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A Qualitative Investigation Into Functional, Expressive, And Aesthetic Apparel Design For Women Cyclists³

Abstract

This study investigates women cyclists' clothing practices, preferences, and unmet expectations to inform the development of women-specific cycling apparel. While cycling is a recognized sustainable transport mode, a significant gender gap persists, partly attributed to insufficient apparel solutions. Employing a qualitative, user-centered design approach, semi-structured interviews were conducted with 20 women cyclists in Eskişehir, Türkiye. Findings reveal that participants often opt for everyday clothing over specialized cycling wear, prioritizing comfort, freedom of movement, and practical safety considerations such as entanglement prevention and visibility. Functional performance expectations, including thermal comfort, weather protection, and secure storage, were strongly influenced by seasonal variations and commuting needs. The research highlights significant market constraints, including limited variety in women's specific designs, colors, patterns, and sizing, often leading participants to compromise with men's apparel. These issues impact not only aesthetic satisfaction but also functional fit, privacy, and the versatility of garments across cycling and non-cycling contexts. The results are interpreted through the Functional–Expressive–Aesthetic consumer needs model as applied in this study, demonstrating that successful women's cycling apparel must holistically address functional (mobility, thermal comfort, protection, visibility, sizing fit), aesthetic (colour, pattern, female-appropriate silhouette), and expressive (suitability to the bicycle's nature and price–performance accessibility) dimensions. The study culminates in strong support for a dedicated women's cycling collection, underscoring the potential for user-centered design to generate concrete product criteria and concepts responsive to identified market needs.

Key words: Women cyclists, cycling apparel, user-centered design, FEA model, apparel design.

Kadın Bisikletçiler İçin Fonksiyonel, İfade Edici ve Estetik Giyim Tasarımına Yönelik Nitel Bir Araştırma

Özet

Bu çalışma, kadın bisikletçilerin giyim alışkanlıklarını, tercihlerini ve karşılanmasını istedikleri beklentilerini araştırarak, kadınlara özel bisiklet kıyafetlerinin geliştirilmesine katkıda bulunmayı

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amaçlamaktadır. Bisiklet sürmenin sürdürülebilir bir ulaşım yolu olarak kabul edilmesine rağmen, kısmen yetersiz giyim çözümlerine bağlı olarak önemli bir cinsiyet eşitsizliği bulunmaktadır. Niteliksel, kullanıcı merkezli bir tasarım yaklaşımı uygulanarak, Türkiye'nin Eskişehir şehrinde 20 kadın bisikletçiyle yarı yapılandırılmış görüşmeler yapılmıştır. Bulgular, katılımcıların genellikle özel bisiklet kıyafetleri yerine günlük kıyafetleri tercih ettiklerini, konfor, hareket özgürlüğü ve takılma önleme ve görünürlük gibi pratik güvenlik hususlarına öncelik verdiklerini ortaya koymaktadır. Termal konfor, hava koşullarına karşı koruma ve güvenli saklama gibi fonksiyonel performans beklentileri, mevsimsel değişikliklerden ve ulaşım ihtiyaçlarından büyük ölçüde etkilenmektedir. Araştırma, kadınlara özel tasarımlar, renkler, desenler ve bedenlerde sınırlı çeşitlilik de dahil olmak üzere önemli pazar kısıtlamalarını vurgulamakta ve katılımcıların genellikle erkek giyim ürünleriyle yetinmelerini ortaya koymaktadır. Bu sorunlar sadece estetik memnuniyeti değil, aynı zamanda fonksiyonel uyumu, mahremiyeti ve giysilerin bisiklet sürme ve sürmeme bağlamlarındaki çok yönlülüğünü de etkilemektedir. Sonuçlar, bu çalışmada uygulandığı haliyle işlevsel–ifadesel–estetik tüketici ihtiyaçları modeli üzerinden yorumlanarak, başarılı kadın bisiklet giyiminin işlevsel (hareketlilik, ısı konfor, koruma, görünürlük, beden uygunluğu), estetik (renk, desen, kadına uygun silüet) ve ifadesel (bisikletin doğasına uygunluk ve fiyat–performans erişilebilirliği) boyutları bütünsel olarak ele alınması gerektiğini göstermektedir. Araştırma, kadın bisiklet giyimine özel bir koleksiyonun güçlü bir şekilde desteklenmesiyle sonuçlanmakta ve kullanıcı merkezli tasarımın, belirlenen pazar ihtiyaçlarına yanıt veren somut ürün kriterleri ve kavramları üretme potansiyelinin altını çizmektedir.

Anahtar Kelimeler: Kadın bisikletçiler, bisiklet giysileri, kullanıcı odaklı tasarım, FEA modeli, giysi tasarımı.

INTRODUCTION

Cycling is widely recognized as a sustainable, low-carbon mode of urban transport that promotes public health through everyday physical activity (Shokoohi & Nikitas, 2017). However, participation is unevenly distributed: most urban cyclists are young to middle-aged men, and women face disproportionate barriers to adoption and sustained engagement (Bean et al., 2024; Lubitow, 2017; Pearson et al., 2023; Riggs et al., 2016). Beyond infrastructural, safety, and normative factors (van Bekkum et al., 2011; Xie & Spinney, 2018), women encounter natural environmental deterrents including inclement weather, hilliness and low light that disincentivize cycling more severely for them than for men (Bean et al., 2024). The clothing worn during cycling serves as a direct interface between the rider and the activity, influencing mobility, thermal and moisture comfort, modesty, and visibility in traffic. For professional women cyclists, these considerations are decisive: restrictive fit compromises range of motion, while overly sporty aesthetics (bright colors, reflective elements) conflict with business-casual dress codes, producing trade-offs between function and workplace appropriateness (Lastovich, 2013). As a result, women frequently use everyday clothing rather than purpose-designed cycling apparel, which exacerbates practical problems such as chain-catch and fabric flapping (Emerich, 2011).

Apparel is a concrete yet underexplored barrier for women cyclists, particularly in everyday urban contexts where the bicycle integrates commuting, errands, and social travel. Studies of professional women cycling to work reveal persistent challenges: garments must accommodate thermal fluctuations through layering, allow modest coverage, and balance durability with stain and wrinkle resistance. Market offerings often prioritize athletic styling over versatile silhouettes, leaving an "in-between" gap of durable, moisture-wicking fabrics in non-sporty appearances that support pedaling without requiring post-commute changes (Lastovich, 2013). These gaps extend across socio-cultural contexts. In urban Nigeria, female cyclists face spatial, infrastructural, and socio-demographic disparities that compound apparel-related inequities (Mogaji & Uzundu, 2022); in urban Australia, the barriers and enablers of women's bicycle uptake show parallel patterns despite a different economic and infrastructural setting (Pearson et al., 2023). Across these contexts, women report difficulty accessing women-specific designs that fit their bodies and preferences (Riggs et al., 2016).

A core challenge in apparel development is to translate multifaceted user experiences including physical, psychological and contextual into design criteria without reducing them to

isolated attributes such as fit or fabric (Lastovich, 2013; Emerich, 2011). The Functional-Expressive-Aesthetic (FEA) consumer needs model, proposed by Lamb and Kallal (1992) for assessing user needs in adaptive clothing design, provides a multidimensional framework for this purpose. Across more than 25 years of application, the model has shown flexibility across consumer groups and product types, guiding needs assessment, prototype development, and validation in sport-specific apparel (Emerich, 2011; Orzada & Kallal, 2021). Functional needs concern in-use performance: mobility (stretch for pedaling, ease across back, underarm, and crotch), protection (windproofing, waterproofing, thermal regulation), visibility and safety (reflective elements), and comfort and fit (moisture-wicking, lightweight, non-restrictive properties) (Al Mahmud et al., 2023). Expressive needs address identity, self-expression, and social signaling through dress, such as feminine details that convey personal style and align with role expectations in professional settings. Aesthetic needs cover sensory appeal: style, color and pattern variety beyond monotone blacks and grays, silhouette proportionality, and visual appropriateness for public or workplace contexts. The three dimensions interact: functional stretch enhances aesthetic drape; modest fit supports safety perceptions; visibility cues operate on both function and aesthetics. The FEA model has been applied to snowboarding apparel (Emerich, 2011) and professional active commuting (Lastovich, 2013); complementary frameworks such as means-end chain analysis in athleisure reinforce a values-based design approach (Zhou et al., 2020).

