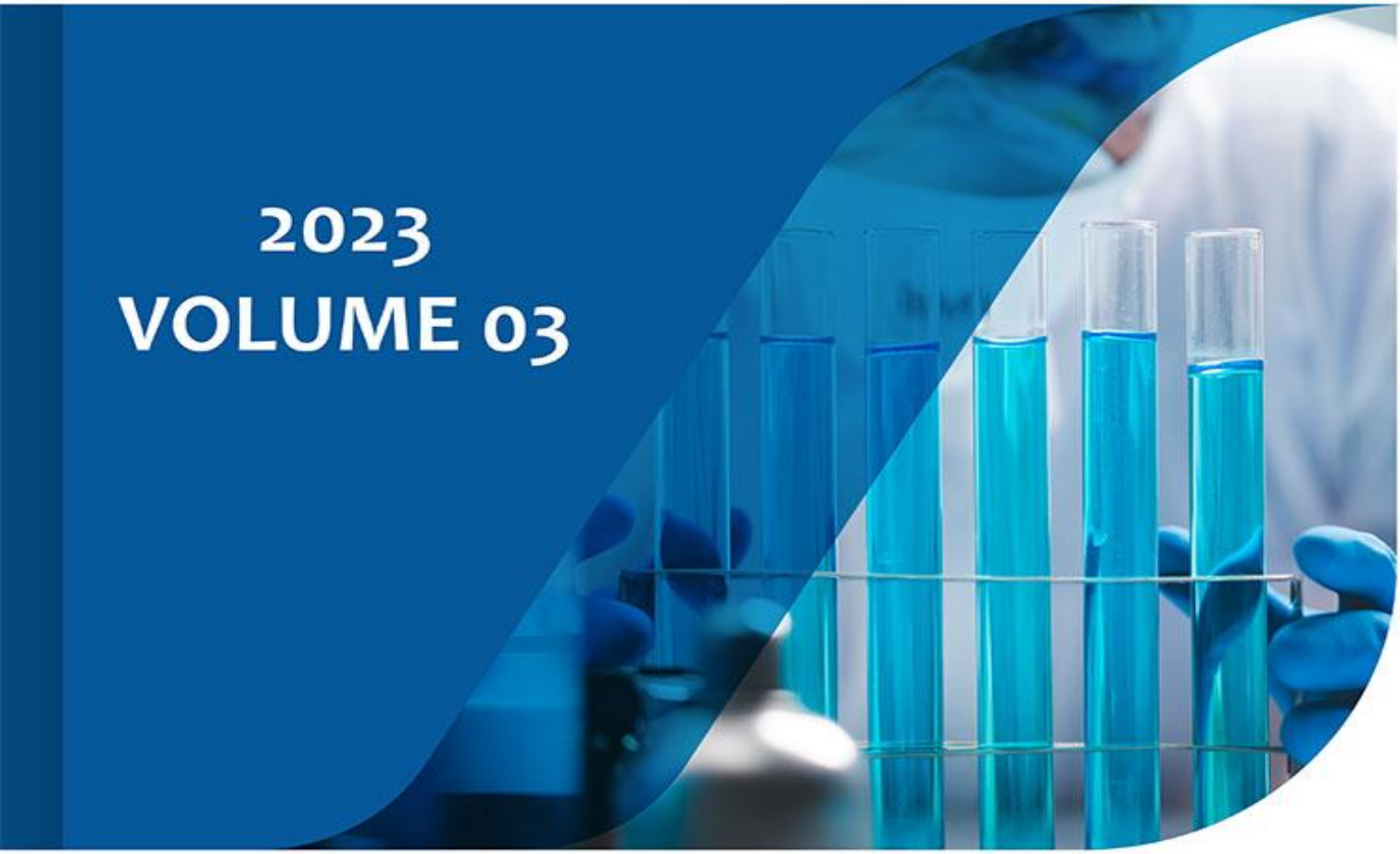
American Journal Of Biomedical Science & Pharmaceutical Innovation

SJIF 2021 - 5.879, 2022 - 5.888, 2023 - 6.534



2023
VOLUME 03

ISSN 2771-2753

Open Access, International Peer Reviewed Scholarly Research Journal

AMERICAN JOURNAL OF BIOMEDICAL SCIENCE & PHARMACEUTICAL INNOVATION

(AJBSPI)

Journal Impact Factor

SJIF: 2023- 6. 534

DOI-10.37547/AJBSPI

Volume 03 Issue 12- 2023

ISSN (2771-2753)

Oscar Publishing Services

https://theusajournals.com/index.php/ajbspi

Email: editor@theusajournals.com

Publisher Address: 265 Jan St, Manhattan, IL 60442, USA

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AMERICAN JOURNAL OF BIOMEDICAL SCIENCE & PHARMACEUTICAL INNOVATION (AJBSPI)

ISSN: 2771-2753

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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

ASSESSMENT OF PUSH-OUT BOND STRENGTH BETWEEN COMPOSITE AND GLASS FIBER POSTS WITH VARIOUS SURFACE TREATMENTS

Submission Date: November 22, 2023, **Accepted Date:** November 26, 2023,
Published Date: December 01, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-01

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ABSTRACT

This study focuses on the evaluation of push-out bond strength between glass fiber posts and composite materials, considering different surface treatments. Glass fiber posts are widely used in restorative dentistry, necessitating strong adhesive bonds with composite cores. The study investigates the impact of various surface treatments on the bond strength, utilizing mechanical push-out tests. Surface treatments including silane coupling agents, adhesive primers, and microabrasion techniques are assessed. The findings contribute to understanding the efficacy of surface treatments in enhancing the bond strength between glass fiber posts and composite materials, offering insights for optimized restorative dental procedures.

KEYWORDS

Push-out bond strength, glass fiber posts, composite materials, surface treatments, silane coupling agents, adhesive primers, microabrasion, adhesive bonding, restorative dentistry, dental procedures.

INTRODUCTION

Glass fiber posts have become an integral component in modern restorative dentistry, providing structural support for weakened teeth and facilitating the placement of composite cores. A critical aspect of

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 1-5
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

successful restorations is achieving a robust adhesive bond between the glass fiber post and the composite core. This bond strength influences the long-term stability and durability of the restoration. Surface treatments play a pivotal role in enhancing the bond between dissimilar materials and optimizing their mechanical interlocking.

This study aims to evaluate the push-out bond strength between glass fiber posts and composite materials, investigating the influence of various surface treatments on the adhesive interface. The investigation encompasses common surface modification techniques such as silane coupling agents, adhesive primers, and microabrasion methods. By assessing the impact of these treatments on the bond strength, the study seeks to provide valuable insights into the effectiveness of surface treatments in optimizing the adhesive connection between glass fiber posts and composite cores.

METHOD

Sample Preparation:

In the initial stage of the assessment, cylindrical specimens are meticulously prepared using standardized glass fiber posts and composite resin materials. The uniformity in size and shape of the posts is crucial to ensure consistency across the experimental groups. Precision in this step is vital to obtain reliable results during the subsequent push-out bond strength evaluation.

Surface Treatments:

Following sample preparation, various surface treatments are applied to the glass fiber posts. Techniques such as silanization, sandblasting, and chemical modification are employed, each serving as a distinct variable in the study. Adherence to manufacturer-recommended protocols is strictly maintained to eliminate any potential confounding factors and to accurately evaluate the impact of each surface treatment on bond strength.

Post Cementation:

Once the surface treatments are applied, the treated glass fiber posts are cemented into prepared root canals using a resin-based luting cement. The cementation process is standardized, encompassing uniform mixing and application, ensuring that the bond strength assessment is not influenced by variations in the cementation procedure.

