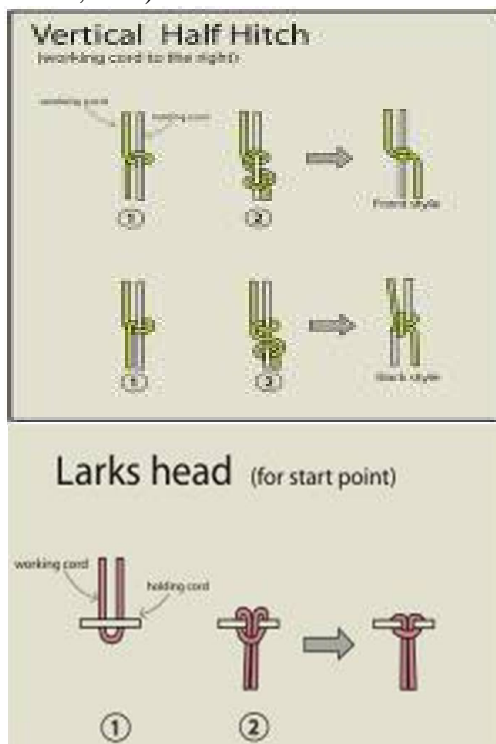
The Larks Head Knot is one of the most frequently used decorative knots in Macramé. Another name for this decorative knot is the Cow Hitch. It is most often used as mounting

knot; to attach one cord to another, or onto a ring, dowel or purse handle

The Vertical Half Hitch is different than other variations of the Double Half Hitch (DHH).

The two knots are arranged vertically. So the second knot rests below the first.

One working cord is used to attach the knots to several holding cords, Fig.8. (Macramé) (Ecocrafta,2013)



**Figure 8.** Larks Head Knot & Vertical Half Hitch

### 1.6 Nubian motifs:

Nubian art reflects Nubian culture many of it

symbols and motifs are significant experiencing of folk traditions and supper stations, this can be easily seen in tattoos and wall painting that decorate the façade and entrances halls of many Nubian houses, these symbols recur in the designs of bead works and many kind of baskets, mate ..etc, Fig.9&10.(Nubia).



**Figure 9.** Nubian motifs in hats



**Figure10.** Nubian motifs in entrance Nubian house

## 2. Materials and methods:

The present research used different methods of zero waste fashion and macramé techniques to create and produce 20 designs inspired from Nubian motifs for age group (30-40) years old.

### 2.1 Material:

In this research two Fabrics were used with high drape and elasticity are single jersey and light crepe, tailor scissors, lock stitch singer sewing machine, and 100%cotton sewing thread were used.

### 2.2 Method:

In this study the researcher created and produced 20 designs for women without any wastages by using zero waste methods and macramé techniques inspired from Nubian motives. depending on some points as following :

- 1- Using geometric cut as (square – rectangle – triangle) and draped it directly on the body.
- 2- The same geometric piece involved in more than one experiment
- 3- Cut the scraps of fabric into thin strips and applied it with macramé technique inspired from Nubian motives as an oriental effects adding Egyptian identity to designs.

For evaluation of designs, the researcher made a questionnaire composed of 10 items as follows:

- 1- Succession of producing creative design from scraps.
- 2- The design keeps up with fashion trends.
- 3- The design expresses the Egyptian identity.
- 4- Succession of creating macramé strips from scraps.
- 5- Macramé strips added aesthetic values to the design.
- 6- The design achieved the balance between decorative motifs and silhouette.
- 7- The chosen technique achieved high level in the design and application.
- 8- Using the fabric's scraps achieved saving cost.
- 9- The design succeeded in combine concept of zero waste fashion and the aesthetics of macramé motives.
- 10- Unity is achieved the design elements (line-shape – color –material – decorative additions).

Each item assessed on 5- degree (5= strongly agree, 1= strongly disagree).

The researcher presented the twenty designs and asked ten professors and assistant professors in the field of fashion design and garment production technology for evaluation through a questionnaire, each participant viewed the twenty designs and was instructed to read the items in the questionnaire and put a degree for each items through a personal interview.