The aim of this study is to determine women cyclists' clothing preferences, identify cycling-related apparel problems, elicit expectations, and propose a collection informed by these findings. So, the main research problem addressed in this study is how the functional, expressive, and aesthetic clothing needs of women cyclists can be identified and transformed into apparel collection according to user-centered apparel design criteria. The work is organized around four sub-questions on garment types, design and functional attributes, market perceptions and reported issues, and purchase drivers. These are:

1. What types of clothes put on, and clothing preferences do female cyclists have while cycling?
2. What functional, expressive, and aesthetic expectations do women cyclists have regarding cycling apparel?
3. What problems and market limitations do women cyclists experience with existing cycling apparel?
4. How can the identified user needs be translated into design criteria and collection for women's cycling apparel?

The empirical basis is semi-structured interviews with 20 women cyclists in Eskişehir, Türkiye, analyzed qualitatively within the local context of daily routines, climate, and retail availability.

This article makes four contributions. First, it provides empirical evidence on women cyclists' practices and choice criteria in everyday urban contexts (Lastovich, 2013). Second, it synthesizes these findings into FEA-aligned design requirements (Emerich, 2011; Orzada & Kallal, 2021). Third, it documents market shortcomings and purchase motivators reported by women cyclists (Riggs et al., 2016). Fourth, it operationalizes the users' needs into a prototype capsule collection with explicit feature-to-need traceability.

MATERIALS AND METHODS

Study Design and Overview

This study used a qualitative, user-centered apparel design approach in two linked phases, consistent with design-development case-study methods in functional apparel research (Bye & Hakala, 2005). Phase 1 elicited women cyclists' needs, problems, and expectations through semi-

structured interviews. Phase 2 translated these interview findings into explicit design criteria, which informed the development of a women's cycling capsule collection for spring/summer use. Figure 1 summarizes the workflow.

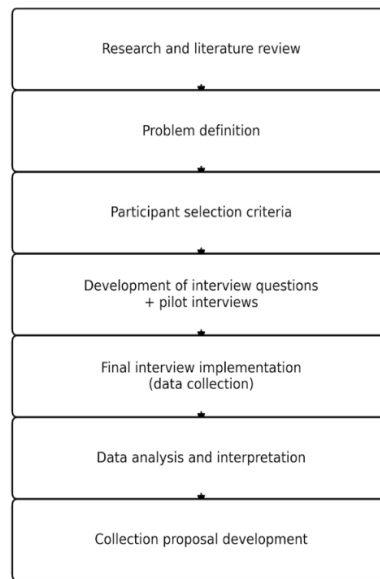


Figure 1. Research workflow used in the study

Participants and Sampling

Participants were recruited using criterion-based purposive sampling, which selects information-rich cases that directly address the research questions (Campbell et al., 2020; Karasar, 2016; Yıldırım & Şimşek, 2008). Four eligibility criteria applied: residence in Eskişehir, Türkiye; use of a bicycle for transportation or recreation; cycling at least 1 hour per week; and being 60 years old or younger. Participation was voluntary. The final sample comprised 20 women cyclists.

Participant Profile and Cycling Context

The 20 participants were aged 26 to 53 years (mean = 37.3; three participants did not report age). Active cycling experience ranged from 3 to 360 months (mean = 116.7 months). Participants cycled on average 4.5 days per week (range 1–7). Most rode primarily in the city (55%), 15% rode mainly outside the city, and 30% rode in both settings. Table 1 summarizes participant characteristics, and Table 2 summarizes cycling context.

Table 1. Participant Characteristics and Cycling Experience Summary

Variable	Summary
Sample size	N = 20 women cyclists (Eskişehir, regular use; non-professional)
Age	Mean age = 37.3 years; age not provided by 3 participants
Cycling experience	Mean = 116.7 months; minimum = 3 months; maximum = 360 months

Table 2. Cycling Context Distribution

Cycling context	Percentage
City	55%
Outside city	15%
Both city and outside city	30%

Data collection instrument and procedure

Data were collected through face-to-face, semi-structured interviews. An interview form was developed for this study, covering three domains: (i) participant demographics, (ii) cycling-related characteristics (bicycle type, features, and riding habits), and (iii) apparel-related preferences, problems, expectations, and market-related considerations. The protocol was refined through a pilot application with a small group of women cyclists, with question adjustments made for clarity and relevance. The finalized interview form is included in the underlying thesis. All interviews were audio-recorded with participant permission and lasted between 25 minutes and 2 hours, depending on the depth of the participant's responses.

Data Analysis

The audio-recorded interviews were transcribed verbatim. Transcripts were analyzed using descriptive analysis: data were organized around themes derived from the research questions and sub-problems, then coded and categorized to identify patterns, similarities, and divergent cases (Karasar, 2016; Yıldırım & Şimşek, 2008). Findings within these themes were used to derive user-need statements and design implications for the second phase.

Design development and prototyping workflow

The design development phase followed a structured apparel design process consistent with design-development case study approaches in functional apparel research (Bye & Hakala, 2005). The user-need evidence from the interviews was tied to explicit design criteria, which guided the development of design concepts. The design phase produced a women's cycling capsule collection of 10 looks, presented through concept sketches, technical drawings, and digital illustrations.

The Functional–Expressive–Aesthetic consumer needs model (Lamb & Kallal, 1992) was applied in this study following the convention adopted in the underlying field investigation. Functional needs cover thermal regulation, protection from rain, wind, and sun, night visibility, physical comfort, and sizing fit. Aesthetic needs cover variety and originality in color, pattern, and silhouette, and female-appropriate cuts. Expressive needs cover suitability to the bicycle's nature and accessibility through price–performance balance. This last axis departs from the identity-and-symbolism reading more common in the wider FEA literature; the departure follows the operationalization established in the underlying thesis. The design choices addressed all three dimensions as articulated by the participants (Emerich, 2011).

Ethics, consent, and confidentiality

Ethical approval for the research was obtained from the Eskisehir Technical University Committee of Science and Engineering Scientific Research and Publication Ethics on June 28, 2019, with Protocol Number 17938.

All participants gave informed consent before the interviews, were informed that participation was voluntary and that they could withdraw at any time, and granted permission for audio recording. Confidentiality and anonymity were maintained throughout data collection, analysis, and reporting: identifying information was separated from the interview data, and findings are presented without identifying individual participants (Nii Laryeafio & Ogbewe, 2023).

RESULTS AND DISCUSSION

Apparel Use and Overall Clothing Preferences During Cycling

Participants reported that clothing choice during cycling is largely governed by ride comfort and practical safety constraints. A key pattern was emphasis on lower-body garments: 55% of participants identified lower-body apparel as their primary cycling-wear concern. Tights were the

most preferred lower-body item, with participants linking this preference to reduced risk of fabric catching in the drivetrain. As one participant explained: "For the bottom, tights — tights are the most comfortable. Otherwise, when you wear sweatpants, the hem catches. We use leg straps, but there's still a chance of it catching; it can slip."