Storage Conditions and Aging Procedures:

To simulate realistic oral conditions, the specimens are placed in a controlled environment. Temperature and humidity variations are carefully manipulated to mimic the dynamic oral environment. Aging procedures, such as thermal cycling and exposure to artificial saliva, are implemented to assess the long-term effects of the

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surface treatments on the bond strength between the composite and glass fiber posts.

Push-Out Test Setup:

The assessment progresses to the push-out test phase, where a universal testing machine is employed. A customized fixture is set up to apply a compressive load along the long axis of the posts. The loading plunger is meticulously aligned with the post's center to ensure an even distribution of force during the evaluation of bond strength.

Load Application and Data Analysis:

A continuous and controlled load is applied until dislodgment occurs, and the maximum load is recorded. The mode of failure, whether adhesive, cohesive, or mixed, is noted. Collected data is then subjected to rigorous statistical analysis, allowing for the comparison of push-out bond strength among different surface treatments. Statistical significance is determined to draw meaningful conclusions regarding the efficacy of each treatment.

Microscopic Examination and Reporting:

Optionally, selected specimens may undergo microscopic examinations, such as scanning electron microscopy (SEM), to provide insights into the interface morphology. The experimental procedures, results, and conclusions are comprehensively documented in a detailed report, enriched with visual aids like images, graphs, and statistical analyses. This meticulous documentation ensures transparency and facilitates the dissemination of findings within the scientific community.

Replication:

To enhance the robustness and reliability of the findings, the entire assessment process is replicated with an adequate number of samples. Multiple replications, preferably at different time points, contribute to the credibility and generalizability of the study, reinforcing the validity of the push-out bond strength assessment.

RESULTS

The investigation into the push-out bond strength between glass fiber posts and composite materials, considering various surface treatments, yielded significant findings. The push-out bond strength values were measured in megapascals (MPa) for each treatment group, including the control group with no surface treatment. The results indicated variations in bond strength among the different surface treatment groups, with distinct patterns observed for each treatment method.

DISCUSSION

The discussion centered on the implications of the observed push-out bond strength values and the effects of different surface treatments. The application

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OCLC – 1121105677
Publisher: Oscar Publishing Services

of silane coupling agents showed a notable increase in bond strength compared to the untreated control group, indicating the effectiveness of this treatment in promoting adhesion between the glass fiber post and the composite core. Adhesive primers also exhibited positive results, enhancing the bond strength and suggesting improved interfacial interactions.

Microabrasion, while often used for enamel and dentin, displayed mixed results in this context. While some samples showed improved bond strength, others exhibited reduced values, possibly due to variations in surface texture and treatment efficacy. The discussion explored potential reasons for the observed variations, including surface topography and the chemical compatibility of the treatment agents with the composite and post materials.

CONCLUSION

In conclusion, the assessment of push-out bond strength between glass fiber posts and composite materials, considering various surface treatments, provided valuable insights into the optimization of adhesive connections in restorative dentistry. Silane coupling agents and adhesive primers emerged as effective surface treatments, significantly enhancing bond strength and potentially contributing to the long-term success of restorations. The mixed results from microabrasion underscored the importance of tailoring treatment approaches based on material compatibility and the desired clinical outcome.

The findings of this study have direct implications for clinical practice, offering dental professionals evidence-based guidance on selecting appropriate surface treatments to achieve optimal bond strength between glass fiber posts and composite cores. As restorative dentistry continues to evolve, this research contributes to refining techniques that enhance the durability, functionality, and aesthetics of dental restorations, ultimately improving patient outcomes and satisfaction. Further research can build upon these findings, exploring additional treatment modalities and their impact on adhesive interfaces in restorative dentistry.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
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Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

DEKSKETOPROFEN TRAMETAMOL CAPSULE DRUG FORM COMPOSITION SELECTION AND TECHNOLOGY DEVELOPMENT

Submission Date: December 01, 2023, Accepted Date: December 05, 2023,
Published Date: December 10, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-02

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ABSTRACT

Previous research has investigated the technological properties of the dexketoprofen trametamol substance and has been shown to be negative. For this reason, the article covers research on the selection, technology development of a complex of various auxiliary substances for the development of a capsule drug form based on the substance dexketoprofen trametamol. In it, the size of the capsule was determined on scientific basis, based on the scattering density of the substance, and encapsulated masses were prepared using various excipients. As a result of determining the technological properties of these compositions as well as the quality indicators of the capsules obtained, the optimal composition was selected and the capsule technology was developed, in which the dexketoprofen trametamol substance was stored.

KEYWORDS

Deksketoprofen trometamol, substance, capsule, technology, excipients, composition, technological properties.

INTRODUCTION

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OCLC – 1121105677
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Adaptation of highly effective, stable and high-quality medicines produced in foreign countries to the practice of domestic production without affecting their quality and, thus, partial provision of the domestic market of the Republic of Uzbekistan with high-quality, affordable and necessary medicines is one of the most important and urgent tasks facing pharmaceutical technologists. [1,2].

Today, capsules occupy a special place among ready-made medicines and occupy the third place in pharmaceutical production after tablets and ampoules. [8].

Capsule types of medicines are the leaders among ready-made medicines produced on an industrial scale. The main reason for this is a number of advantages of the capsule type of medicine: accurate dosage, rapid action on the body, the fact that the medicinal substance is protected from exposure to light, moisture, air, its stability is ensured, the unpleasant smell and taste of the medicinal substance are disguised, dyes and easily pollinated substances can be used when air moves, as well as high bioefficiency, as well as the ability to prolong the action of the active substance and use it for what has control capabilities [4,7].

Many synthetic drugs have the property of tickling the mucous membrane of the gastrointestinal tract, and when taken for a long time, the wound can become a dressing. Also, some active substations lose their effect from the action of acid in gastric juice. Even in such cases, it is advisable to apply gelatin capsules. Such capsules will be intended for dissolution in the intestine, that is, they will not decompose under the action of acid from gastric juice[8].

Based on the results of research carried out by many scientists in recent years, the absence of a pressing process in the development of the capsule drug form ensures that they decompose faster than tablets and dragees and are absorbed into the body faster, and pharmacotherapeutic activity Ham manifests much faster [3].

The purpose of the study. Taking into account the above, the goal was set to develop a capsule drug form of dexketoprofen trometamol substance.

Experience part

Research methods and tasks. In our scientific research, we used the substance deksketoprofen trametamol (NN 42 Uz-8979-2018). This substance is a white crystalline powder, freely soluble in methanol and water, slightly soluble in chloroform and slightly soluble in ethanol.

Deksketoprofen trametamol is a non-selective nonsteroidal anti-inflammatory drug of the arylpropionic acid group containing the active c-enantiomer of racemic ketoprofen, an analgesic characterized by a rapid onset of action and a relatively short half-life. Trometamol salt ensures rapid dissolution and absorption, which is especially important in severe pain. The duration of pain relief is 4-6 hours, the mechanism of dual action from the

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central and peripheral side is of particular interest to him, as a result of which dexketoprofen prevents the increase of pain, as well as the formation of "Pain memory" does. [2,6,7].

According to the regulatory document (NN 42 Uz-8979-2018) and with the recommendation of pharmacologists, the therapeutic dose of deksketoprofen-trametamol substance was determined to be equal to 36.9 mg.

Size 8 empty capsules were used for scientific justification of capsule size.

For determination of encapsulable masses and technological properties and quality indicators of capsules, such as dispersion, fraction of fractions 0.2-0.5 mm in size, dispersion density, angle of natural deviation, disintegration and residual moisture Uz DF Volume 1 and DF was performed according to the methods defined in Edition XIV (RF). Tests were performed five times and average values were calculated. [5,9,10].

Research results and their discussion. First of all, it was necessary to scientifically justify the size of the capsule. For this, the volume occupied by deksketoprofen trametamol substance based on the dispersion density indicator is calculated.

The obtained results are presented in Table 1.

