

Apparel Design for Plus-Size Females in Scope of Recycled Fabric Manipulation Techniques

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Abstract:

Nowadays, there is an increasing interest of plus size models with different body shapes in fashion shows all over the world. Therefore, the acceptance of plus size body shapes is increasingly common in the foreign societies. In addition, fabric is a key variable in fashion design in terms of colors, weights, patterns, and textures. The recycled fabric manipulation techniques provide various opportunities for creative fashion designs yet devise sustainable formulation for the dimensions of plus size females. The study problem is to support plus size Egyptian females to gain better acceptance in the Egyptian society and define the best fabric manipulation techniques to be applied in plus size fashion design in scope of sustainable fashion design. Therefore, the study aims to examine the potential of using recycled fabric manipulation techniques for plus size females in the age group (20-30) in scope of recycled fabrics through the aesthetics of fabric manipulation techniques. The importance of the study is to provide the market of plus size apparel with contemporary innovative casual cardigan designs using recycled fabric in scope of fabric manipulation aesthetic and functional aspects to achieve better acceptance for plus size females in the Egyptian society. The study follows the descriptive analytical and experimental methodologies. The designs were based on an interview and a survey for plus size females in the age group (20-30) to determine their problems and requirements concerning the cardigan design. The interview included 45 females while the survey included 460 females. The study relied on exploring three innovative techniques of fabrics manipulation and apply them on nine fashion designs for plus size females in the age group (20-30). A questionnaire was applied on 34 specialists in the fashion field and another questionnaire was applied on 45 plus size females to find out the best designs and fabric manipulation techniques suitable for the target age group with the target size. Accordingly, the major results of the research were determined through the statistical data analysis using SPSS-PC statistical program package version 27, the three designs which got the highest acceptance levels in the two questionnaires were implemented using recycled fabric manipulation techniques. The final results proved that the best technique of fabric manipulation between all three techniques is Ripple Knife Pleats, followed by Reverse Applique, and then Layering and Slashing.

Keywords:

Apparel Design- Plus Size Females- Fabric Manipulation- Recycling- Body Shape

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1. Introduction:

Preserving the environment is the most important requirements of modern sustainable apparel industry, as the pollution resulting from this industry has a great impact on the environment starting from the design process. Therefore, costumers have become aware of the need to protect the environment and themselves by using recycled fabrics.

Furthermore, fabric is a key variable in the process of apparel design, as it offers unlimited options in terms of colors, weights, and textures. In addition, fabric manipulation provides effective techniques for the apparel designers to create innovative contemporary designs of recycled fabrics.

On the other hand, although the sociocultural theoretical studies highlight the social believe for standards of thinness which is promoted by media,

and fashion models (Zancu, S.A., et al., 2019), in 2018 the World Health Organization confirms the global epidemic "globesity", referring to "a globe obese" (Büttner, A.J., et al., 2019). In addition, the studies' statistics estimate that over 50% of nowadays female's all over the world are size 14+ (Constance, P., et al., 2019). As there are few apparel designers, industries and retailers who offer apparel for plus size female consumers, these consumers cannot express themselves in a modern look specially in the Egyptian society. These consumers seek for modern apparel designs that fulfill their requirements, express their personality, and make them feel acceptable in the Egyptian society.

In this context, the study aims to examine the potential of using recycled fabric manipulation techniques to produce cardigans for plus size females in the age group (20-30) in scope of

recycled fabric manipulation aesthetic and functional aspects to achieve better acceptance for plus size females in the Egyptian society.

2. Literature Review

2.1. Recycling

The annual number of losses in the Arab countries caused by neglecting waste recycling exceeds \$ 5

billion which can produce 202 million tons of cloth for \$110 million (Shweikhi, J., et al., 2017). In addition, it is confirmed that apparel industry has damaging effects to climate change, as it causes more than 8% of carbon emissions globally and is expected to increase by 50% in 2030. (Assoune, A., 2020) (Figure 1)



Figure 1. Climate impact through the apparel lifecycle's steps (BoF, 2022)

Concerning the climate change problem, it is important that apparel designers explore sustainable strategies. Recycling is one of these strategies that can pursue ethical apparel designs through fabric manipulations (Burns, A., 2022). Recycling means the re-manufacturing, either for expired products, or for waste materials generated during production processes (Ahmed, S.M., 2020). It could be defined as a process in which some raw materials or waste fabrics are used to produce new products. (Yousry, R., et al., 2022)

Materials recycling warrant the attention of the apparel industry, as it improves the industry's sustainability and provide cost-competitive opportunities and better connections with consumers. (BoF, 2022)

2.2. Fabric Manipulation:

Weaving, embroidery, printing, and fabric manipulation techniques are used to transform normal fabrics into unique fabrics.

The word manipulation is used based on the exploitation of different raw materials and wastes (Attia, S., 2022). Therefore, fabric manipulation is defined as a modification of fabrics to create new innovative fabrics' surfaces (Burns, A., 2022), in scope of compliance with the design elements and principles for a complete harmony (Al-Shammari, A., 2019), considering the aesthetical, technical and functional aspects, in addition to the properties of the fabric. (Barakat, M., 2020)

The researcher defines the fabric manipulation as "creative techniques where flat fabrics are used to create regular or irregular three-dimensional unique fabrics according to fabrics' properties".

The researcher divides the fabric manipulation techniques into three categories:

1. Texturing: using pleats and gathers.
2. Stitching: using stitches, cuts, and trims.
3. Tuck: using stitched folds in different directions. (Table 1)

Table 1. Examples of fabric manipulation

	Ripple Knife Pleats	Folds	Gatherd Folds
Texturing			
	Cut Away Applique (Reverse Applique)	Layering and Slashing	Cut Surface Quilting
Stitching			
	Slashed Tuck	Blind Tuck	Arrow Smocking
Tuck			

(Wolff, C., 1996), (Qurashi, W.,2021), (Ahmed, O., et al., 2019), (Small,A.,2017), (Burns, A., 2022)

Moreover, fabric manipulation became prevalent in the creative fashion realm. Famous fashion designers involved fabric manipulation in their innovative collections such as the pleated silk of Mariano Fortuny, the appliques of Issey Miyake, and Iris Van Herpen who uses fabric manipulation

and mix it with new technologies. The researcher believes that the importance of fabric manipulation in the apparel design is evident through preparing the designer by creative artistic solutions for the creative formation of the fabrics and the functional performance of the final apparel design. (Figure 2)



Figure 2. fabric manipulation in the collections of Iris Van Herpen. (Herpen, I., 2023)