Accessories were framed as integral to perceived safety. Helmet use was frequently described as "necessary," and 20% of participants explicitly identified the helmet as "essential." Gloves, rain and wind protection layers were treated as part of a functional riding outfit rather than fashion-driven choices: "The helmet is the most important — helmet and gloves; apart from that, thin clothes that don't trap sweat."

A recurring fit-related criterion was avoidance of extremes in tightness and looseness: tight garments were described as restrictive during effort, while loose garments were framed as hazardous because of drivetrain entanglement. One participant explained: "Form-fitting tights feel like you're not wearing anything. But anything loose can catch — the hem can get caught on the chain." This "balanced fit" requirement functions as a practical constraint that shapes acceptable silhouettes for women's everyday cycling apparel.

Preferred design features: silhouette, color, and visibility cues

Participants' design preferences emphasized forms that support comfortable riding. Preferred silhouette also shifted by season (tighter or looser forms depending on weather) indicating that design choices were partly aesthetic and partly adaptive to environmental conditions.

Color preference varied across participants but was frequently subordinated to visibility. Of 14 respondents commenting on color, three stated they had "no color option" because comfort was the primary criterion; three chose colors based on personal aesthetic preference unless visibility was a concern; and eight preferred colorful or fluorescent options to be seen and/or to match the appearance of their bicycles. One participant said: "Yes. Since my bike is green, I usually wear green. As I said, I prefer tights since they're more comfortable." These accounts position color as serving both a functional role (visibility) and an aesthetic role (style and bicycle-matching).

Reflective elements were discussed as a visibility component: 15% specifically emphasized reflectors as increasing visibility for night riding. Several participants distinguished between general reflective details and the broader visibility system required for safe riding (see section 3.4), implying that reflectivity alone may be insufficient without active lighting.

Functional performance expectations: thermal comfort, weather protection, storage, and safety

Functional expectations were strongly seasonal. Participants described a requirement for high air permeability in summer (to manage elevated body heat) and lower air permeability in winter (to preserve body heat), in line with established thermal comfort findings for cycling clothing (Marmaralı et al., 2006; Oğlakcıoğlu et al., 2013; Al Mahmud et al., 2023). In practice, this translated into multi-layer strategies for intra-day weather variability, with raincoats and windbreakers as common outer-layer choices. As one participant put it: "There's a saying: there's no bad weather, only bad clothing. The clothing has to be suitable. With appropriate clothing, you can ride in any condition. The most important thing for me, I think, is that it doesn't make me sweat. Sometimes I prefer wearing several layers - a t-shirt, plus a thin raincoat if needed."

Material performance was framed around moisture management and odor control: participants emphasized fabrics that "do not hold sweat" and that resist odor. Comfort during exertion was thus reported as a combination of thermophysiological and sensory considerations.

Utility requirements were reported around storage and safety. Pockets and secure on-body storage emerged as a recurrent expectation, especially for participants who preferred not to wear a backpack: "If you don't carry a bike bag and there's no ventilation in the back, your back gets soaked. So having pockets in the back, you put your phone, your jacket, your wallet, you ride more comfortably." Safety was articulated both as passive protection (fit preventing entanglement) and as visibility through an integrated system of clothing reflectors plus active lighting. One participant emphasized that rear lights, in particular, were decisive for whether she would ride at all: "Reflectors, yes, OK but I see that lights are very, very, very important. Both front and rear. I feel safer with a rear light because the person behind me sees me. If I don't have a rear light, I prefer never to go out. The rear light is very important."

Expectations and problems in women's cycling apparel: aesthetics, fit, and social constraints

Responses to the prompt about "feeling good and attractive" revealed a bifurcation. Twenty percent stated they did not associate "attractive" with cycling apparel and described expectations oriented toward comfort and functionality rather than visual appeal. At the same time, participants' descriptions of desired cuts such as feminine necklines, fitted but modest jersey patterns, and female-tailored zippers indicate that aesthetic preferences and functional fit needs remain salient for many.

Structural market constraints were repeatedly highlighted. Thirty percent reported that women's options in the cycling apparel market were limited, making it difficult to find preferred colors, patterns, and forms; this group described compensating by purchasing from men's sections and wearing cuts not optimized for their bodies. As one participant explained: "Because there are too many men's jerseys, we sometimes end up wearing men's jerseys, even if it's XS. Of course, the cut is a man's straight cut. When I can find a women's cut, they're more body-fitting, with feminine lines, and they actually feel more comfortable when turning side to side." Another 20% discussed skirts, noting perceived social disapproval of cycling in skirts within local cultural norms while suggesting that cycling-compatible skirt designs could be feasible with appropriate adaptations. These findings highlight socio-cultural barriers and the gender gap in apparel offerings (Bean et al., 2024; Pearson et al., 2023).

Concrete product problems were also documented: thin tights causing transparency, padded cycling tights restricting walking, limited pattern and color variety, and a lack of feminine shaping in jersey patterns. The transparency problem was particularly emphasized: "Our underwear shows through the tights. I don't know how we'll solve this. With this tight fabric, your body shows in the sun, and especially what kind of underwear you have on. The first time this happened to me, I was so embarrassed I didn't know what to do." These issues affect privacy, mobility across ride and non-ride contexts, and perceived appropriateness for everyday use. Discomfort with padded cycling tights, in particular, has also been reported in female-specific cycling research and points to a need for female-tailored ergonomic designs (Larsen et al., 2021).

Purchasing motivations and market access constraints

Motivations for purchasing new cycling garments were reported as primarily need-driven (replacement due to wear or inadequacy), with social influence (observing other cyclists' apparel)

and a desire to "feel better" in cycling contexts as secondary factors. As one participant put it: "Usually I prefer to buy when something has worn out or been damaged. ... Functionality and comfort are important to me; it doesn't need to be too fancy." Means-end chain analyses in adjacent athleisure markets indicate similar attribute-to-outcome linkages (Zhou et al., 2020).

Participants' assessments of market adequacy were mixed (Table 3): 35% described the women's cycling apparel market as sufficient, while 35% described it as insufficient. Where adequacy was acknowledged, participants often qualified it by price barrier: "I think it exists — but only if you have money. Because these products are special, they're very expensive. ... I think this is entirely related to a person's economy." Reported purchasing channels concentrated in physical retail: 45% in active sports stores and 35% in bicycle shops, with 20% preferring online purchasing. Size availability emerged as a salient access barrier, particularly for petite users. One participant elaborated: "Absolutely not. Because I'm XXS, unfortunately I can't find a jersey. Children's jerseys aren't suitable either. When I want something custom-made, I have difficulty communicating my body measurements. At least jerseys should be produced for petite women." Together these accounts indicate that "limited women's options" is experienced not only as a design and assortment gap but also as a price-access gap and a sizing-and-distribution gap.

Table 3. Participants' Evaluation of the Women's Cycling Apparel Market

Market evaluation	Percentage
Positive (adequate number/quality of stores)	35%
Negative (insufficient variety; does not meet needs)	35%
No answer / insufficient knowledge	Remaining participants

Support for a dedicated women's cycling apparel collection and design implications

Support for developing a dedicated women's cycling collection was strong: 90% of participants responded positively. They justified this through (i) inadequate variety in color and pattern, (ii) a perceived male-oriented market structure, and (iii) the mismatch between performance-focused activewear and women's everyday clothing integration needs. Some participants suggested that ready-to-wear brands could deliver broader variety and more accessible pricing, and several framed a potential collection as a vehicle for social-awareness messaging on environmental impact and women's rights. One participant emphasized Eskişehir's relatively large community of women cyclists: "Definitely this will draw people in... in Eskişehir there really are a lot of bicycles. Women cyclists are very common in Eskişehir. Collections like this- the colors, the patterns - will appeal to people. They'll also increase cycling itself. Because... I can't go to work in sweatpants."