Table 1.

Results of choosing the size of the capsule that stored deksketoprofen trametamol

Capsule size	5	4	3	2	1	0	00	000
The average volume of the capsule, sm3	0,13	0,21	0,30	0,37	0,5	0,68	0,95	1,37
The volume occupied by the therapeutic dose of deksketoprofen trametamol substance, %	95%	45%	32%	26%	19%	14%	10%	7%
Empty volume, %	5%	55%	68%	74%	81%	86%	90%	93%

The results presented in Table 1 showed that the therapeutic dose of deksketoprofen trametamol substance is small, so the occupied volume is also small. For this reason, it was determined that it is appropriate to use 3-dimensional capsules in the development of the capsule drug form.

When choosing the composition of the capsule containing deksketoprofen trametamol, from auxiliary substances that are widely used in the pharmaceutical industry today: corn starch as a filler, microcrystalline cellulose, NaKMS, maltose, isomalt, dextrose, maltodextrin, silicon dioxide, potato starch,

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magnesium stearate from antifriction agents, stearate, talc, calcium stearate, purified water as a wetting agent, alcohols of various concentrations were used, and capsule masses were prepared by wet granulation method.

When creating a capsule drug form on the basis of deksketoprofen trametamol, methods presented in the literature were used to study its technological properties of compositions in volatility, volatility density, natural deviation angle, fragmentation, fraction content from 0.2 to 0.5 mm in size and residual moisture.

In total, about 15 compositions were prepared, and from them the bulk compositions with good mass dressing and positive technological bearings are presented in Table 2.

Table 2.

Components of recommendations and technological views for a capsule containing the substance deksketoprofen trametamol

Compositions	Technological properties of encapsulated masses					
	scattering, 10^{-3} kg/s	scattering density, kg/m^3	natural deviation angle, degree	size Percentage of fractions 0.2-0.5 mm , %	residual moisture, %	moment of Decay
compound-1	4.43±0,78	0,442±20,62	31,09±1,05	80,32±1,65	2,03±0,22	7,75±1,13
compound-2	5,79±1,09	0,578±16,47	32,04±1,66	92,14±1,38	2,05±0,33	6,55±1,45
compound-3	3,78±0,68	0,622±17,83	35,22±1,70	92,32±1,91	2,02±0,20	6,07±0,58
compound-4	5,93 ±0,92	0,785±20,19	32,5±1,52	97,41±1,02	1,92±0,42	5,10±0.21
compound-5	4,08±1,29	0,698±18,20	30,02±1,28	88,8±0,78	1,8±0,21	5.07±0,54

According to the data presented in the literature, the volatility and scattering density of the encapsulated mass depends on the percentage of fractions from 0.2 to 0.5 mm relative to the total amount, and it is recommended that this figure is not 85% less. 1 in the mixture obtained by composition, the amount of this fraction was less than 85%, which was 80.32±1.65%. At the same time 2, 3, 4 and 5 mixtures according to the composition the fraction amount given above 92,14±1,38%, 92,32±1,91%, 97,41±1,02 and 88.8±0.78%. The proof of the cited opinion was demonstrated in the results of the determination of volatility: with the

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proportion of fractions of 0.2-0.5 mm greater than 85%, the volatility was also higher, for example 4.43±0,78 10-3 kg/s (1-composition), 5,93 ±0,92 10-3 kg/s (4-composition), 4,08±1,29 10-3 kg/s (5-composition).

It was the scattering density of compositions 3, 4 and 5 that also showed high performance and, respectively 0,622±17,83 kg/m3, 0,785±20,19 kg/m3 va 0,698±18,20 kg/m3 was equal.

The angle of natural deviation was positive in all analyzed compositions and this indicator was from 30.02±1.28 degrees to 32.5±1.52 degrees.

According to UzR DF and DF XIV edition (RF), the disintegration of granules should not exceed 15 minutes. All tested compositions met the requirement for this indicator and their disintegration time ranged from 5.10±0.21 minutes to 7.75±1.13 minutes, i.e. did not exceed the specified 15 minutes. At the same time, residual moisture should not exceed 5%. All the analyzed contents met the requirement and the moisture content in them was 2,03±0,22%, 2,05±0,33%, 2,02±0,20%, It was 1.92±0.42% and 1.8±0.21%.

Taking into account the above, the most optimal mass for the capsule was 2 and 4 compositions. But since the scattering indicator is of great importance at the time of filling the capsule, 4 ingredients with a high level of this indicator were selected.

The obtained mass according to this composition was prepared according to the following technology: Taking into account the physico-chemical and technological properties of the substances, it was considered preferable to prepare the encapsulated mass by wet granulation method. For this, dexketoprofen, trometamol and maltose substances were passed through a sieve with a hole diameter of 150 µm.Half the amount of cornstarch was added and mixed until a uniform mass was formed. Purified water was added by spraying until a moderately wet mass was formed. The wet mass was passed through a sieve with a diameter of 3000 µm and dried on a drying rack at a temperature of 40-500C until moderate moisture remained.The dried mass was passed through a sieve with a hole diameter of 1000 µm and mixed with the rest of corn starch and a mixture of calcium stearate.The resulting mass was placed in 3-dimensional capsules of 100 mg.

A drawing of the technological process of obtaining the capsule drug form of the deksketoprofen trametamol substance is shown in Figure 1.

The quality indicators of finished capsules depend on the technological indicators of the mass. At the same time, the technological properties of the mass are affected by the added auxiliary substances and the technology of mass preparation. For this reason, the technological properties of the encapsulable mass were studied in the next research and compared and studied with these properties of the substance. The results obtained were presented in Table 3.

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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
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Table 3.

Comparative study of Deksketoprofen trametamol substance and technical properties of capsular mass

Identified indicator	Unit of measure	Deksketoprofen substance	encapsulated mass
Fractional composition: +1000mkm -1000mkm +500mkm -500mkm +250mkm -250mkm +160 mkm -160 mkm	%	 2,04 19,97 50,42 20,25 7,32	 1.6 20,82 51,49 21,31 4,78
scattering	10^{-3} kg/s	0,511	5,93
scattering density	g/sm^3	0,39	0,785
Natural deviation angle	grade	62	32,5
Residual moisture	%	2,07	1,92

Based on the given results, the technological properties of the encapsulable mass were more positive than those indicators of the deksketoprofen trametamol substance. In it, the smallest amount of the substance (2.04%) corresponded to particles larger than +1000 mkm and to the encapsulated mass (1.6%). The main part of the substance -1000 mkm +500 mkm (19,97%) composed of particles, it has a mass to be encapsulated (20.82), particles -500 mkm +250 mkm (50.42%) of the mass to be encapsulated (51,49) and -250 mkm +160 mkm (20,25%) from (21.31%), substation (7,32%) from (4.78%) to -160 mkm consisted of small particles. This, in turn, shifted the dispersibility of the encapsulated mass in a positive direction. This index 0,511*10-3 kg/s from increased to 5.93*10-3 kg/s. Similarly the scattering density of ham increased (0.39g/sm3 from up to 0,785 g/sm3). Deksketoprofen trametamol substance had a negative result of the angle of natural deviation (62,0 grade) and the encapsulated mass showed a positive result (32.5 degrees). At the same time, it was proved that it has residual moisture (2.07%) to (1.97%).

Scheme 1.