The following is an over view of twenty creative designs and their technical drawings. They are produced by zero waste and macramé techniques inspired from Nubian motifs.

#### Design 1, 2, 3, 4:

These designs were created from a rectangular piece of fabric with width 120 cm. It was transferred into a top of Jacket and warped around the upper part of body in different ways, macramé strips are applied as value – added decorations. It was inspired from fig. (9).



Design (1)

#### Design 1:

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half hitch knot applied as a value – added decoration.

It is a white cendrine top, loose fitted without sleeves, it has a slit armhole. There are no side seams.

It has shawl collar . The cascades drape left towards the center. The vest has waistline where fabric gathered to make ruffled hem, macramé strips distributed on both sides of collar.

#### Design 2:

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half hitch knot applied as a value – added decoration.

The design consists of plain white shawl that draped around upper part of body, macramé strips add to cap hem.



Design (2)

#### Design 3:

**Zero Waste Technique:** Geo-cut.

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half hitch knot applied as a value – added decoration.

The design consists of plain white cap with shawl collar, macramé strips distributed around two sides of collar.



Design (3)

#### Design 4:

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half hitch knot applied as a value – added decoration.

The design consists of plain white shawl draped across the shoulders making asymmetrical neckline, macramé strips distributed on one side of collar and around another side of shoulder.



Design (4)

**Design 5, 6:**

Formed from two pieces, one of them has a triangular shape which used as a front part and the other has trapezoidal shape that used as back part, and macramé strips were applied as decorative additions.

**Design 5:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half hitch knot applied as a value – added decoration. Nubian motifs were inspired from fig (10).

It is a sac shaped brown blouson without sleeves. Macramé strips were distributed around chest in X shape.



Design (5)

**Design 6:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half hitch knot applied as a value – added decoration, Nubian motifs were inspired from fig (9).

It consists of a brown tunic without sleeves. It has

cowl drape expended to the hem. Macramé strips were distributed around neck and chest.



Design(6)

**Design 7, 8, 9:**

These designs were created from cut left over cloth which draped on the mannequin. The macramé strips are not used as outer cut added, but they emerge from scraps directly. Macramé strips were inspired from fig (9).

**Design 7:**

**Zero Waste Technique:** reused cut left over - draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with Lake knot

three pieces of fabric scraps were used to create a sleeveless black tunic with V neckline and two pockets. Macramé strips were distributed on both sides of the chest.



Design(7)

**Design 8:**

**Zero Waste Technique:** reused cut left over - draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with Lake Knot

The design was created from two pieces of fabric scraps, it's a black vest with cowl collar, and the rest is tied at the waist, the Macramé strips

distributed on two sides of vest.



Design (8)

**Design 9:**

**Zero Waste Technique:** reused cut left over - draping

**Suggest Fabric:** Jersey & light crepe

**Decorative Motifs:** Macramé strips with Lake Knot applied as a value added decoration.

The design was created from one piece of fabric scrap. It's a halter neckline corset with two cowl pieces on the two sides of vest covering the area under the chest. Macramé strips were distributed around the chest.



Design (9)

**Design 10, 11:**

These designs were created from a square piece which used as two triangles, Neck hole was cut as a horizontal slit between them, macramé strips were applied as decorative additions inspired from fig (9).

**Design 10:**

**Zero Waste Technique:** Geo-cut, sewing

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with Lake Knot.

The design is a blouse with domain sleeves and v neckline. Macramé strips were distributed on left shoulder and the right side of hip line.



Design (10)

**Design 11:**

**Zero Waste Technique:** Geo-cut, sewing

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with Lake Knot.

The design is a blouse with domain sleeves, and v neckline where fabric are gathered on middle of the chest. Macramé strips were distributed on both shoulders.



Design (11)

**Design 12:**

The design was created from three pieces of cut leftover cloth which sewing together. Macramé strips were emerged from these scrap directly. It was inspired from fig (9).