The interview findings were translated into a capsule-collection proposition: a 10-look spring/summer concept line of raincoats, windbreakers, t-shirts, cycling jerseys, sports bustiers, trousers, Bermuda shorts, and tights. The intent was to align color, pattern, and form decisions with current trend sources (e.g., WGSN, Pantone) while directly responding to the user needs surfaced in Section 3.1- Section 3.5. Table 4 maps each major design feature to its originating user need(s) and to the corresponding axis of the Functional-Expressive-Aesthetic model under the convention adopted in this study.

Table 4. Design Evaluation Matrix: Feature-to-Need Traceability for the Women’s Cycling Capsule Collection

Design feature	User need addressed	Functional problem solved	FEA axis	Originating user datum
Bias-cut knee panel	Physical comfort during pedalling	Knee mobility; leg movement under load	F	Section 3.1 P3 (balanced fit); Q3.4 P3 (mobility)
Mesh ventilation insert	Thermal management	Sweat retention; overheating	F	Section 3.3 P1, P2 (thermal/moisture)
Reflective trim and panels	Night visibility	Low-light visibility	F	Section 3.2 P3; Q3.4 P3 (integrated visibility system)
Bustier-mounted bag	On-body storage	Backpack avoidance; back-sweat	F	Section 3.3 P3 (Q3.1 quote)
Cross-body hip bag (detachable)	On-body storage	Backpack avoidance	F	Section 3.3 P3
Saddle-area gusset	Saddle comfort	Saddle pressure; padded-tight walking discomfort	F	Section 3.3; Section 3.4 P3 (Larsen et al., 2021)
Adjustable knee-buckle hem	Hem-catch avoidance	Drivetrain entanglement (loose hems)	F	Section 3.1 P1, P3 (Q1.3 quote); Section 3.5
Feminine-silhouette outer layer	Non-masculine aesthetic	Lack of women’s-cut visual lines	F + A	Section 3.4 P1 (female-specific cuts); P2 (Q4.2 quote)
Female-appropriate jersey cut	Women’s body-fit	Men’s-cut compromise; transparency issue	F + A	Section 3.4 P2 (Q4.2 quote); P3 (Q4.1 transparency excerpt)
Layered modular outfit	Multi-context wear (ride / non-ride)	Mismatch between activewear and everyday clothing	F	Section 3.4 P3; Section 3.7 P1 (Q7.1 quote)

Note. FEA axis: F = Functional; A = Aesthetic; E = Expressive. No row in this matrix maps to E because the design responses to the expressive findings reported in Section 3.6 (price-performance accessibility; bicycle-suitability) are addressed at the collection level rather than through a single garment feature. Section locators refer to the present manuscript; quote codes (Q...) refer to the verbatim participant excerpts integrated in Section 3.

The matrix demonstrates how participant evidence was translated into design features. The bias-cut knee panel is a functional response to physical comfort during pedalling (Section 3.3); mesh ventilation inserts respond to thermal management (Section 3.3); reflective trim and saddle-area gussets address night visibility and saddle comfort respectively (Section 3.2, Section 3.3, Section 3.4). Feminine-silhouette outer layers respond to both functional fit and aesthetic preference for a non-masculine appearance (Section 3.4). The interview evidence indicates that failure in any one need dimension, transparency in tights, absence of women's cuts, inadequate visibility integration, can undermine overall garment acceptance. The collection is therefore developed as an integrated system rather than as isolated performance features (Lamb & Kallal, 1992; Orzada & Kallal, 2021). Detailed look-by-look design specifications are presented in Appendix A.

CONCLUSIONS

This study examined women cyclists' clothing practices, preferences, and unmet expectations to inform the development of women-specific cycling apparel. Participants frequently cycled in

everyday clothing rather than dedicated cycling wear, often because specialized options were inadequate or conflicted with professional dress codes. Their evaluation of apparel rested mainly on comfort and freedom of movement, together with safety-related concerns including entanglement risk and visibility in traffic. The repeated emphasis on lower-body choice particularly the preference for tights over loose trouser hems, which catch in the drivetrain, illustrates these priorities. Participants also rejected both extremes of tightness and looseness, indicating a "balanced fit" requirement that shapes acceptable silhouettes for everyday cycling use.

Design expectations went beyond performance attributes to include visibility cues, preferences for colourful or fluorescent options and reflective elements, which participants linked to traffic safety. Participants articulated seasonally varying thermophysiological needs: high air permeability in summer to manage heat, lower air permeability in winter for insulation, often achieved through layering (Al Mahmud et al., 2023). Storage was also salient, with several participants favouring on-body solutions over backpacks. Several accounts further indicated that perceived safety relies on an integrated visibility system that combines apparel and active lighting rather than apparel features alone. Fashion sketches and technical drawings of the resulting capsule collection are presented in Appendix A; the feature-to-need mapping is summarized in Table 4.

Market-related findings indicate a mismatch between women cyclists' needs and available offerings. Participants reported limited women's product variety in colour, pattern, and form, together with sizing constraints particularly for petite users. Several compensated by purchasing from men's sections, which often produced garments with cuts not optimized for their bodies. These constraints affect aesthetic satisfaction, functional fit, privacy (e.g., transparency in tight materials), and the perceived suitability of garments across ride and non-ride contexts.

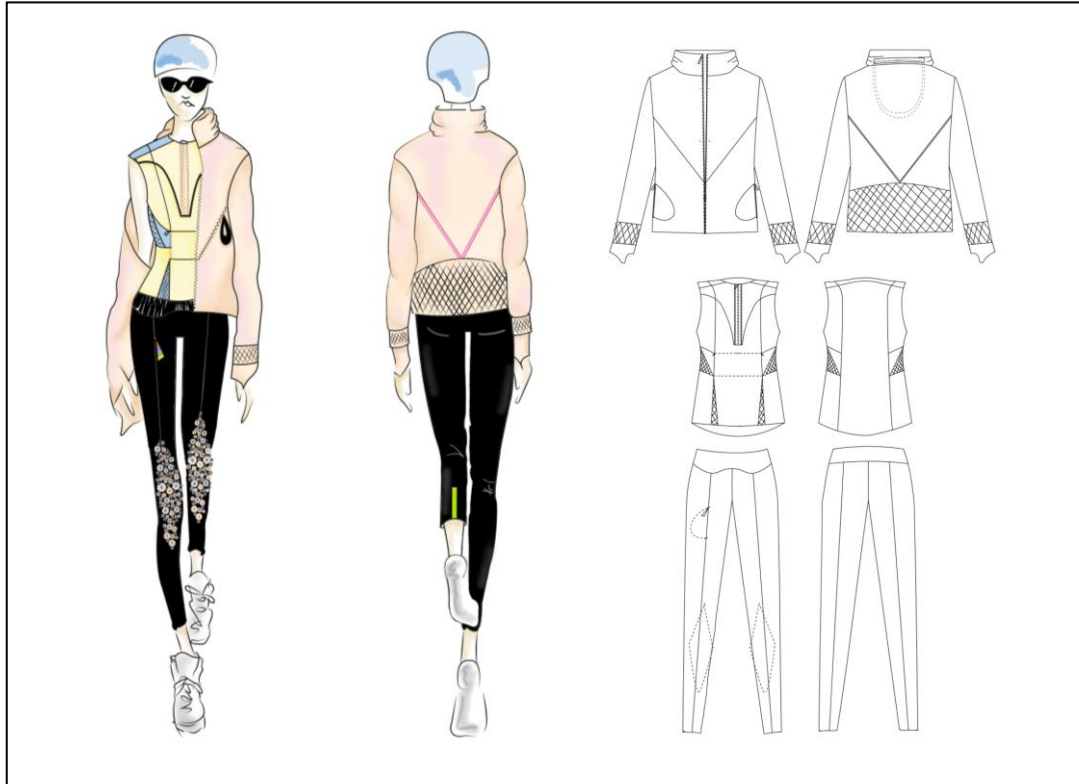
The findings align with the multidimensional needs structure of the Functional-Expressive-Aesthetic (FEA) consumer needs model (Lamb & Kallal, 1992; Orzada & Kallal, 2021). Apparel acceptance, in this framework, depends on meeting functional criteria (mobility, thermal comfort, protection, storage, visibility, sizing fit), aesthetic preferences (colour, pattern, silhouette, female-appropriate cuts), and expressive needs operationalized in this study as bicycle-suitability and price-performance accessibility (Section 2.5). The 90% support for a dedicated women's cycling apparel collection, together with the 10-look capsule outcome in Appendix A and the feature-to-need mapping in Table 4, demonstrates that the user evidence can be translated into design criteria responsive to local market realities (Bye & Hakala, 2005).