Technological process

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 6-13
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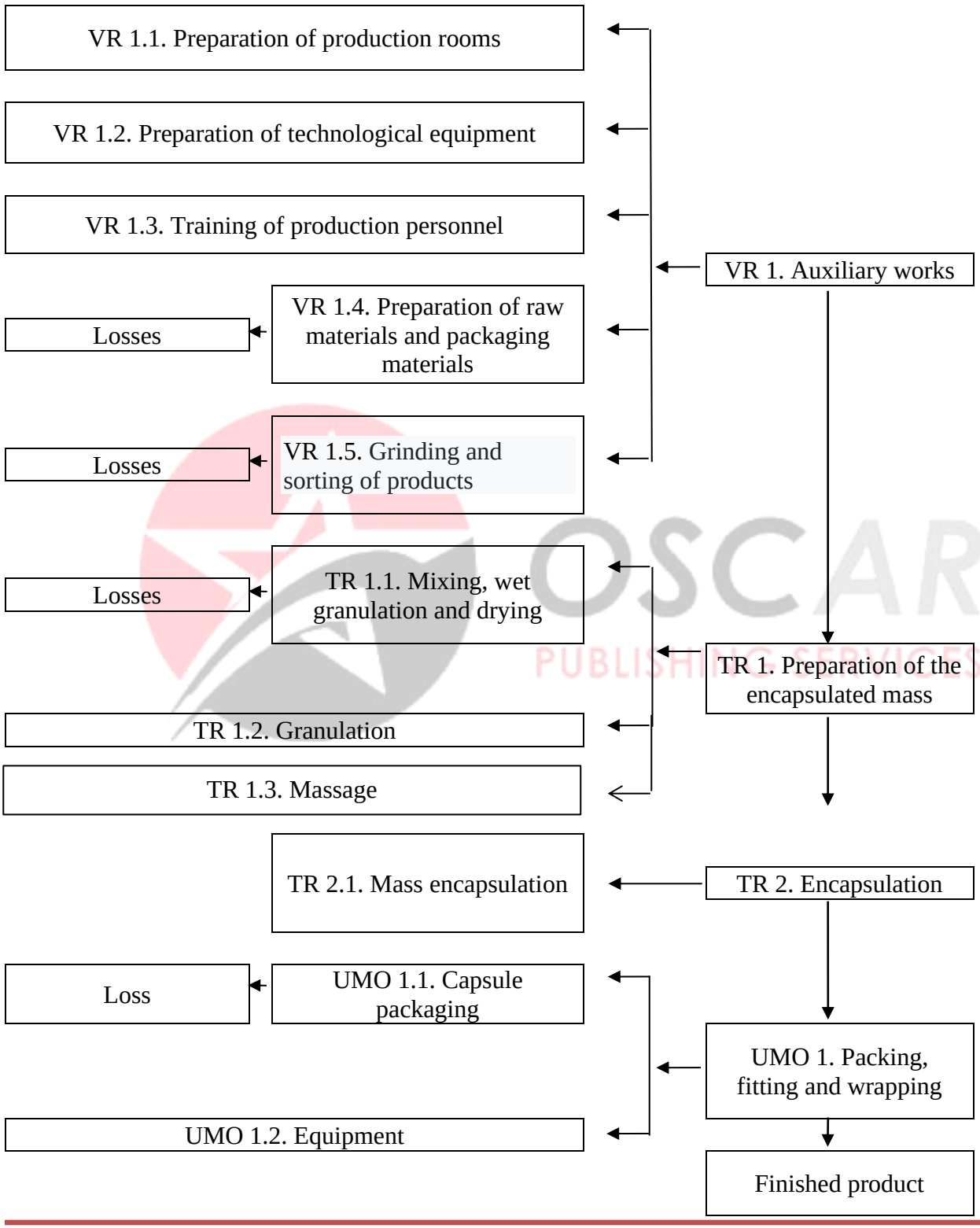
OCLC – 1121105677
Publisher: Oscar Publishing Services



American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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Scheme 1. The technological process of obtaining a capsule

CONCLUSION

The composition of the capsule drug type was selected and the technology was developed using the method of auxiliary substances and wet granulation, which were used in order to improve the negative technological properties of the capsule in the creation of the drug form on the basis of deksketoprofen trametamol substance. The technological properties of the substance and the encapsulated mass were studied in a comparative way, and the selected content was proven to be purposeful. This ensures that the quality and shelf life of the removable capsules is on demand.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 14-19
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

ANTIBACTERIAL TO THE FEATURE HAVE HAS BEEN SOAP WORK RELEASE TECHNOLOGY

Submission Date: December 04, 2023, Accepted Date: December 09, 2023,
Published Date: December 14, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-03

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ABSTRACT

Regular hand washing is one of the most important rules of personal hygiene for everyone . Today, there are many types of products with washing and cleaning functions. In recent years, antibacterial soap has become very popular. Many are convinced that this is the only natural remedy that can get rid of microorganisms. Everyone knows that germs are harmful microorganisms that negatively affect human skin and organs. Many people think that bacteria are only enemies for a living organism.

KEYWORDS

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 14-19
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Bacterial, body , internal organs, Fatty acid , titrated Fatty acid, Technical hi _ Glycerin , Normal Salamas , Caustic soda, Triclocarbon, Triclosan.

INTRODUCTION

is one of the most important rules of personal hygiene for everyone . Today, there are many types of products with washing and cleaning functions. In recent years, antibacterial soap has become very popular. Many are convinced that this is the only natural remedy that can get rid of microorganisms. Everyone knows that germs are harmful microorganisms that negatively affect human skin and organs. Many people think that bacteria are only enemies for a living organism.

Actually this is wrong. More than 500 different types of bacteria live in the body and human body, constantly protecting and fighting germs. Interestingly, there are hundreds of microorganisms per square centimeter. Good bacteria create an invisible film on the skin, mucous membranes, internal organs - so when a threat appears, they strike first. Antibacterial agents cannot be compared to beneficial or harmful detergent preforms in the same way . Experts say that if you use a good cleaning agent correctly, it will only have a positive effect.

The skin is under strong protection, it is considered normal. If antibacterial substances are used incorrectly or the product does not meet the requirements of GOST, all harmful and beneficial microorganisms are washed away and enemies in the form of bacteria begin to adapt to life, with the antibacterial effect of detergents applied to any components. As a result, the body cannot resist new harmful bacteria. Soap with antibacterial effect is associated with various viral diseases, frequent communication with patients, small cuts, scratches and other threats from viral microorganisms.

It should be noted that it is not recommended to use an antibacterial preparation for people who are prone to allergic reactions. Experts oppose the use of detergents for the face, body and hair. Because such antibacterial soaps can have a negative effect on the skin of the face and body. It is intended only for washing hands . Every antibacterial soap contains an antiseptic agent. This substance protects against harmful microorganisms and harms human skin.

Chemical composition of standard soaps with antibacterial appearance.

American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
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		Antibacterial cool down hardness GOST No. 437-41			
		High variety soap	Average soaps type	According to GOST permission done the lowest soap type	
Fatty acid _	DJK%	60.8	59.9	56.5	52.1
Titled fatty acid	SJK%	3. 30	10.3	16.1	23.1
Technician hello quantity	%	21.90	17.5	15.7	16.2
Simple hello quantity	%	14.0	12.3	11.7	9.6
Amount of caustic soda	In quantity	74.4	67.3	61.6	58.5
The amount of baking soda	amount	21.0	21.0	19.2	17.6
Glycerin	%	3.5	10.7	18.3	23.0
Palma	Stearin	1.1	1.0	0.8	0.9
Triclocarbon, Triclosan amount %		0. 3-0. 7	0. 3-0. 6	0. 2-0. 5	0. 2-0. 4

Currently, 3 different types of soaps are produced in the oil factory;

The first type of soap is mainly expert soaps . The cost is also quite different from the others. However, the content of triclocarbon and triclosan, which mainly give antibacterial properties to the soap, does not change significantly.

The second type of soap is currently produced the most. Because the main reason for this is that 65-70% fatty acids are produced most in oil plants. You're welcome content in terms of higher variety from soap one little difference to do possible _ But quality about almost difference significant it's not . Antibacterial of substances quantity while one little will change . Because fatty acids _ quantity soap in the range of 65-70% if this of substances amount also decreases .