2.3. Apparel Design for Plus Size Consumers:

Body shape is defined as a quantitative description of the body's morphological structure, expressed in three main types, which are Ectomorph, Mesomorph and Endomorph (Ali, S., 2018). The range of female sizes above 16 are plus size

“Endomorph type” for UK point of view, while it is above 14 for USA point of view (Constance, P., et al., 2019) and above 44 for Arabs point of view according to French's measurements chart. (Table 2)

Table 2. Females' size chart

UK	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
USA	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
France	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62

Females' dissatisfaction about their body sizes is linked to the cultural acceptance, which influence female's physiological problems (Robinovich, J., et al., 2021). Studies proved that exposure to thin model images in media and fashion shows increases body dissatisfaction for plus size females (Tiggemann, M., et al., 2020). Moreover, studies proved that plus-size female consumers are extremely unsatisfied concerning the available apparel designs, styles, fitting, in the plus size market. (Shiva, H., 2021)

Although studies proved a significant proportion of adults globally towards plus size (Gyi, D., et al., 2019), there is a serious lack of females' plus-size apparel designs, which is summarized in plain or dark colors and unfashionable basic designs (Dion, D., et al., 2020). Therefore, plus size female consumers are very limited in apparel designs which causes the feeling of dissatisfaction. (Christel, D.A., et al., 2018)

As a response to that, the Body Positive Movement (BPM) appeared lately in USA as an extension of National Association to Advance Fat Acceptance (NAAFA), which was generated in 1969 in USA to call for:

- Include models with different body sizes in media.

- apparel designers, industries and retailers should include products for different body sizes. (Thompson, M.L., 2020), (BBC,2022)

Some brands and retailers responded to the calls of BPM and offered plus size apparel designs such as Elvi, Premme, Phase Eight, ASOS, River Island, Primark, H&M, DXL, Boohoo, New Look and Nike for active wear. In addition, few brands specialized in plus size designs such as Jean Marc Philippe, Ulla Popken, and Marina Rinaldi.

According to the market research of NPD (National Purchase Diary Panel Inc.), the USA female's plus-size apparel reached \$21.4 billion in 2016(Sokolowski, S.L., et al., 2019). Furthermore, plus-size female apparel retail has annual growth of 4.6% starting from 2018 and is expected to increase by the support of plus size models such as Ashley Graham, Candice Huffine and Tess Holliday(Constance, P., et al., 2019). Accordingly, the researcher believe that it is essential to consider the plus size market in Egypt as it proved to be a very promising market in the future.

3. Methods and Analysis:

The study aims to provide the market of plus size apparel with innovative casual cardigan designs using recycled fabric in scope of fabric manipulation aesthetic and functional aspects to

achieve better acceptance for plus size females in the Egyptian society in the age group (20-30).

3.1. Interview and Survey:

An interview and a survey were conducted for plus size females in the age group (20-30) to determine their problems and requirement concerning the cardigan design. The interview included 45 females, while the survey included 460 females.

The questions included two sections, the first is personal information such as age, education level and place of living. The second is about cardigan concerning cardigan's size, style, color, fabric, embellishment technique, the ability of wearing cardigan of recycled fabrics, and the reasons of buying cardigans.

For the first section, most of the participants were in the age group (20-30) and the majority were highly educated and living in Cairo and Giza, Egypt. (Figure 3-4)

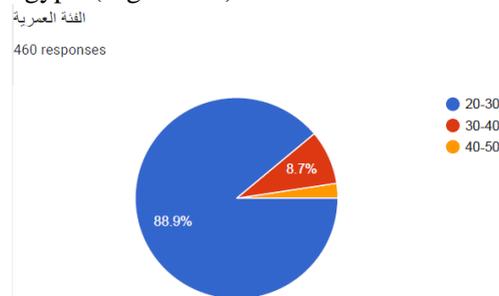


Figure 3. Age Group

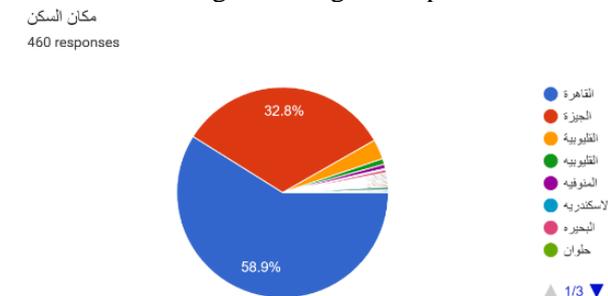


Figure 4. Place of Living

For the second section, participants' sizes were 12.4% "more than 2XL", 40.4% "2XL", 23.5% "XL" and 14.6% "L". 77.4% of the participants preferred "the casual style" while 22.6% preferred the "classic style". When asking the participants about the factors that affect their choices when buying clothes, the factors' order was "design" in the first place followed by "fashionable, price, color, fabric and finishing" in the last place. The participants were asked about the reason for buying a cardigan and the order of the reasons was "it is attractive, and I like it" in the first place, "it is fashionable" in the second place, and "I need it" in the third place. (Figure 5- 8)