Limitations and future work

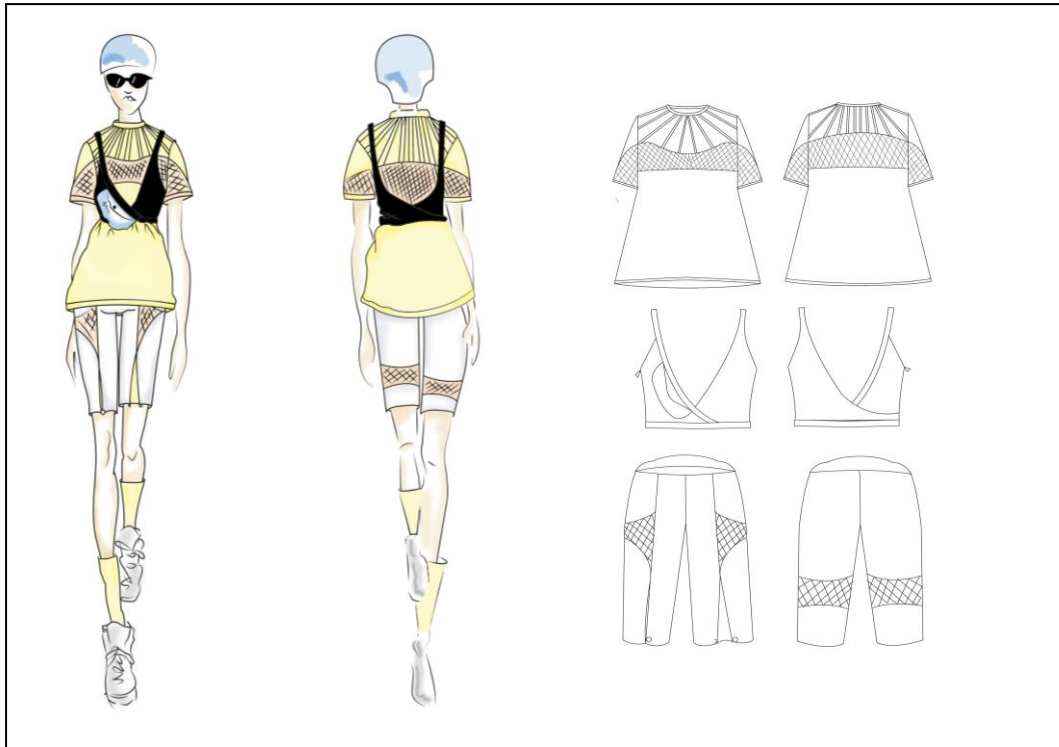
The primary limitations of this study are its qualitative design and context specificity. The sample is 20 women cyclists residing in Eskişehir, Türkiye, and reflects self-reported experiences and preferences rather than experimentally tested performance outcomes. Results should therefore be interpreted as design-relevant evidence for need identification and concept development within the studied context.

Two extensions are proposed for future work. First, prototyping the 10-look collection (Appendix A) and conducting instrumented wear trials would allow the qualitative design criteria identified here to be validated against quantitative performance and comfort measures across seasonal conditions. Second, extending the sampling frame beyond Eskişehir particularly to cities with weaker cycling infrastructure or different cultural contexts, would test whether the user needs surfaced in this study are stable across Turkish women cyclists more broadly or are partly specific to Eskişehir's relatively cycling-friendly environment.