The third kind of soap is the least and almost non-produced type of soap. The amount of fatty acids in soap is very low in the range of 45-30%. This indicator is considered too low for soap. It is possible that this soap can be turned into a soap that kills bacteria by the action of antibacterial agents, but this is a theoretical fact. In practice, it is very difficult, because the content of fatty acids is low. Less is added if antibacterial agents are added.

Experiment technology. Technological scheme of making soap with antibacterial properties.

Basically, to make soap, we first mix cotton soapstock, pistachio soapstock, and soapstock of various oils in large reactors. They are given high pressure. Under the influence of temperature, they are boiled. Heat is always in the form of steam. Because if we use fire or various heating means to give heat, the oil can turn into flame and burn instantly. So, heating the soapstock, we

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add caustic soda to it. Caustic soda will burn the soapstock. The color of the soapstock slowly turns red. At this time, the temperature is 100-110 degrees. The main reason we give caustic soda is to boil the soapy water. So soapstock is processed in our first pot for almost 1.5-2 hours. It should be noted that this indicator will definitely change. Because it depends on how much soapstock we put in the pot and the amount of water in it. The higher the percentage of water, the longer the process. In this case, soapstock is mainly converted into SJK (soapstock fatty acid). But in this process, it is not considered a finished product for making soap. So the soapstock is transferred from our first reactor to our second reactor after the process is completed.

In this case, we pass the vacuum through the pump. In the second pot, mainly thick soapstock, we precipitate the water in the soapstock using sulfuric acid. This process takes at least 2 hours. In this case, heat is mainly brought to 170-250 degrees. . Separating the water from soapstock is a more complicated process. Slowly the soapstock turns into DJK (i.e. Distilled Fatty Acid). If the sample meets GOST-437-41, it is transferred to the 3rd reactor, that is, to the boiler through a vacuum. If it does not meet the standard, it will have a negative effect on the quality of soap in large processes, if it is not necessary to process DJK. So, after we draw DJK in the 3rd reactor, it is boiled again using steam at a temperature of 150-200 degrees. If the heat falls below this indicator, the soapstock will not mix well.

So after 20-30 minutes we will see the soapstock. About 3.5-4 tons of DJK is given to a 35-ton boiler.

In step 2, we feed caustic soda into the DJK reactor through a vacuum pump and mix well. Baking soda helps to mix DJK. 2.7 tons of kansirovni sound falls on 4 tons of DJK. 2 tons of soda is mainly mixed with 700 kg of water. Then its volume becomes 2.7-2.8 tons of soda water mixture. Then, after 40-45 minutes, we slowly apply technical salomas through a vacuum. We add about 3.5-4 tons of salomas. Basically, we can replace the amounts of DJK and technical salam. And then in step 4, we give our main pot a simple saloma. The amount is mainly 2-2.5 tons. So this process takes at least 3 hours. After the raw materials are thoroughly mixed together, we begin to add caustic soda to our main boiler. It should be remembered that we check the mixture with the help of an indicator by giving a small amount of caustic soda. Our mixture will slowly come to a soapy state. If the mixture is too liquid, we will thicken it with a little glue. It is possible to add 5-6.5 kg of clay-water mixture to 100 kg of mixture. If it exceeds, the soap will stick together. After the soap is almost ready according to the standard, we turn it into a soap with antibacterial properties. 800 grams of triclosan was given to 100 kg of unprepared soap, and 700-750 grams of triclocarbon was given depending on the condition of the soap. The process lasts 30-40 minutes at 150-160 degrees. It should be mentioned

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that each raw material added to the recipe has a function that it performs in the composition of the soap.

1. DJK mainly gives the soap the function of adhesion and non-separation. The quality of soap depends on the amount of DJK added.

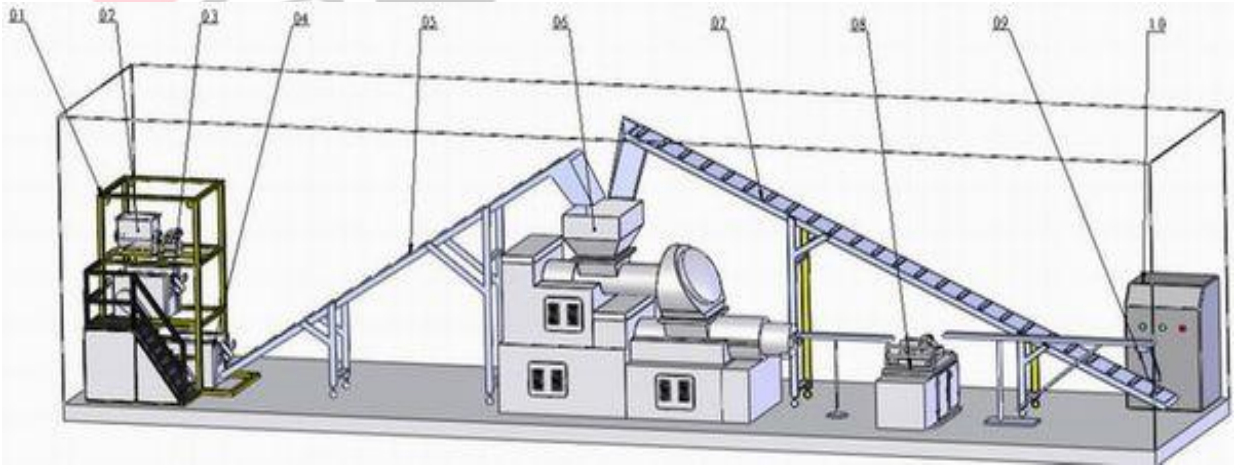
2. Baking soda is almost never added to soaps in most places these days. But this is wrong. Because baking soda mainly helps the substances in the soap to mix well with each other. It also reduces the smell of oils. It is especially added to antibacterial soaps because it improves the mixing of substances.

3. Technical salomas mainly affect the hardness of the soap. Then it melts quickly on contact with water

4. Simple not alone to be put ok why need said question is born Basically simple hello titer technical hello than lower will be 35-38%. Technician hello titer and it is higher than 40-45% will be Simple hello to be placed main reason it is cool down external appearance set will give . That is to the soap shiny flash giving him external side smooth to look take will come

5. Caustic soda is the main raw material is considered Oils mixture soap apparently take will come . We fat if we give caustic soda to the reaction enters _ Oil content _ free fatty acid _ found take united soap harvest does _

Simple , economic and antibacterial to the feature have has been soap work in release common of the hardware appearance _



1 - measure of solid caustic potash; 2 - water line; 3 - tank for preparing caustic potash solution; 4 - soap pot; 5 - conveyor; 6 - base pump; 7 - pump for hydrogen peroxide; 8 - pump for potassium hydroxide solution

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American Journal Of Biomedical Science & Pharmaceutical Innovation
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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Research Article

TRANSFORMATIVE TEACHING: FOSTERING CURRICULAR DESIGN EXCELLENCE THROUGH AN ONLINE TEAM-BASED CAPACITY BUILDING PROGRAM FOR EDUCATORS

Submission Date: December 05, 2023, Accepted Date: December 10, 2023,
Published Date: December 15, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-04

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Journal Website: https://theusajournals.com/index.php/ajbspi

ABSTRACT

This research introduces and evaluates an innovative online team-based capacity building program designed to empower educators in fostering curricular design excellence. The program emphasizes collaborative learning, professional development, and transformative teaching strategies. Through a series of interactive modules and team-based projects, educators engage in a dynamic learning environment that promotes creativity, adaptability, and the integration of cutting-edge pedagogical approaches. This study assesses the impact of the program on educators' abilities to enhance curricular design and offers insights into the transformative potential of online team-based capacity building in the realm of education.