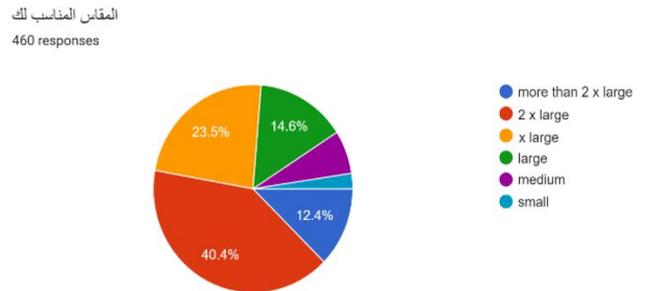


Figure 5. Size

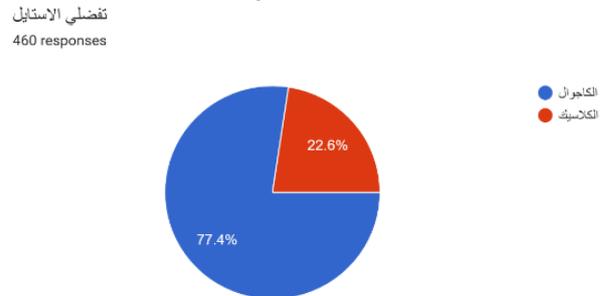


Figure 6. Style

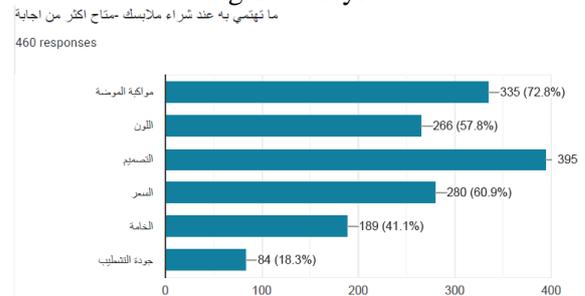


Figure 7. Factors for buying decision

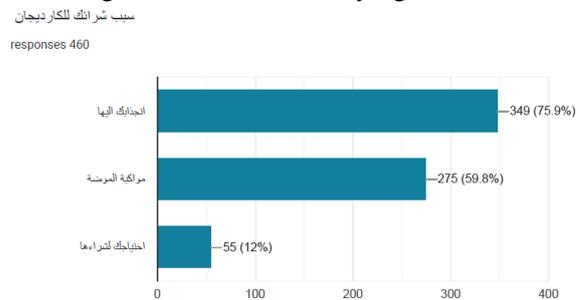


Figure 8. The reason for buying a cardigan

The researcher asked the participants about their problems with the available cardigan designs and which factors needs to be adjusted and redesigned according to fashion trends, the responses proved that most participants are completely unsatisfied with what is available in the market. The participants confirm that as soon as the size is over 42, the female suffers to find a fashionable cardigan that fits her body shape. They asked for redesigning the "cutlines, lengths, fabrics, and embellishment technique". In addition, when asking the participants about the factors that affect their choice for a certain cardigan design, the factors' order was "comfortable" in the first place, followed by "new look, simple look, and easy to put on and take of"

in the last place. The researcher asked the participants about their preferred cardigan's width, the majority voted for "the wide and very wide". In addition, concerning the cardigan's embellishment, most of the participants preferred to have "small size motifs" while the rest preferred to have "a plain cardigan". The researcher asked the participants for their preferred closure item and the order was "buttons" in the first place, "hooks" in the second place, and the cardigan is "open" in the third place. Furthermore, the order of the cardigan's color was "neutral colors" in the first place, then "cold colors" in the second place, and "hot colors" in the third place. Moreover, the order of the cardigan's fabric the order was "jeans" in the first place, followed by "wool, linen, cotton, and polyester" in the last place. (Figure 9-14)

اي العناصر ترغبين في تجديدها مقارنة بالمتوفر حالياً بالاسواق
responses 460

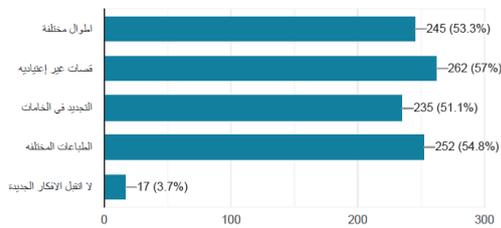


Figure 9. Cardigan's items to be redesigned

اسباب تفضيل تصميم الكارديجان-مناخ أكثر من اجابة
responses 460

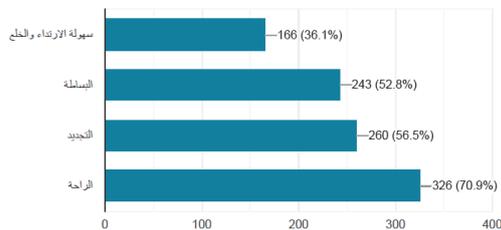


Figure 10. Factors to choose cardigan design

تفضلي اساتيل الكارديجان
responses 460

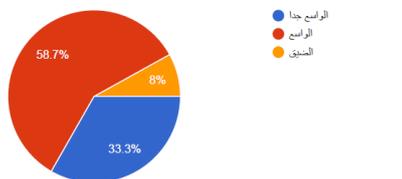


Figure 11. Cardigan's width

حجم الزخارف على الكارديجان
460 responses

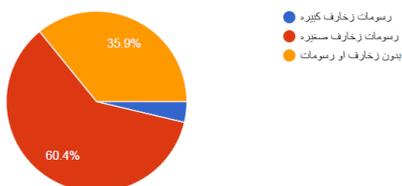


Figure 12. Cardigan's embellishment

تفضلي اسلوب اغلاق الكارديجان - مناخ أكثر من اجابة
responses 460

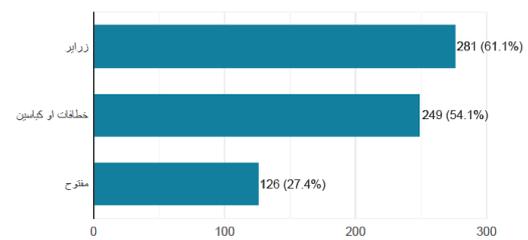


Figure 13. Cardigan's front closure

الالوان المفضلة للكارديجان - مناخ أكثر من اجابة
460 responses

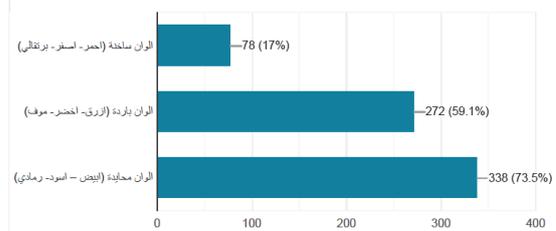


Figure 14. Cardigan's color

The researcher asked the participants about their opinion in using recycled fabrics and embellishing the cardigans using fabric manipulation techniques. The participants accepted both ideas of using recycled fabric and fabric manipulation techniques as they believe it will be fashionable cardigans that adds modern aesthetic look and uniqueness for their style. (Figure 15-16)

هل يمكنك ارتداء كارديجان من خامسة معاد تدويرها
responses 460

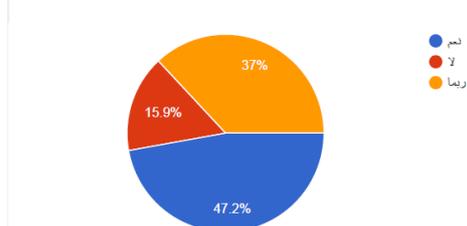


Figure 15. Using recycled fabrics

هل تفضلي استخدام زخارف باستخدام تقنيات مختلفة في القماش
responses 460

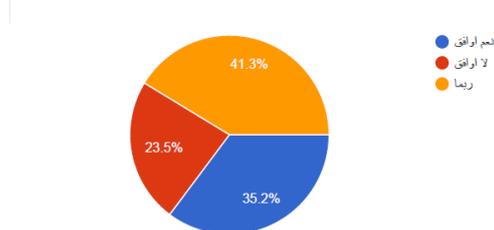


Figure 16. Using fabric manipulation techniques
In addition to that, through the interviews, the participants complained that the apparel brands in the Egyptian markets are targeting small size consumers and when a brand produce plus size cardigans, it usually has fitting problems in addition to the basic and unfashionable designs. They confirm that plus size female in the Egyptian society feels neglected from the fashion market,

which causes sort of depression feeling while shopping. Furthermore, these negative feelings are increasing when these plus size Egyptian females expose to the foreign plus size models in fashion shows and foreign apparel markets which are targeting plus size females.