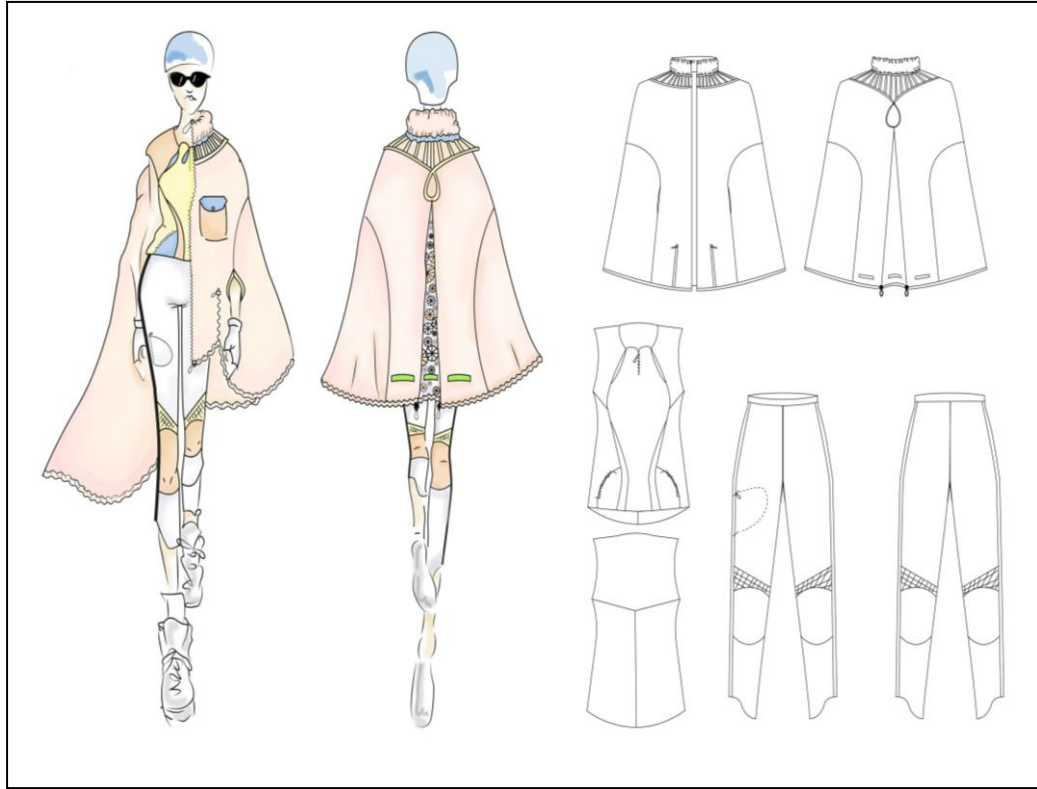
Appendix



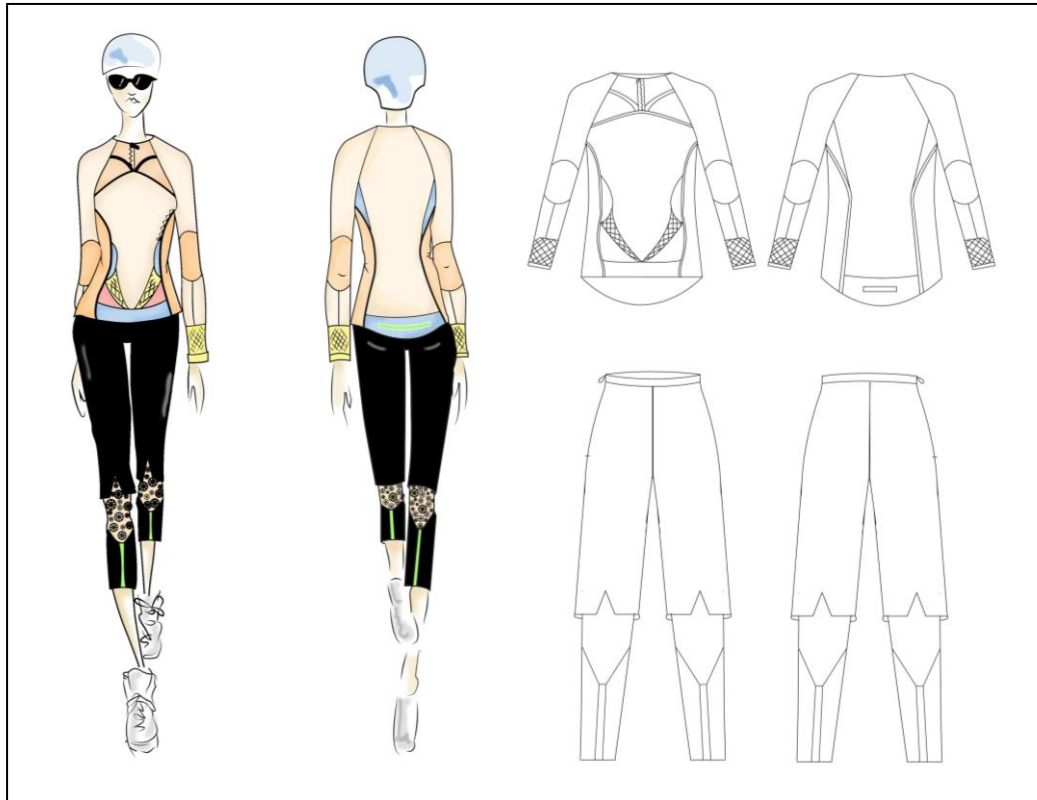
Design Look 1



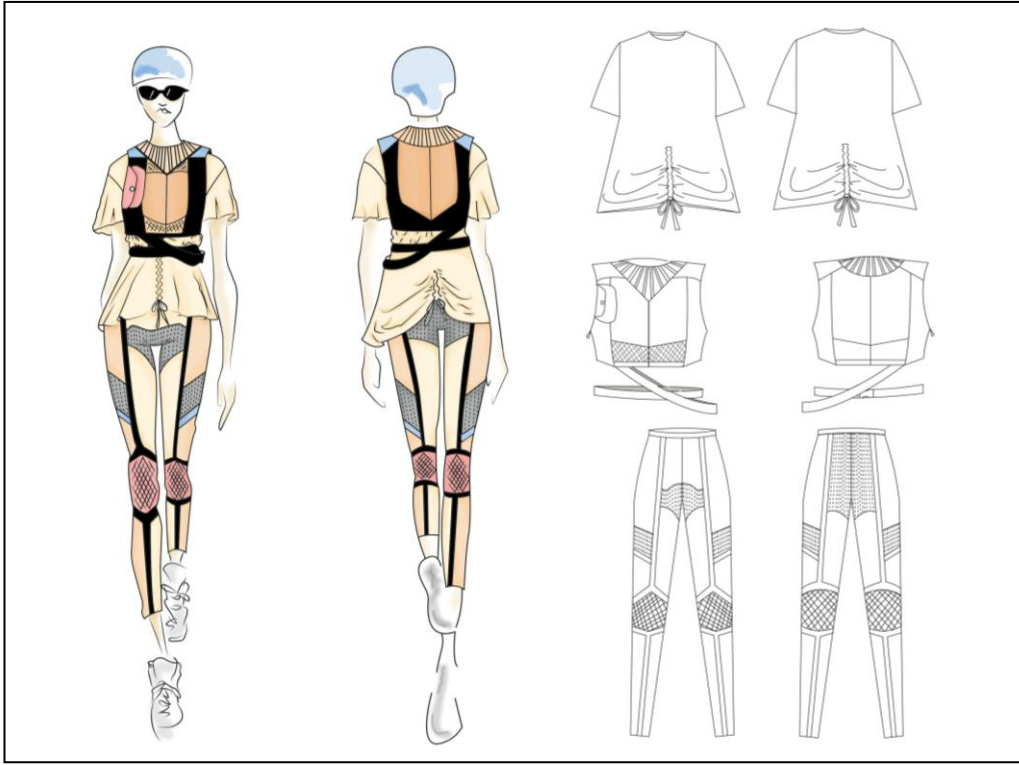
Design Look 2



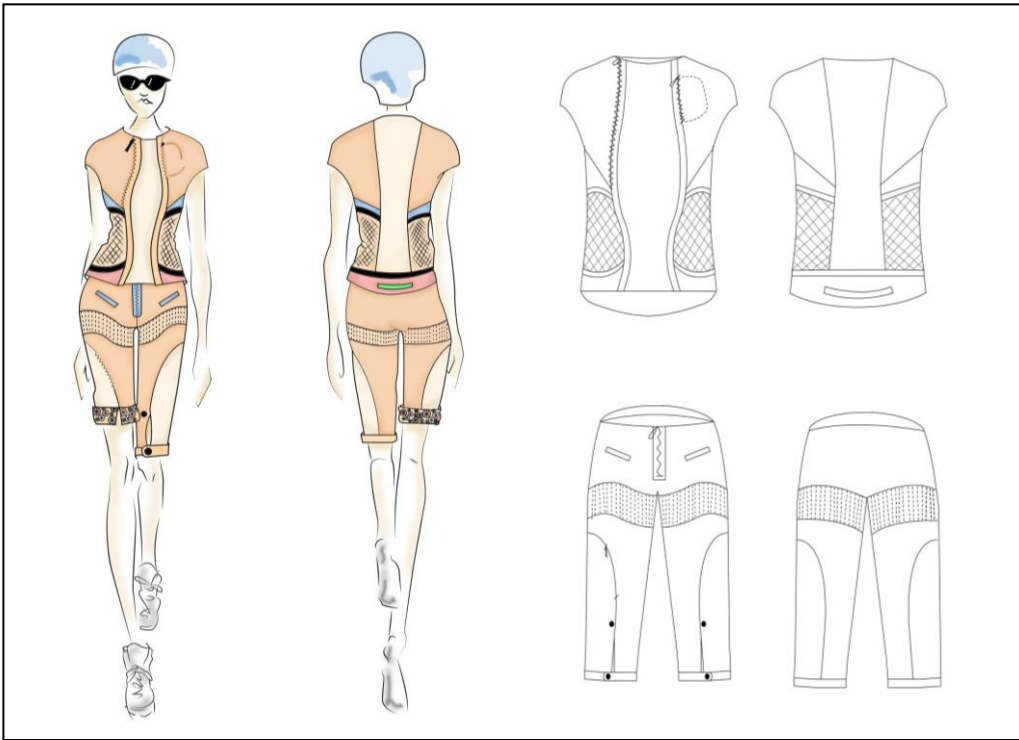
Design Look 3



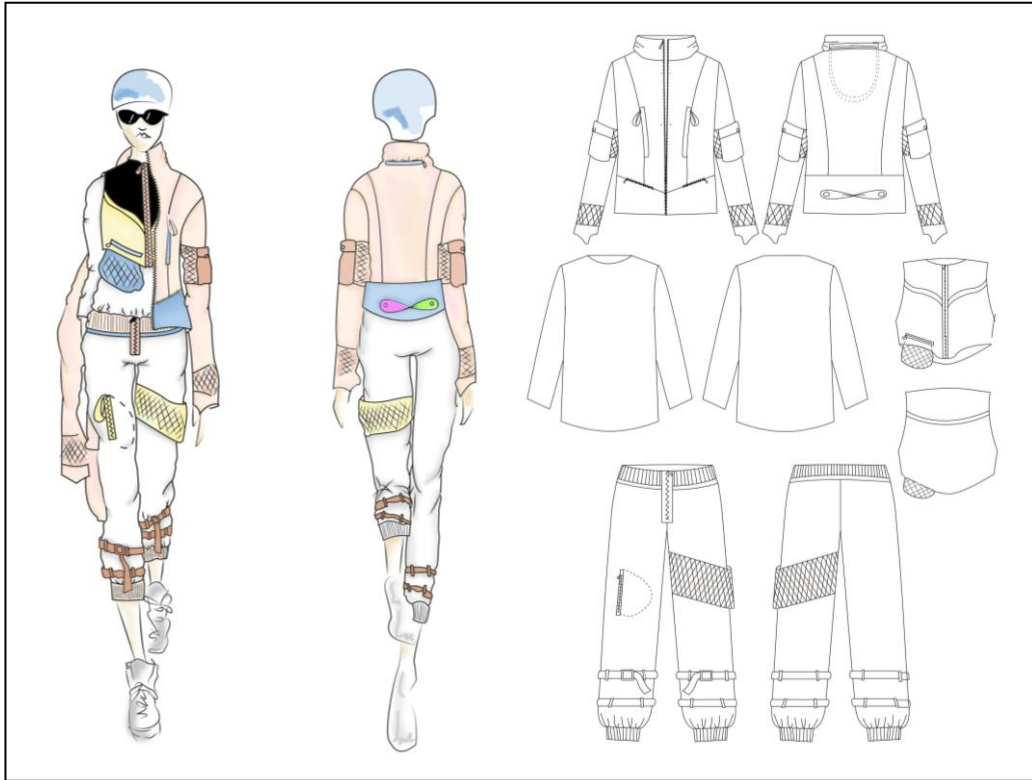
Design Look 4



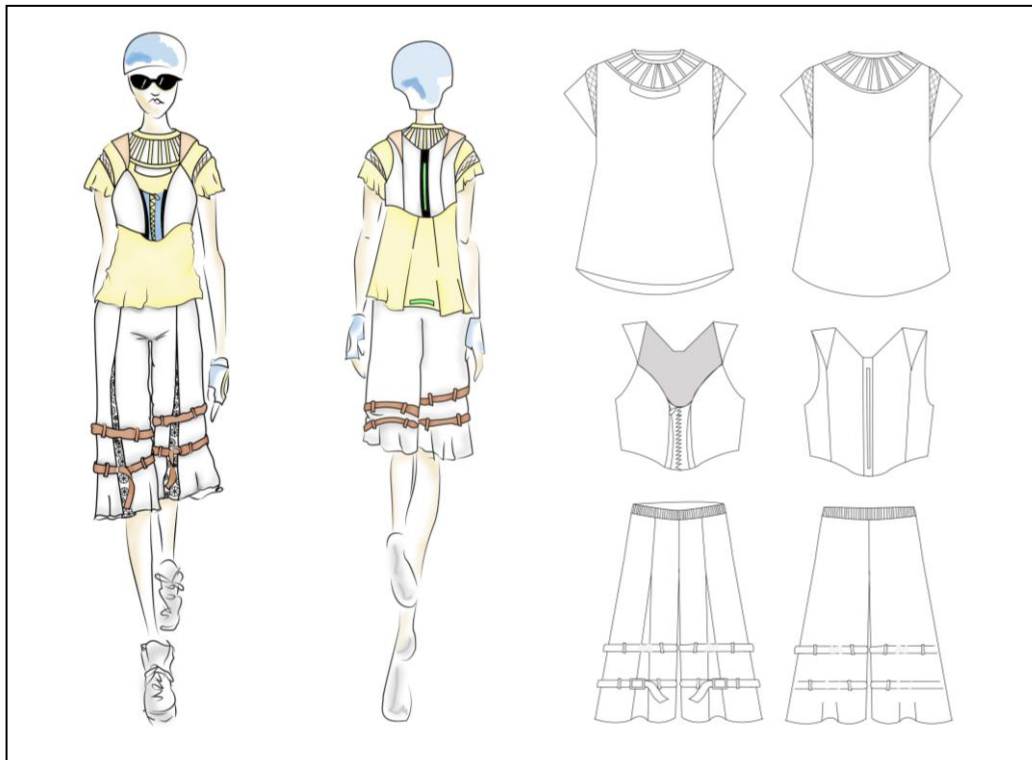
Design Look 5



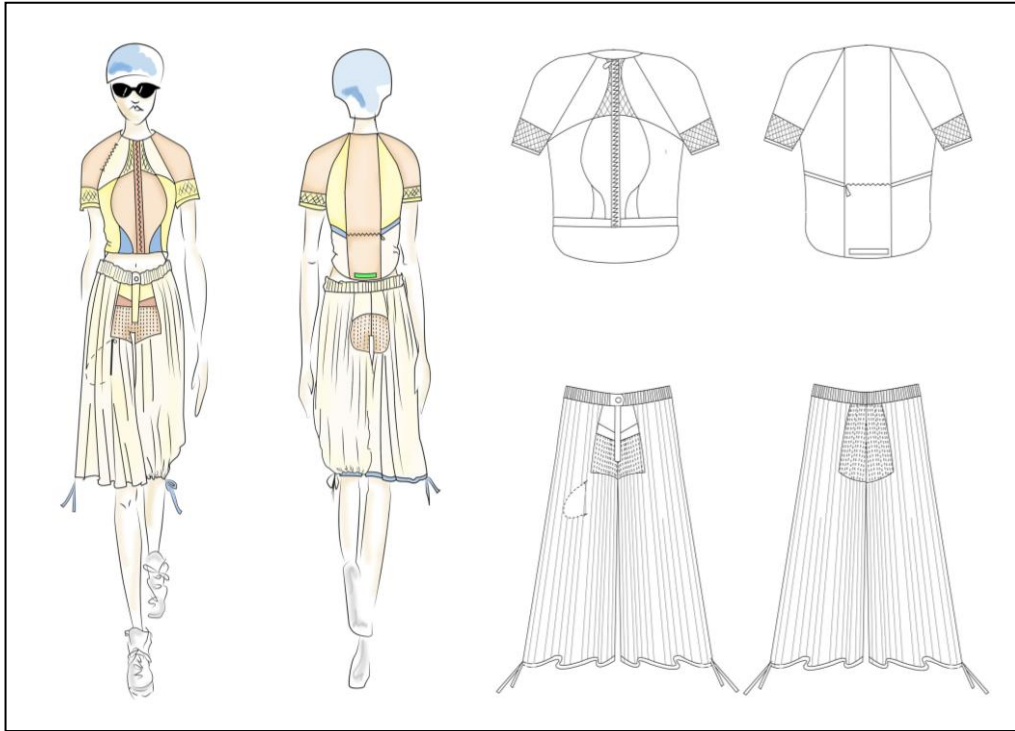
Design Look 6



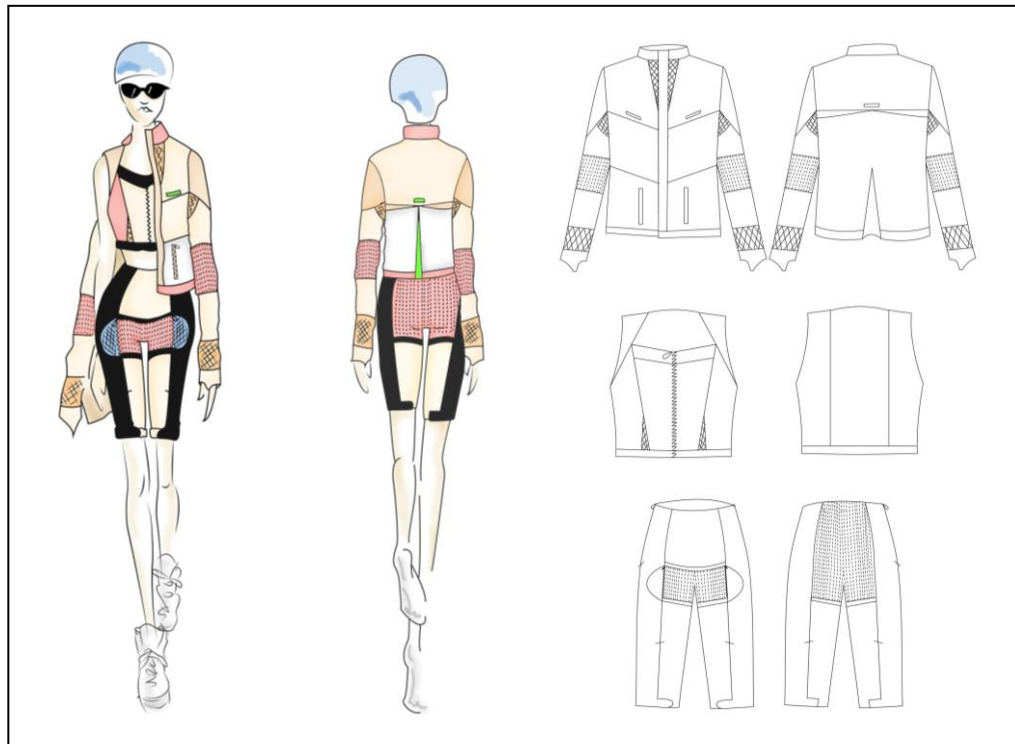
Design Look 7



Design Look 8



Design Look 9



Design Look 10

Etik Komite Onayı: Araştırmanın etik onayı, Eskişehir Teknik Üniversitesi Fen ve Mühendislik Bilimleri Araştırma ve Yayın Etiği Kurulu tarafından 28 Haziran 2019 tarihinde 17938 numaralı protokol ile alınmıştır.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları:

Araştırma Probleminin Belirlenmesi-E.V., D.S.; Araştırma Modeli ve Veri Toplama Aracı Geliştirme-E.V., D.S.; Denetleme-E.V.; Literatür Taraması-E.V., D.S.; Veri Toplanması-D.S. Verilerin Analizi-E.V., D.S.; Koleksiyon Geliştirme-D.S.; Eleştirel İnceleme-E.V.; Yayın Haline Dönüştürme-E.V.

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Determination of the Research Problem – E.V., D.S.; Development of the Research Model and Data Collection Tool – E.V., D.S.; Supervision – E.V.; Literature Review – E.V., D.S.; Data Collection – D.S.; Analysis of the Data – E.V., D.S.; Development of the Collection – D.S.; Critical Review – E.V.; Converting to Article Format – E.V.

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EXTENDED ABSTRACT

Aim: The aim of this study is to determine women cyclists' clothing preferences, identify cycling-related apparel problems, elicit expectations, and propose a collection informed by these findings. So, the main research problem addressed in this study is how the functional, expressive, and aesthetic clothing needs of women cyclists can be identified and transformed into apparel collection according to user-centered apparel design criteria. The work is organized around four sub-questions on garment types, design and functional attributes, market perceptions and reported issues, and purchase drivers. These are:

1. What types of clothes put on, and clothing preferences do female cyclists have while cycling?