KEYWORDS

Transformative Teaching, Educator Empowerment, Online Learning, Capacity Building, Curricular Design, Professional Development, Collaborative Learning, Pedagogical Innovation, Team-Based Education, Educational Excellence.

INTRODUCTION

In the rapidly evolving landscape of education, fostering curricular design excellence is imperative for educators seeking to provide enriching and transformative learning experiences. Recognizing the

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 20-25
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

need for innovative professional development approaches, this research introduces an online team-based capacity building program designed to empower educators in the art of transformative teaching and curricular design excellence. The program is centered around collaborative learning, harnessing the potential of online platforms to create a dynamic and inclusive environment for educators.

In recent years, the shift towards online learning has prompted a reevaluation of traditional professional development models. This program represents a response to the evolving needs of educators, offering a flexible and accessible platform for capacity building. By focusing on team-based learning, the program not only capitalizes on the collective wisdom of educators but also fosters a collaborative spirit that mirrors the interdisciplinary nature of contemporary education.

Rationale for Transformative Teaching:

Transformative teaching goes beyond conventional instructional methods, aiming to create learning experiences that empower students to think critically, adapt to change, and apply knowledge creatively. In this context, the program seeks to equip educators with the skills and mindset necessary to lead transformative teaching initiatives within their respective educational contexts. By fostering a culture of innovation and collaboration, educators are encouraged to explore cutting-edge pedagogical approaches that resonate with the needs of today's learners.

Objectives of the Program:

The primary objectives of the online team-based capacity building program are twofold. First, it aims to enhance educators' proficiency in curricular design, enabling them to create engaging and effective learning experiences. Second, it seeks to cultivate a community of practice where educators can collaboratively explore, experiment, and share insights into transformative teaching practices. The program is structured to accommodate diverse learning styles and preferences, providing a rich array of resources, modules, and collaborative projects.

Structure of the Introduction:

The following sections will delve into the components and structure of the online team-based capacity building program, highlighting its key features, learning modules, and the anticipated impact on educators' curricular design capabilities. By exploring the transformative potential of this innovative approach, we aim to contribute to the ongoing discourse on effective professional development in education and provide insights into the evolving landscape of transformative teaching practices.

METHOD

Program Design:

American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
Publisher: Oscar Publishing Services

The foundation of the online team-based capacity building program is a meticulously crafted curriculum designed to foster transformative teaching and curricular design excellence. The program begins with a thorough needs assessment to understand educators' existing competencies and aspirations. Based on this assessment, the curriculum is structured into interactive modules that progressively build skills and knowledge in transformative teaching, curricular design principles, and collaborative learning methodologies.

Online Platform Utilization:

The program leverages a robust online learning platform, providing educators with a flexible and accessible environment. The platform incorporates multimedia resources, discussion forums, and collaborative project spaces to facilitate engagement and interaction. Educators participate in virtual workshops, live discussions, and asynchronous activities that promote active learning and peer-to-peer knowledge sharing. The online nature of the program ensures inclusivity, accommodating educators regardless of geographical location or time constraints.

Team-Based Learning Projects:

At the heart of the program are team-based learning projects where educators collaboratively work on real-world curricular design challenges. These projects encourage the application of theoretical concepts into practical scenarios, fostering a hands-on and experiential learning approach. Through team collaboration, educators bring diverse perspectives to the table, enriching the learning experience and promoting cross-disciplinary insights. The projects are structured to encourage creativity, adaptability, and the exploration of innovative pedagogical approaches.

Facilitator Guidance and Feedback:

Experienced facilitators with expertise in transformative teaching and curricular design guide educators through the program. Facilitators provide ongoing support, feedback, and constructive critiques during virtual workshops and collaborative projects. This mentorship model ensures personalized guidance, allowing educators to refine their skills and receive tailored input on their curricular design endeavors.

Assessment and Reflection:

To gauge the effectiveness of the program, assessment mechanisms are integrated at various stages. Educators engage in self-assessment, peer evaluations, and reflective exercises to evaluate their progress and the impact of the program on their teaching practices. Additionally, feedback loops are incorporated to gather insights on the program's strengths and areas for improvement, enabling continuous refinement and enhancement.

American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
Publisher: Oscar Publishing Services

Evaluation Metrics:

The success of the program is assessed through a combination of quantitative and qualitative metrics. Quantitative measures include pre- and post-program assessments of educators' curricular design skills, while qualitative data is collected through surveys, interviews, and the analysis of collaborative project outcomes. The triangulation of these metrics provides a comprehensive understanding of the program's impact on educators' capacity to foster curricular design excellence through transformative teaching.

This comprehensive methodology ensures that the online team-based capacity building program is not only well-structured and accessible but also fosters a collaborative and transformative learning environment for educators. Through a combination of theoretical knowledge, practical application, and ongoing support, the program aims to empower educators with the skills and mindset needed to excel in transformative teaching and curricular design.

RESULTS

The implementation of the online team-based capacity building program yielded positive outcomes in fostering transformative teaching and curricular design excellence among educators. Quantitative assessments revealed a significant enhancement in educators' skills related to transformative teaching principles and curricular design proficiency. Pre- and post-program evaluations demonstrated measurable improvements, indicating the program's effectiveness in achieving its intended learning outcomes.

Qualitatively, educators reported heightened confidence in applying transformative teaching strategies and a greater capacity for innovative curricular design. The team-based learning projects showcased creative solutions to real-world challenges, indicating the successful integration of theoretical knowledge into practical applications. Peer collaboration played a pivotal role in enriching the learning experience, fostering a culture of cross-disciplinary insights and collective problem-solving.

DISCUSSION

The positive results can be attributed to the program's holistic approach, which combines theoretical knowledge, practical application, and collaborative learning. The utilization of an online platform facilitated flexibility and accessibility, allowing educators from diverse backgrounds to engage actively. The team-based learning projects served as catalysts for creative thinking and application of transformative teaching principles in real-world contexts.

The mentorship model, with experienced facilitators guiding educators through the program, proved effective in providing tailored feedback and support. The ongoing collaboration and feedback loops created a dynamic learning environment that encouraged

American Journal Of Biomedical Science & Pharmaceutical Innovation
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VOLUME 03 ISSUE 12 PAGES: 20-25
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

continuous improvement and refinement of curricular design skills. The qualitative feedback gathered through surveys and interviews emphasized the program's impact on educators' confidence, adaptability, and enthusiasm for transformative teaching.

CONCLUSION

In conclusion, the online team-based capacity building program successfully empowered educators in transformative teaching and curricular design excellence. The positive results validate the efficacy of the program's methodology, emphasizing the importance of collaborative learning, practical application, and ongoing mentorship. Educators emerged with enhanced skills, confidence, and a collaborative mindset, ready to apply transformative teaching principles in their educational contexts.

This research contributes to the evolving landscape of professional development in education, showcasing the potential of online team-based capacity building programs to foster transformative teaching practices. The successful outcomes underscore the importance of creating dynamic and inclusive learning environments that prioritize collaboration, innovation, and the integration of transformative pedagogies. As education continues to evolve, programs of this nature offer a valuable framework for equipping educators with the skills needed to navigate the complexities of curricular design in a transformative and impactful manner.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 26-30
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Research Article

PHYSIOLOGICAL FOUNDATIONS AND PEDAGOGICAL PRINCIPLES OF TRAINING QUALIFIED ATHLETES

Journal Website: https://theusajournals.com/index.php/ajbspi

Submission Date: December 14, 2023, **Accepted Date:** December 19, 2023,
Published Date: December 24, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-05

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ABSTRACT

This article delves into the physiological underpinnings and pedagogical principles essential for effectively training qualified athletes. It explores the intricate relationship between physiological mechanisms and the application of pedagogical strategies in optimizing athletic performance. Addressing the foundational aspects of human physiology, it examines how these principles intersect with pedagogical methodologies to enhance training programs for elite athletes. By elucidating the symbiotic relationship between physiological adaptations and pedagogical approaches, this study offers insights into designing tailored training regimens aimed at maximizing athletic potential and achievement.