As female express herself through the fashion image, the participants complained from the Egyptian society impression towards them because they do not look as fashionable as thin females. The society refers this look as they are unhealthy, lazy, and poor to afford suitable designs that fits their body, while they refer the fashionable look of the thin females as they are healthy, active, and upper class. The truth, that plus size females are suffering to find the fashionable design that suits their body shapes.

The participants approved that apparel brands do not include plus size cardigan designs to their collections as this could undermine the brand image. They complain that the majority of cardigans available in the market for plus size females are basic, plain and completely far of the fashionable look.

The participants' experiences with the apparel market in the Egyptian markets reflects the serious lack of consideration to their requirements. The available cardigans have awkward look and fitting for plus size females as they are not designed or produced to suite their requirements.

The participants approved that they seek to be unique through their clothes and respect their expectations and requirements. Therefore, the researcher believes that in our urban lifestyle consumers should be the reference source for the apparel designers and industry. Plus size females in the Egyptian society have requirements to dress fashionable clothes that suits their bodies. They do not have to think that they have to modify their

bodies to fit smaller sizes, but the opposite is what should be done that the size, design and production must be modified to fulfill the requirement of an increasing the Egyptian market of plus size.

3.2. Designs:

The researcher used recycled fabrics to produce cardigans that suit plus size females in the Egyptian society, yet fashionable. The recycled fabrics were denim and cotton in different weights, colors and textures and the choice of the fabrics was depending on fashion trends, requirements of plus size females, the suggested design, and the colors schemes to achieve harmony.

The researcher used pencils and papers to illustrate sketches for plus size females' cardigans divided into design lines. Final three cardigan design lines were illustrated by adobe illustrator and adobe photoshop computer programs. Each design line consisted of three designs that fulfill the requirements of plus size females in the Egyptian society and suit their body shapes yet follow the latest fashion trends.

3.2.1. Aesthetic Aspects for the Cardigan Designs:

Three fabric manipulation techniques were used to personalize each design of the suggested lines, to keep pace with the fashion trends and use unusual embellishment techniques to enrich the aesthetic and functional aspects of the design. The used fabric manipulation techniques were ripple knife pleats for the first design line, reverse applique for the second design line, and layering and slashing for the third design line.

Designs follow the theme of High-Contrast Brights for A/W 24/25 according to WGSN reports (Figure 17). The theme considers the dynamic palette, affected by nature with increasing need for optimism in lifestyle products that have soft and spontaneous quality.



Figure 17. High-Contrast Brights for A/W 24/25 (Kostiak, Y., 2022)

The researcher considered the design principles represented in symmetry, proportionality, balance, and contrast between all design elements concerning cutlines, colors, textures, and shapes to achieve the unity, harmony and consistency that fulfill the aesthetic aspects in designing cardigans for plus size females in the Egyptian society.

3.2.2. Functional Aspects for The Cardigan Designs:

By studying the body shapes of plus size females, the researcher concluded the main design requirements for plus size females that should be taken into consideration to achieve a constant look for the female and gain better acceptance in the

society. Using the suitable silhouettes such as “A”, “tent” and “I” is very important factor to be considered as it has great impact concerning the body appearance. The use of vertical cutlines and embellishments and avoiding horizontal cutlines and round neck lines, reduce the appearance of the body to appear thinner. In addition, using small embellishments in the center of the design attract the eyes to the center part of the body neglecting the side areas of the body which gives the illusion for a thinner body shape. Furthermore, the colors should be carefully chosen as it play an important role in the apparel design for plus size females. Moreover, designers should avoid the waist length designs for the upper part of the body and rely on the knee length designs to ensure a thinner look for the full abdominal area.

For the current study, fabric manipulation techniques offered unlimited solutions for creating innovative casual designs for plus size cardigans. Fabric manipulation added unique value to the designs and offered an attractive fashionable look. In addition, the different fabric manipulation techniques provided harmonic look to plus size female body which fulfill the requirement of the plus size female. Furthermore, using fabric manipulation provided modern techniques for recycling waste fabrics in a fashionable look that keep pace with the apparel sustainability values. The researcher considered the requirements for plus size females in the Egyptian society according to the outcomes of the interview and the survey

concerning design items, cut-lines, width, embellishment, closures, fabrics, colors, styles, collars, necklines, fitting, and the reason for buying cardigans. Moreover, fabrics are jeans and cotton due to its suitability for cardigan design in terms of durability, and comfort, and easy wash and care to fulfill the functional aspects in designing cardigans for plus size females in the Egyptian society.

3.2.3. Design Lines:

3.2.3.1. First Design Line Relies on Ripple Knife Pleats Fabric Manipulation:

This design line follows the “Tent” silhouette, as it has a tight-fitting look for upper part of the design and wide flared for the bottom part starting from waist level. The cardigans (design 1,2, and 3) are sleeveless with different shapes for armhole line. Different shapes of neckline were used, and the closures are designed to be hidden hooks. The length of the cardigans reaches the knee level with various shapes for hem line. The ripple knife pleats fabric manipulation are recycled denim in the reverse face of the jeans fabric to achieve a harmonical shades through the pleats and play important role as visual illusion. The ripple knife pleats fabric manipulation were used in the center of the design to attract the eyes to the center part of the body neglecting the side areas of the body which gives the illusion for a thinner body shape. In addition, having the ripple knife pleats fabric manipulation in vertical lines in the center of the design promotes a thinner appearance for the wearer. (Figure 18-21)