2. What functional, expressive, and aesthetic expectations do women cyclists have regarding cycling apparel?
3. What problems and market limitations do women cyclists experience with existing cycling apparel?
4. How can the identified user needs be translated into design criteria and collection for women's cycling apparel?

Method: This study used a qualitative, user-centered apparel design approach in two linked phases, consistent with design-development case-study methods in functional apparel research. Phase 1 elicited women cyclists' needs, problems and expectations through semi-structured interviews. Phase 2 translated these interview findings into explicit design criteria, which informed the development of a women's cycling capsule collection for spring/summer use.

Results: Participants reported that clothing choice during cycling is largely governed by ride comfort and practical safety constraints. Participants identified lower-body apparel as their primary cycling-wear concern. Tights were the most preferred lower-body item. Accessories were framed as integral to perceived safety. Helmet use was frequently described as "necessary" and "essential." Gloves, rain and wind protection layers were treated as part of a functional riding outfit rather than fashion-driven choices.

A recurring fit-related criterion was avoidance of extremes in tightness and looseness: tight garments were described as restrictive during effort, while loose garments were framed as hazardous because of drivetrain entanglement. Participants' design preferences emphasized forms that support comfortable riding. Preferred silhouette also shifted by season (tighter or looser forms depending on weather) indicating that design choices were partly aesthetic and partly adaptive to environmental conditions. Color preference varied across participants but was frequently subordinated to visibility.

Responses about "feeling good and attractive" revealed a bifurcation. Some of them did not associate "attractive" with cycling apparel and described expectations oriented toward comfort and functionality rather than visual appeal. At the same time, participants' descriptions of desired cuts such as feminine necklines, fitted but modest jersey patterns, and female-tailored zippers indicate that aesthetic preferences and functional fit needs remain salient for many.