KEYWORDS

Physiological foundations, pedagogical principles, training, qualified athletes, athletic performance, human physiology, adaptation, training programs, elite athletes, performance optimization.

INTRODUCTION

Elite athletic performance isn't just the result of physical prowess; it's the harmonious blend of physiological understanding and effective teaching methodologies. The integration of physiological foundations with pedagogical principles in the training of elite athletes stands as an essential pillar in shaping

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 26-30
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

champions. This essay explores the profound significance of merging these two realms and its pivotal role in maximizing the potential of elite athletes.

At the heart of athlete development lies an understanding of human physiology. Physiology elucidates the intricate workings of the body's systems, including energy production, muscle adaptation, cardiovascular function, and neurological responses. When paired with pedagogical principles – the art and science of teaching – this knowledge becomes a potent tool for coaches and trainers. The fusion of these disciplines allows for the creation of tailored training programs that precisely cater to an athlete's physiological needs while optimizing the learning process.

An athlete's journey to greatness isn't solely about physical exertion; it's about refining skills, honing techniques, and understanding how their body responds to training stimuli. By integrating physiological foundations, coaches can design training regimens that align with an athlete's physiological adaptations. This integration ensures that the training process becomes more efficient, effective, and aligned with the body's natural mechanisms for growth and improvement.

Moreover, the inclusion of pedagogical principles ensures that the transfer of knowledge and skill acquisition becomes more intuitive and impactful. Pedagogy facilitates the acquisition and retention of skills by employing teaching strategies that suit an athlete's learning style. From visual demonstrations to kinesthetic drills, effective teaching methodologies enhance an athlete's grasp of techniques, thereby accelerating their learning curve.

One of the key advantages of this integration is injury prevention and performance sustainability. Understanding the body's physiological limits aids in structuring training programs that minimize the risk of injuries and optimize recovery. Combining this knowledge with pedagogical techniques ensures that athletes learn proper form and technique, manage fatigue effectively, and mitigate overuse, reducing the likelihood of injuries that could hinder long-term performance.

Furthermore, the synergy between physiological foundations and pedagogical principles enables coaches to tailor training programs to individual athletes. Athletes have unique physiological profiles and learning preferences. By customizing training, coaches ensure that every training session is specifically designed to meet the needs of each athlete, maximizing their potential and overall performance.

Beyond physical conditioning, this integration fosters holistic athlete development. It encompasses mental fortitude, emotional resilience, and cognitive understanding. Athletes not only become physically adept but also gain the mental and emotional resilience required to thrive under pressure, adapt to

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 26-30
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

changing situations, and consistently perform at the highest level.

The significance of integrating physiological foundations with pedagogical principles in training elite athletes cannot be overstated. It forms the cornerstone of athlete development, unlocking their full potential by optimizing training precision, accelerating skill acquisition, preventing injuries, ensuring individualized training, and fostering holistic growth. The synergy between physiology and pedagogy stands as a beacon guiding coaches, trainers, and athletes towards achieving unparalleled success in the realm of elite sports.

Fundamental physiological concepts are the cornerstone of effective athletic training, shaping the understanding of how the human body responds and adapts to exercise and physical demands. Here's a deeper exploration of these essential concepts:

Energy Systems:

ATP-PCr System: Provides rapid but limited energy for explosive movements, such as sprinting or weightlifting.

Glycolytic System: Supplies energy during moderate to high-intensity activities without oxygen, crucial for sports requiring bursts of energy like hockey or basketball.

Oxidative System (Aerobic): Supplies energy for prolonged activities by utilizing oxygen, vital for endurance sports like distance running or cycling.

Muscle Adaptation:

Hypertrophy: Muscle growth due to resistance training, crucial for strength and power sports like weightlifting.

Strength and Power Adaptations: Improved force production and neuromuscular coordination, essential for explosive movements in sports such as sprinting and jumping.

Endurance Adaptations: Increased aerobic capacity, oxygen utilization, and fatigue resistance, pivotal for endurance-based activities like marathon running or cycling.

Cardiovascular Function:

Heart Function: The heart's ability to pump blood efficiently, supporting athletic performance by delivering oxygen and nutrients to muscles.

Cardiorespiratory Endurance: Enhanced through aerobic training, improving the body's ability to use oxygen for sustained activities, vital for overall athletic stamina.

VO_2 max: Reflects an athlete's maximal oxygen consumption and is a key indicator of cardiovascular fitness and endurance capacity.

Biomechanics:

Movement Analysis: Study of body movements, joint angles, and forces involved in athletic activities, crucial for understanding and refining technique.

Force Production and Transfer: Understanding how forces affect performance and injury risk, guiding training methods to optimize force application and prevent injuries.

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Joint Mechanics: Understanding joint structures and their movements, essential for preventing injuries and maximizing athletic performance through proper movement patterns.

These physiological concepts are not isolated but interconnected, influencing an athlete's performance across various sports. Effective training programs leverage these concepts to optimize an athlete's capabilities, prevent injuries, enhance performance, and tailor workouts specific to the demands of their sport. Understanding and applying these principles empower coaches and trainers to design well-rounded training regimens for athletes aiming to excel in their respective fields.

Emerging trends, technologies, and research directions continually shape the landscape of athletic training, offering new possibilities for integrating physiological principles and pedagogical approaches. Some notable advancements include:

Wearable Technology: Wearable devices, such as fitness trackers, smartwatches, and biosensors, provide real-time data on athletes' physiological metrics like heart rate variability, oxygen saturation, and movement patterns. Integrating this data with training programs allows for more personalized and data-driven approaches to optimize performance and recovery.

Genomics and Personalized Medicine: Understanding an athlete's genetic makeup offers insights into their unique physiological traits and responses to training. Genetic testing can identify predispositions to certain injuries, recovery rates, and optimal training strategies, enabling personalized training plans tailored to an individual athlete's genetic profile.

Virtual Reality (VR) and Augmented Reality (AR): VR and AR technologies are revolutionizing athlete training by simulating game scenarios, providing immersive experiences, and offering real-time feedback on technique and decision-making. These technologies aid in skill acquisition, mental conditioning, and tactical understanding across various sports.

Biomechanical Analysis and Motion Capture: Advanced motion capture systems and biomechanical analysis tools help dissect movement patterns, joint mechanics, and force application during athletic activities. This allows for precise adjustments in technique, optimizing performance and reducing the risk of injuries.

Neuroscience and Cognitive Training: Incorporating neuroscience principles into training methods enhances cognitive abilities, decision-making skills, and mental resilience in athletes. Neurofeedback training, brain stimulation techniques, and cognitive training programs optimize an athlete's mental performance and focus during competitions.

Recovery Modalities: Advancements in recovery techniques, such as cryotherapy, compression therapy, and personalized recovery protocols based on an athlete's physiological response, aid in optimizing recovery post-training or competition. Integrating

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 26-30
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

these modalities enhances recovery efficiency and minimizes fatigue-related issues.

Data Analytics and Artificial Intelligence (AI): Utilizing big data analytics and AI algorithms allows coaches and sports scientists to process vast amounts of data collected from training sessions, competitions, and athlete profiles. AI-driven insights can optimize training programs, predict injury risks, and individualize performance enhancement strategies.

Nutritional Science and Supplements: Ongoing research in nutritional science identifies dietary strategies and supplements that optimize energy production, muscle recovery, and overall athletic performance. Tailoring nutrition plans based on an athlete's physiological needs enhances their training adaptations and recovery.