First Design Line Relies on Ripple Knife Pleats Fabric Manipulation



Figure 18. Ripple Knife Pleats Fabric Manipulation



Figure 19. Design No. 1



Figure 20. Design No. 2



Figure 21. Design No. 3

3.2.3.2. Second Design Line Relies on Reverse Applique Fabric Manipulation:

This design line follows the “A” silhouette, as it has a tight-fitting look of the upper part of the design and wide bottom part starting from waist level with straight hem lines. Two cardigans (design 4 and 6) are sleeveless with different shapes for armhole line while the (design 5) has drop shoulders. Two necklines in a V and square shapes were used in (design 4 and 5), in addition to a shawl collar for (design 6), and the closures are designed to be hidden hooks for (design 4 and 5) and buttons for (design 6). The length of the cardigans reaches the knee level with various lengths for hem lines. The reverse applique fabric manipulation is recycled

jeans in the reverse face of the fabric to achieve a harmonical shades through the appliques and play important role as visual illusion. The reverse applique fabric manipulation was used in the center of (design 4 and 5) to attract the eyes to the center part of the body neglecting the side areas of the body which gives the illusion for a thinner body shape. The reverse applique fabric manipulation was used in the sides of (design 6) which gives the illusion for a deep look in the holes to achieve a thinner body shape. In addition, having the reverse applique fabric manipulation in vertical areas of the design promotes a thinner appearance for the wearer. (Figure 22-25)

Second Design Line Relies on Reverse Applique Fabric Manipulation



Figure 22. Reverse Applique Fabric Manipulation



Figure 24. Design No. 5



Figure 23. Design No. 4



Figure 25. Design No. 6

3.2.3.3. Third Design Line Relies on Layering and Slashing Fabric Manipulation:

This design line follows the “I” silhouette, as it has a straight-fitting look of the design with straight hem line. Two cardigans (design 8 and 9) are sleeveless with different shapes for armhole line while (design 7) design has batwing sleeves. Two different shapes of neckline were used (design 7 and 9) in addition to a mandarin collar (design 8), and the closures are designed to be hidden hooks for two designs (design 7 and 9) and buttons for the third design (design 8). The length of the cardigans

reaches the knee level with various lengths. The layering and slashing fabric manipulation is recycled bright colored cotton fabrics to achieve the contrast through the slashes and play important role as visual illusion. The layering and slashing fabric manipulation was used in the center of the design to attract the eyes to the center part of the body neglecting the side areas of the body which gives the illusion for a thinner body shape. In addition, having the reverse applique fabric manipulation in vertical areas of the design promotes a thinner appearance for the wearer. (Figure 26-29)

Third Design Line Relies on Layering and Slashing Fabric Manipulation



Figure 26. Layering and Slashing Fabric Manipulation



Figure 27. Design No. 7



Figure 28. Design No. 8



Figure 29. Design No. 9

3.3. Study Tools:

According to the collected data and the study approach; the researcher found that questionnaire is

a suitable tool to achieve the objectives of the study. (Table 3)

Table 3. Fifth Likert scale

Response	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Rate	5	4	3	2	1

The questionnaire investigates “the potential of using recycled fabric manipulation techniques for plus size Egyptian females in the age group (20-30) in scop of recycled fabrics through the aesthetics of fabric manipulation techniques”. Likert scale is used in the questionnaire to measure the responses.

3.4. Data Analysis:

Analyses were conducted using the SPSS-PC statistical program package, Version 27. Descriptive analysis of the scale was conducted, and measures of central tendency were evaluated for each item and the total scale score.

3.5. Validity and Reliability:

Validity and reliability are two concepts that are important for defining and measuring bias and distortion in this study.

3.5.1. Specialists' Questionnaire:

Cronbach's alpha was used to examine the internal reliability of the total “10” questions of Specialists' questionnaire. Cronbach's alpha value method, regarding the reliability of the given response has been confirmed at 0.961 for all “10” questions. The scale items used have a satisfactory internal

consistency and can be deemed reliable statistically.

3.5.2. Non- Specialists' Questionnaire:

Cronbach's alpha was used to examine the internal reliability of the total “8” questions of non-Specialists' questionnaire. Cronbach's alpha value method, for the reliability of the given responses has been confirmed at 0.966 for all 8 questions. Cronbach's coefficient alpha shows the total 8 questions had high acceptable internal consistency.

3.6. Empirical Data of Correlation Analysis for Specialists' and Non- Specialists' Questionnaires

Correlation analyses between variables were conducted using Pearson correlations. A simple correlation was computed within each question with sum of all questions, the significance level for the correlation statistics in this study was set at $p < .01$.

The results of the present study variables proves that there is a significant correlation ($p < 0.001$) between each question and sum of all questions. Corrected item-total correlation values are above 0.3 and hence, have a measure similar to the scale as a whole. (Table 4, 5)

Table 4. Pearson Correlation Analysis of Specialists' questionnaire

no	Specialists' questionnaire	Correlation	Sig.
1	The design is suitable for the age group (20-30) years	.830**	0.000
2	The design lines are appropriate for plus-size body-shapes (sizes greater than 44)	.844**	0.000
3	The technique of fabric manipulation adds an aesthetic value to the design	.885**	0.000
4	There is a compatibility between the used fabric manipulation and the design elements as a whole	.899**	0.000
5	The suggested colors are compatible with plus-size body-shapes to provide a consistent body appearance	.842**	0.000
6	The fabric manipulation technique provides a consistent body appearance	.903**	0.000
7	The succession of using the concept of recycled fabric manipulation	.879**	0.000
8	The jeans fabric is suitable for implementing the design	.751**	0.000
9	The design keeps pace with contemporary fashion trends	.893**	0.000
10	The design contributes in creating a design treatment for plus-size body-shapes, so that it provides a consistent body appearance	.870**	0.000

**Correlation is significant at the 0.01 level (2-tailed).

Table 5. Pearson Correlation Analysis of non-Specialists' questionnaire

no	Non-Specialists' questionnaire	Correlation	Sig.
1	The design is suitable for the age group (20-30) years	.894**	0.000
2	The design is suitable for plus-size body-shapes to provide a consistent body appearance	.872**	0.000
3	The suggested colors are compatible with plus-size body-shapes	.905**	0.000
4	The technique of fabric manipulation adds an aesthetic value to the design	.930**	0.000
5	The jeans fabric is suitable for implementing the design	.893**	0.000
6	The acceptance of using the concept of recycled fabric manipulation	.888**	0.000
7	The design keeps pace with contemporary fashion trends	.926**	0.000
8	The design can be purchased if sold in the market	.904**	0.000

** Correlation is significant at the 0.01 level (2-tailed).

4. Results:

4.1. Data Analysis And findings

4.1.1. Descriptive Statistics

The descriptive statistics utilized in the current study to analyses the demographic data included frequencies and percentages. Thirty- four specialists in the apparel industry field from a

variety of specializations and age groups were involved in the specialists' questionnaire. In addition, Forty- five plus size non-specialists' Egyptian females from a variety of age groups, sizes and heights were involved in the non-specialists' questionnaire. (Table 6)

Table 6. Demographic profile of non-specialists' respondents

Demographic profile		Frequency	Percent
Age	From 20-30 years	39	87%
	Older than 30 years old	6	13%
	Total	45	11.1
Size	Sizes range from (38-42)	4	9%
	Sizes range from (44-48)	22	49%
	Sizes range from (50 - 54)	19	42%
	Total	45	100%
Height	150-160 cm	22	49%
	160-170 cm	19	42%
	170-180 cm	4	9%
	Total	45	100%

4.1.2. Results Of the Descriptive Statistics for Specialists' and Non- Specialists' Questionnaires

This analysis helps to test the hypotheses, by investigating the relationship between the different variables that the questions represent.