**Design 12:**

**Zero Waste Technique:** reused cut left over - draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with Lake Knot.

The design is a sleeveless black tunic made from 3 pieces of fabric scraps. The inner side composed from two pieces forming the halter neckline and a tie under chest, the outer side formed from the third piece covering the upper body with cowl draping. Macramé strips were concentrated on the chest.





Design (12)

**Design 13, 14, 15, 16 :**

These designs were created from one rectangular piece that draped with different ways around upper part of the body. Macramé strips were used a main part of the design inspired from fig (9).

**Design 13:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half knots .

The design is a white tunic with a halter neckline formed from twisting the rectangular piece , macramé strips formed the inner side of the design sending X shaped twist bands over the tunic , macramé motifs were concentrated on the chest.



Design (13)



Design (15)

**Design 14 :**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with half..

The design is white tunic with loose sleeves and deep armholes. It has front cowl drape extend from both sides of shoulders. Macramé strips were fixed as inner piece under the tunic .



Design (14)

**Design 15:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with half knots.

The design is a white tunic with a halter neckline formed from twisting the rectangular piece It has a waist line. Macramé strips were fixed as inner piece under the vest.

**Design 16:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with half.

The design is a white jacket with domain sleeves. It has a deep shawl collar. Macramé strips were fixed as inner piece under the jacket, it covers the chest.



Design (16)

**Design 17, 18, 19, 20:**

These designs were created from a rectangular piece which draped around the upper part of the body, The macramé strips are not used as outer cut added, but they emerge from scraps directly and it's motifs inspired from fig (10).

**Design 17:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with lake knots .

The design is a blue tunic with short wide sleeves and a gathering shawl collar. It has v neck line and high waste line where fabric was draped on both sides. Macramé strips were concentrated vertically in the middle of chest.



Design (17)

**Design 18:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with lake knots .

The design is a short blue cape reaching to elbow. It has wide short sleeves with slit armholes. It has a shawl collar, macramé strips were distributed vertically on both sides of midline.



Design (18)



Design (19)

**Design 19:**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** macramé strips with lake knots .

It is a short vest with halter neckline. It has a waistline where fabric was gathered to make ruffled hem. Macramé strips extend vertically from neckline to nearby waist line.

**Design 20 :**

**Zero Waste Technique:** Geo-cut, draping

**Suggest Fabric:** Jersey

**Decorative Motifs:** Macramé strips with lake knots .

The design is a short top with halter neck line. It has cascades full down from the center, macramé strips were distributed around neck line



Design (20)

**Validity and Reliability of the Questionnaire:**

**1-Validity of the Questionnaire:**

Validity is the extent to which a test measures what it is supposed to measure. Validity was calculated using internal consistency by calculating the correlation coefficient (Pearson Correlation Coefficient) between the total score for each item and the total score of the questionnaire, and the following table illustrates this.

**Table 1: Values of correlation coefficient between the score for each item and total score of the questionnaire**

Item	Correlations	Sig
Item 1	0.795	0.01
Item 2	0.902	0.01
Item 3	0.714	0.01
Item 4	0.829	0.01
Item 5	0.777	0.01
Item 6	0.641	0.05
Item 7	0.851	0.01
Item 8	0.940	0.01
Item 9	0.635	0.05
Item 10	0.608	0.05

It is evident from the table (1) that, the correlation coefficients are all significant at the level of (0.01,

0.05) as it approached from the one which shows the reliability of the items and the homogeneity of the questionnaire's items.

**2-Reliability of the Questionnaire:**

Reliability refers to how accurately a technique actually measures the phenomenon you are investigating. So, reliability means repeatability or consistency. A measure is regarded as reliable if it would give us the same result on repeated use, assuming what you are measuring doesn't change as you measure it, or between measurement. Reliability was calculated by using cronbach's alpha coefficient (a) and split – half.

**Table (2): Reliability Coefficient values for the items of the questionnaire**

Items	Cronbach's alpha (a) coefficient	Split – half
The stability of the questionnaire as a whole	0.824	0.903-0.761

It is evident from the table (2) that all the values of reliability coefficients: Cronbach's alpha coefficient ( $\alpha$ ) and split – half a significant at the level of 0.01 which demonstrates the reliability of the questionnaire.