Structural market constraints were highlighted. Some participants reported that women's options in the cycling apparel market were limited, making it difficult to find preferred colors, patterns, and forms; this group described compensating by purchasing from men's sections and wearing cuts not optimized for their bodies.

Concrete product problems were also documented: thin tights causing transparency, padded cycling tights restricting walking, limited pattern and color variety, and a lack of feminine shaping in jersey patterns. Motivations for purchasing new cycling garments were reported as primarily need-driven (replacement due to wear or inadequacy), with social influence (observing other cyclists' apparel) and a desire to "feel better" in cycling contexts as secondary factors. Support for developing a dedicated women's cycling collection was strong.

Research findings were translated into a capsule-collection proposition: a 10-look spring/summer concept line of raincoats, windbreakers, t-shirts, cycling jerseys, sports bustiers, trousers, Bermuda shorts, and tights. The intent was to align color, pattern, and form decisions with current trend sources (e.g., WGSN, Pantone) while directly responding to the user needs.

Conclusions: This study examined women cyclists' clothing practices, preferences, and unmet expectations to inform the development of women-specific cycling apparel. The findings align with the multidimensional needs structure of the Functional-Expressive-Aesthetic (FEA) consumer needs model. Apparel acceptance, in this framework, depends on meeting functional criteria (mobility, thermal comfort, protection, storage, visibility, sizing fit), aesthetic preferences (colour, pattern, silhouette, female-appropriate cuts), and expressive needs operationalized in this study as bicycle-suitability and price-performance accessibility. A dedicated women's cycling apparel collection, together with the 10-look capsule outcome in Appendix A suggested.