4.1.2.1. Specialists' Questionnaire

The independent variables that were measured at the ordinal level included (10 statement). The independent variables were treated as continuous variables, which is common for the 5-point Likert scale items where the overall mean score is 4.23. (Table 7) (Figure 30)

Table 7. Means and percentage of mean and responses for Specialists' questionnaire

no	Specialists	Mean	Std. Deviation	%	T	Sig.	rank
1	The design is suitable for the age group (20-30) years	4.25	0.815	85.0%	26.72	0.000	6
2	The design lines are appropriate for plus-size body-shapes (sizes greater than 44)	4.1	0.870	82.0%	22.22	0.000	9
3	The technique of fabric manipulation adds an aesthetic value to the design	4.27	0.785	85.4%	28.25	0.000	3
4	There is a compatibility between the used fabric manipulation and the design elements as a whole	4.27	0.798	85.4%	27.81	0.000	4
5	The suggested colors are compatible with plus-size body-shapes to provide a consistent body appearance	4.28	0.788	85.6%	28.37	0.000	2
6	The fabric manipulation technique provides a consistent body appearance	4.07	0.862	81.4%	21.76	0.000	10
7	The succession of using the concept of recycled fabric manipulation	4.26	0.753	85.2%	29.29	0.000	5
8	The jeans fabric is suitable for implementing the design	4.39	0.680	87.8%	35.82	0.000	1
9	The design keeps pace with contemporary fashion trends	4.24	0.828	84.8%	26.10	0.000	7
10	The design contributes in creating a design treatment for plus-size body-shapes, so that it provides a consistent body appearance	4.15	0.859	83.0%	23.42	0.000	8
sum all		4.23	0.80	84.6%	99.25	0.000	

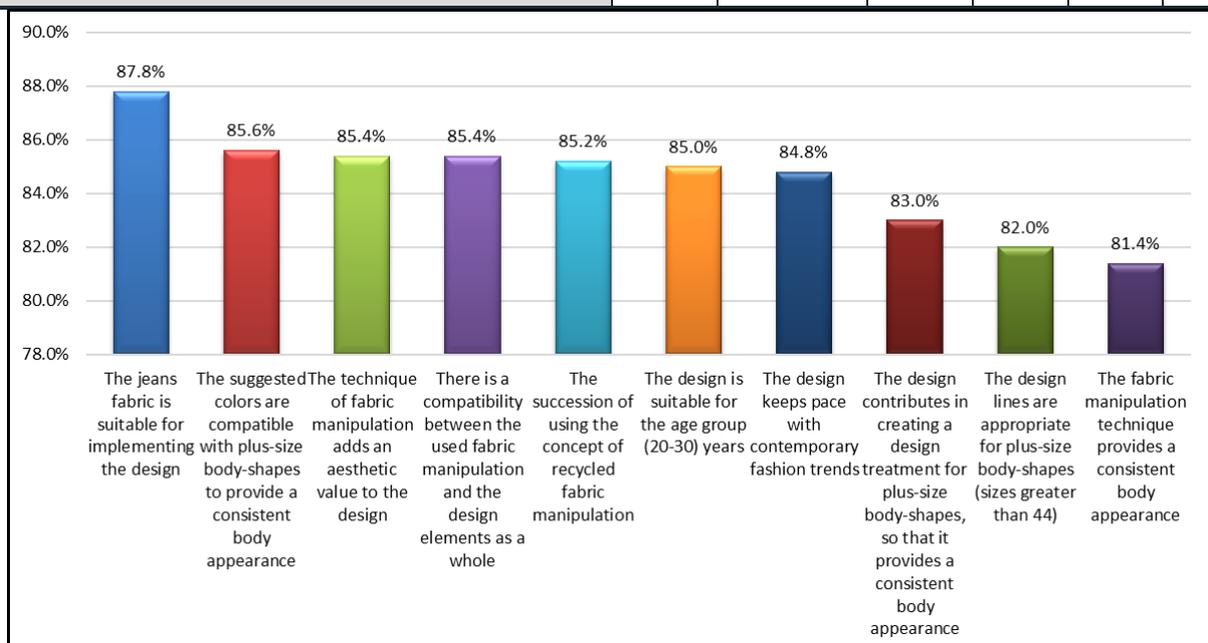


Figure 30. Means and percentage of mean and responses for Specialists' questionnaire

4.1.2.2. Non-Specialists' Questionnaire:

The independent variables that were measured at the ordinal level included (8 statement). The independent variables were treated as continuous

variables, which is common for the 5-point Likert scale items where the overall mean score is 4.08. (Table 8) (Figure 31)

Table 8. Means and percentage of mean and responses for non- Specialists' questionnaire

no	Specialists	Mean	Std. Deviation	%	T	Sig.	rank
1	The design is suitable for the age group (20-30) years	3.93	1.087	79%	17.135	0.000	8
2	The design is suitable for plus-size body-shapes to provide a consistent body appearance	4.01	1.046	80%	19.527	0.000	6
3	The suggested colors are compatible with plus-size body-shapes	4.17	0.924	83%	25.449	0.000	3
4	The technique of fabric manipulation adds an aesthetic value to the design	4.15	0.939	83%	24.548	0.000	4
5	The jeans fabric is suitable for implementing the design	4.19	0.906	84%	26.376	0.000	1
6	The acceptance of using the concept of recycled fabric manipulation	4.19	0.936	84%	25.543	0.000	2
7	The design keeps pace with contemporary fashion trends	4.03	1.031	81%	20.093	0.000	5
8	The design can be purchased if sold in the market	4.01	1.075	80%	18.950	0.000	7
	sum all	4.08	0.99	82%	83.394	0.000	