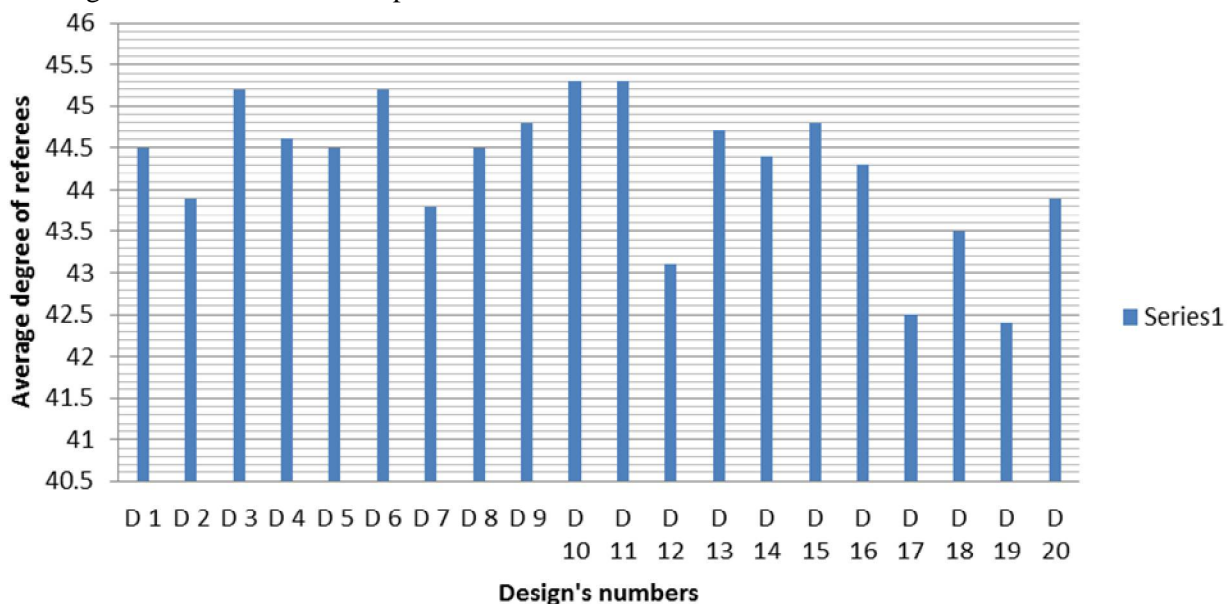
**Referee Comparison:**

**Table (3) the average results of questionnaire for evaluating designs.**

	Designs' numbers																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ref 1	44	45	46	46	46	47	44	47	47	46	45	45	45	46	47	45	45	46	47	46
Ref 2	42	44	44	44	41	43	46	44	43	45	44	43	41	36	36	41	44	44	45	44
Ref 3	42	46	43	44	50	50	46	50	48	46	44	49	44	42	46	43	32	37	42	39
Ref 4	49	47	49	47	48	46	44	48	49	49	48	50	49	49	49	49	48	48	48	49
Ref 5	35	36	34	38	37	39	43	43	39	32	38	39	36	37	40	42	39	42	36	33
Ref 6	47	48	50	46	41	48	48	46	50	50	49	38	47	49	48	47	42	38	39	43
Ref 7	50	48	50	49	49	47	40	42	40	48	47	42	47	46	45	45	46	47	46	48
Ref 8	45	44	46	47	44	45	46	43	45	44	47	45	44	46	46	46	45	44	46	45
Ref 9	45	45	45	45	46	47	46	45	47	43	46	46	44	46	43	48	49	50	43	50
Ref 10	46	36	45	40	43	40	35	37	40	50	45	34	50	47	48	37	35	39	32	42
Average	44.5	43.9	45.2	44.6	44.5	45.2	43.8	44.5	44.8	45.3	45.3	43.1	44.7	44.4	44.8	44.3	42.5	43.5	42.4	43.9