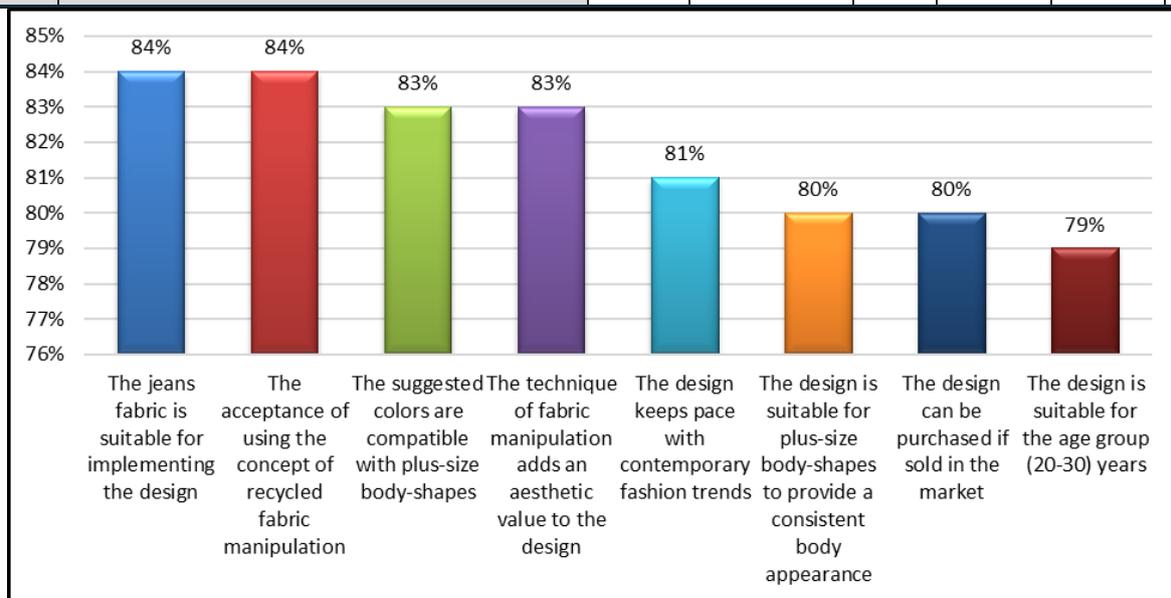


Figure 31. Means and percentage of mean and responses for non- Specialists' questionnaire

4.1.3. Descriptive Statistics for Means of Specialists and Non-Specialists According to Designs:

By comparing averages between specialists and non-specialists according to all nine designs, the results indicate that all the designs succeeded in expressing components of fashion design. They all have a positive result and close results with slight differences as follow:

4.1.3.1. Specialists:

The best design for specialists is design 6 with an average of (43.82), followed by design 3 with an average of (43.21), design 1 with an average of (42.97), design 8 with an average of (42.71), design 2 with an average of (42.03), design 5 with an

average of (42.00), design 7 with an average of (41.79), design 4 with an average of (41.38) and then design 9 with an average of (40.56).

4.1.3.2. Non- Specialists:

The best design for specialists is design 1 with an average of (35.04), followed by design 6 with an average of (34.96), design 7 with an average of (34.82), design 8 with an average of (34.02), design 5 with an average of (31.96), design 2 with an average of (31.58), design 4 with an average of (31.24), design 3 with an average of (30.13) and then design 9 with an average of (29.84). (Table 9) (Figure 32)

Table 9. Means of designs according to Specialization

Specialists				Non- Specialists			
Design	Mean	Std. Deviation	Rank	Design	Mean	Std. Deviation	Rank
Design 1	42.97	7.412	3	Design 1	35.04	5.165	1
Design 2	42.03	6.708	5	Design 2	31.58	8.392	6
Design 3	43.21	6.669	2	Design 3	30.13	6.472	8
Design 4	41.38	7.165	8	Design 4	31.24	6.023	7
Design 5	42.00	6.420	6	Design 5	31.96	6.112	5
Design 6	43.82	5.997	1	Design 6	34.96	6.640	2
Design 7	41.79	7.587	7	Design 7	34.82	7.356	3
Design 8	42.71	7.026	4	Design 8	34.02	6.583	4
Design 9	40.56	7.399	9	Design 9	29.84	9.050	9

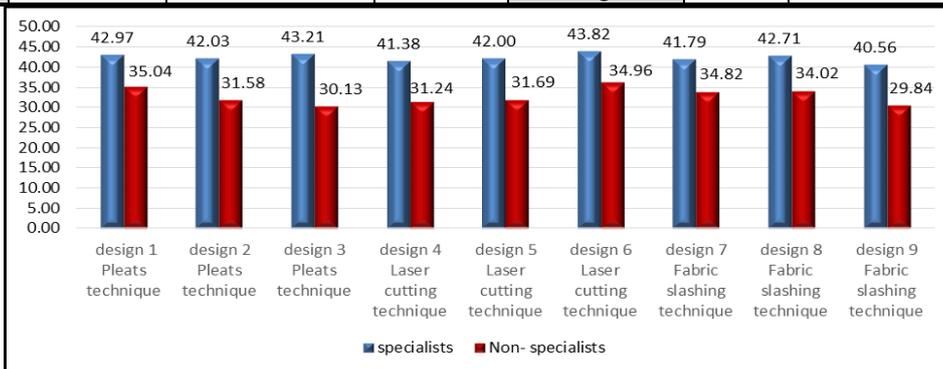


Figure 32. Means of 9 designs according to Specialization

4.1.3.3. Descriptive Statistics for Sum Mean of Specialists and Non-Specialists According to Designs

Descriptive statics was made of the responses of the study sample, to get acquainted with the arrangement of designs from the point of view of

specialists and non-specialists.

The best design is design 6 (39.38) followed by design 1 (38.46), design 8 (37.76), design 7 (37.22), design 2 (36.18), design 5 (36.18) design 3 (35.76), design 4 (35.61) and then design 9 (34.71). (Table 10) (Figure 33)

Table 10. Sum means of specialists and non-specialists according to designs

Design	Mean	Std. Deviation	Rank
Design 6	39.38	6.659	1
Design 1	38.46	7.341	2
Design 8	37.76	8.004	3
Design 7	37.22	8.961	4
Design 2	36.18	9.266	5
Design 5	36.18	7.976	6
Design 3	35.76	9.213	7
Design 4	35.61	8.228	8
Design 9	34.71	9.797	9

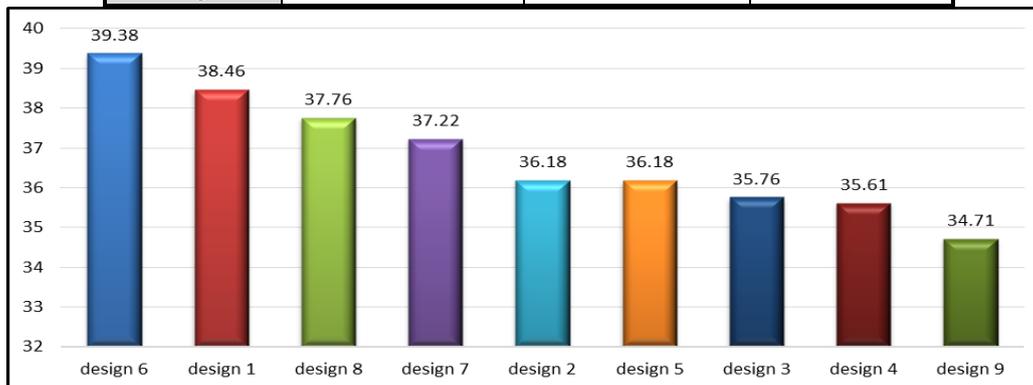


Figure 33. Sum means of specialists and non-specialists according to designs

4.1.4. Descriptive Statistics for Means of Specialists and Non-Specialists According to Techniques

By comparing averages between specialists and non-specialists according to all three techniques (Ripple Knife Pleats, Reverse Applique, and Layering and Slashing fabric manipulations), the results indicate that all the techniques succeeded in expressing components of fashion design they all have a positive result and close results with slight differences as follow:

4.1.4.1. Specialists:

The best technique is technique 1 with an average of (42.74) followed by technique 2 with an average of (42.4) and then technique 3 with an average of (41.69).

4.1.4.2. Non- Specialists:

The best technique is technique 3 with an average of (32.49) followed by technique 2 with an average of (32.72) and then technique 1 with an average of (32.25). (Table 11) (Figure 34)

Table 11. Means of technique according to Specialization

Specialists				Non- Specialists			
Technique	Mean	Std. Deviation	Rank	Technique	Mean	Std. Deviation	Rank
Technique 1 Ripple Knife Pleats	42.74	6.888	1	Technique 1 Ripple Knife Pleats	32.25	7.065	3
Technique 2 Reverse Applique	42.4	6.563	2	Technique 2 Reverse Applique	32.72	6.424	2
Technique 3 Layering and Slashing	41.69	7.321	3	Technique 3 Layering and Slashing	32.94	7.955	1

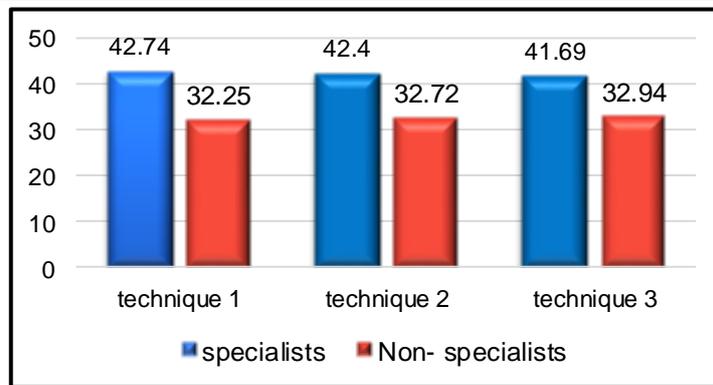


Figure 34. Means of technique according to Specialization

4.1.4.3. Descriptive Statistics for Sum Mean of Specialists and Non-Specialists According to Techniques

The best technique between all three techniques is

technique 1 (Ripple Knife Pleats) (39.75) followed by technique 2 (Reverse Applique) (39.64), and then technique 3 (Layering and Slashing) (39.20). (Table 12) (Figure 35)

Table 12. Sum means of specialists and non-specialists according to techniques

Technique	Mean	Rank
Technique 1, Ripple Knife Pleats (First Design Line)	39.75	1
Technique 2, Reverse Applique (Second Design Line)	39.64	2
Technique 3, Layering and Slashing (Third Design Line)	39.20	3

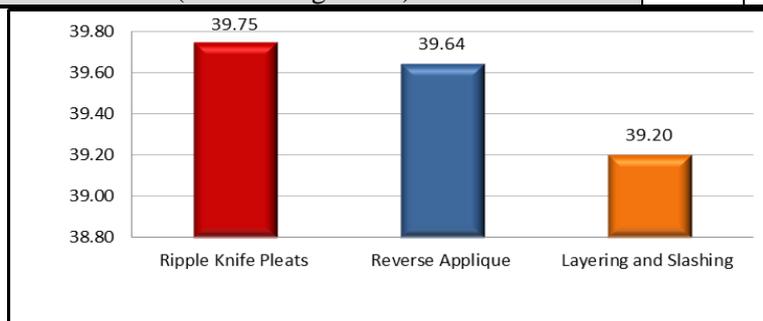


Figure 35. Sum means of specialists and non-specialists according to techniques

4.2. Applied Designs:

According to statical results, three designs got heigh acceptance level among specialists in the apparel industry field and plus size non- specialists Egyptian females. These three designs (No. 6, 1, 8) were implemented using the suggested recycled

fabric manipulation techniques as follow:

4.2.1 First Cardigan:

Design Line No.: 1

Design No.: 1

Fabric Manipulation Technique No. (1): Ripple Knife Pleats (Figure 36)



Figure 36. First Cardigan

4.2.2. Second Cardigan

Design Line No.: 2

Design No.: 6

Fabric Manipulation Technique No. (2): Reverse Applique (Figure 37)



Figure 37. Second Cardigan

4.2.3. Third Cardigan

Design Line No.: 3

Design No.: 8

Fabric Manipulation Technique No. (3): Layering and Slashing (Figure 38)



Figure 38. Third Cardigan

5. Conclusion

Studies proved the significant increase in the weight of females all over the world, especially with the increase in fast food and a fast lifestyle. Since clothes play an important role in the first impression for a person in the society and presenting the body in a consistent and attractive manner, regardless of the size. Therefore, the apparel market for plus size females is constantly increasing, and apparel designers and industries must provide designs that suit the contemporary needs of plus size females. It is possible to achieve the appropriate shape by studying the requirements of plus size females, following fashion trends, and using appropriate embellishment techniques in a consistent manner, which supports the psychological state of plus size females and shows them in a consistent and attractive look. Since one of the most important global trends of sustainable fashion is the recycling of fabric wastes, the use of fabric manipulation techniques in producing designs for plus size females is an effective method for obtaining unique designs that consider the dimensions of sustainability and meet the requirements of a growing class of consumers so that they meet their functional and aesthetic requirements.

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