It is evident from table (3) that the design no. 10 and the design no 11 came first with an average of 45.3, followed by the design no. 3 and the design no. 6 in the second with an average 45.2, then the ninth design and the fifteenth design came in third position with an average 44.8, the design no.13 came in the fourth position with an average 44.7, the design no 4 came in the fifth position with an average 44.6, the designs no. (1,5&8) came in sixth position with an average of 44.5, followed by the design no 16 in the seventh position with an

average of 44.3, the design no. (2&20) came in the eighth position with an average of 43.9, then the design no. 7 came in ninth position with an average of 43.8, then the design no 18 came in tenth position with an average of 43.5, followed by the design no. 12 in the eleventh position with an average of 43.1, then the design no. 17 came in twelfth position with an average of 42.5, finally the design no. 19 came in the last position with an average 42.4.



**Figure 11.**the average degrees of the referees for each design



**Table (4) significant differences between the designs produced**

Designs produced	Mean "m"	Standard Deviation "SD"	Number of Sample "n"	Confidence Level (95.0%)
D1	44.5	4.031	20	1.884
D2	43.9	4.182	20	1.954
D3	45.2	4.400	20	2.056
D4	44.6	3.169	20	1.481
D5	44.5	3.879	20	1.813
D6	45.2	3.341	20	1.561
D7	43.8	3.600	20	1.682
D8	44.5	3.442	20	1.609
D9	44.8	3.842	20	1.795
D10	45.3	5.001	20	2.337
D11	45.3	2.900	20	1.355
D12	43.1	4.742	20	2.216
D13	44.7	3.848	20	1.798
D14	44.4	4.363	20	2.039
D15	44.8	3.868	20	1.808
D16	44.3	3.437	20	1.606
D17	42.5	5.277	20	2.466
D18	43.5	4.201	20	1.963
D19	42.4	4.964	20	2.320
D20	43.9	4.826	20	2.255

Table (4) shows the average degree of the referees for each design (mean) and the standard deviation (SD) between the average degree of the referees, which ranged from 2.900% as the lowest value and 5.277% as the highest value. The confidence level (95.0%) which shows that the moral calculated is greater than 0.05 and this indicates that there is no significant difference between the results of the referees for each design, which indicates that the representation and judgment on these results correctly according to the statistical analysis.

#### **4. Discussion:**

To get idea about designs that best indication the researcher review the next:

**Designs (10, 11):** They keep up with fashion trends at the same time they express the Egyptian identity, The simplicity of the idea and application were behind design success and the aesthetic value was achieved by using macramé strips with motifs balanced with lines of designs.

**Designs (6):** it focuses on fashionable femininity look which reflected in the design's lines and simplify design pattern, the triangular piece of fabric enabled to make draping lines which add aesthetic appearance with a comfortable sensation and the addition of trapezoidal piece in back add modernity to the design.

#### **Design (9, 15):**

They are different in pattern parts, they emphasized the femininity look by halter neck

which allowed the smoothness of draping lines appear. Decorative macramé strips concentrated on the chest in order to pay attention for draping lines patterning with curved lines which gave a soft and pretty look.

#### **Design 17:**

It was created from rectangular piece of fabric and the construction of design is may be featured with complicated look which take the design a way from fashionable look and expressing the Egyptian identity. Decorative motifs distributed in manner may lead to lose its Nubian sign and aesthetic value.

#### **Design 19:**

The complicated look may cause the design not to express the properties of unity (line – shape – decorative additions). Application technique of zero waste didn't achieve advanced level in the field of designing and production, distribution of macramé strips may be not computable with design lines.

#### **Conclusions:**

- 1- The application of zero waste fashion can be used in designing and producing the women clothes.
- 2- Macramé technique can be applied from scraps and used in designing and producing the women's clothes.
- 3- Macramé technique can applied in Nubian motifs and used in designing and producing women's clothes expressing Egyptian identity

and enriches the aesthetic values.

- 4- As regard to the result of the statistical evaluation :
- most of designs achieve success.
  - designs no (10, 11, 6, 15) get the higher scores where they based on (Geo- cut) technique.
  - Designs no. (9) was competitor for designs no (10, 11, 6, 15) in their scores which is the only design from left over scraps group

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