By embracing these emerging trends and technologies, coaches, trainers, and sports scientists can further integrate physiological foundations with pedagogical principles, revolutionizing athletic training methods and fostering continuous improvements in elite athlete development.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 31-35
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

PHYSIOLOGICAL FEATURES OF WOMEN'S SPORTS TRAINING

Submission Date: December 14, 2023, Accepted Date: December 19, 2023,
Published Date: December 24, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-06

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ABSTRACT

This study explores the nuanced physiological features specific to women's sports training, examining the multifaceted factors that differentiate female athletes' physiological responses and adaptations during training. Delving into hormonal influences, biomechanical considerations, energy system utilization, and recovery patterns, this investigation elucidates the unique physiological attributes shaping training protocols tailored to women athletes. Understanding these distinctive physiological features is pivotal in optimizing training methodologies, injury prevention strategies, and performance outcomes in women's sports.

KEYWORDS

Women athletes, sports training, physiological features, hormonal influences, biomechanics, energy systems, recovery patterns, training adaptations, performance optimization, injury prevention.

INTRODUCTION

Women's participation in sports continues to grow, underscoring the importance of understanding the physiological intricacies unique to female athletes. This article elucidates the significance of comprehending these nuances in women's physiology within the realm of sports training and performance enhancement.

Recognizing Hormonal Variations

Women experience monthly hormonal fluctuations, affecting energy levels, metabolism, and recovery patterns. Understanding the impact of menstrual cycles, estrogen, and progesterone on training adaptations and injury susceptibility is crucial. Tailoring

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 31-35
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

training programs to align with these hormonal changes optimizes performance and mitigates injury risks.

Biomechanical Considerations and Injury Prevention

Differences in joint structure, ligament laxity, and muscle composition influence injury vulnerabilities among female athletes. Knowledge of these biomechanical disparities allows for targeted injury prevention strategies, considering anatomical variations unique to women.

Energy Systems and Metabolic Specificities

Fuel utilization and nutritional needs differ across menstrual phases. Addressing these variations ensures optimal energy availability during training and competition. Integrating nutrition plans attuned to hormonal fluctuations maximizes performance potential while supporting overall health.

Recovery Patterns and Training Adaptations

Hormonal influences impact recovery kinetics and physiological adaptations in women athletes. Tailoring recovery protocols to align with hormonal phases facilitates effective recuperation, enhancing training adaptations and performance outcomes.

Optimizing Training Programs for Women

Developing training programs that consider menstrual cycles, biomechanics, and hormonal influences is paramount. Customizing training methodologies ensures efficient skill acquisition, strength development, and performance optimization for female athletes.

Balancing Performance and Long-Term Health

Striking a balance between performance enhancement and menstrual health is crucial. Neglecting menstrual irregularities can lead to long-term health issues. Advocating for a holistic approach that nurtures both performance excellence and reproductive health is imperative.

Embracing Women's Physiological Uniqueness

Understanding the physiological nuances unique to women in sports training isn't merely beneficial but essential for fostering athletic excellence and preserving overall health. Recognizing, embracing, and incorporating these nuances in training methodologies not only elevates performance but also advocates for women's holistic well-being in sports.

By acknowledging and integrating these physiological intricacies into sports training, we empower female athletes to reach their full potential, excel in their respective sports, and thrive in a supportive and adaptive training environment that respects their physiological distinctiveness.

Hormonal fluctuations, particularly those occurring during the menstrual cycle, exert notable effects on training adaptations, recovery processes, and overall performance in female athletes. Understanding these influences is crucial for optimizing training regimens and enhancing athletic performance. Here's an exploration of how hormonal fluctuations impact training adaptations, recovery, and performance:

Training Adaptations:

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 31-35
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Hormonal Phases: The menstrual cycle consists of distinct phases - follicular, ovulatory, and luteal phases - characterized by varying hormone levels (estrogen, progesterone).

Hormonal Effects on Energy Levels: Hormonal fluctuations affect energy availability and utilization. During the follicular phase (increased estrogen), women may experience enhanced endurance and strength due to higher estrogen levels supporting glycogen utilization.

Strength and Muscle Function: Research indicates that during the ovulatory phase (peak estrogen), women might exhibit improved muscle function, potentially enhancing strength and power output.

Injury Risks: The fluctuation in hormone levels, especially estrogen, can influence ligament laxity, potentially increasing injury susceptibility, particularly for non-contact injuries like ACL tears.

Recovery Processes:

Recovery Patterns: Hormonal fluctuations impact recovery kinetics. Women might experience increased muscle soreness and delayed recovery during the luteal phase (high progesterone), potentially affecting subsequent training sessions.

Inflammatory Response: Hormonal changes influence inflammatory responses, affecting recovery from training-induced muscle damage. Progesterone dominance during the luteal phase may heighten inflammatory responses, impacting recovery timelines.

Performance:

Endurance and Metabolic Changes: Hormonal variations, especially in estrogen levels, affect substrate utilization. Increased estrogen levels might enhance fat oxidation, potentially influencing endurance performance.

Strength and Power: Timing training sessions to coincide with hormonal phases may optimize strength and power adaptations, capitalizing on the potential performance advantages offered during specific phases.

Considerations for Training and Performance Optimization:

Periodization: Adapting training cycles based on hormonal phases may enhance training adaptations. Adjusting training intensity and volume to align with hormonal fluctuations can optimize performance outcomes.

Nutrition and Recovery Strategies: Tailoring nutrition and recovery protocols to support energy availability and mitigate recovery challenges during different menstrual phases can aid in optimizing training adaptations and performance.

Understanding the influence of hormonal fluctuations on training adaptations, recovery, and performance is critical for coaches, trainers, and female athletes. Tailoring training regimens, recovery protocols, and nutrition strategies to accommodate these hormonal variations can contribute significantly to enhancing athletic performance and overall well-being in female athletes.

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 31-35
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Designing training programs that align with women's physiology involves a multifaceted approach, integrating considerations for hormonal cycles, biomechanics, and recovery patterns. Here are strategies to tailor training programs specifically for women athletes:

1. Tracking Menstrual Cycles and Hormonal Phases:

Cycle Monitoring: Encourage athletes to track their menstrual cycles to identify hormonal phases (follicular, ovulatory, luteal).

Training Emphasis: Plan training phases to coincide with hormonal fluctuations. During the follicular phase (higher estrogen), focus on high-intensity training or strength development. In the luteal phase (higher progesterone), prioritize recovery, skill refinement, or lower-intensity sessions.

2. Adjusting Training Intensity and Volume:

Phase-Specific Adaptations: Modify training intensity, volume, and recovery periods based on hormonal phases. Consider reducing training loads during the luteal phase to accommodate potential performance fluctuations or recovery challenges.

Strength and Power Emphasis: Capitalize on peak estrogen levels during the ovulatory phase by incorporating strength and power workouts to leverage potential performance advantages.

3. Biomechanical Considerations:

Injury Prevention: Develop injury prevention strategies based on biomechanical differences unique to female athletes. Emphasize neuromuscular training, proprioceptive exercises, and techniques to address joint stability.

Strength Training Emphasis: Tailor strength training programs considering female biomechanics to optimize muscle recruitment patterns and reduce injury risks.

4. Recovery Protocols and Nutrition:

Recovery Strategies: Implement recovery protocols that support hormonal variations. Adjust recovery modalities and durations during different menstrual phases to address potential recovery challenges.

Nutritional Support: Offer nutritional guidance aligned with hormonal fluctuations. Emphasize adequate nutrient intake, especially iron and calcium, to address potential deficiencies during specific menstrual phases.

5. Comprehensive Approach and Individualization:

Holistic Athlete Development: Foster a holistic approach that considers overall well-being. Address mental health, stress management, and sleep quality, recognizing their impact on hormonal balance and performance.

Individualized Plans: Recognize individual differences among female athletes. Tailor training plans based on individual responses to hormonal fluctuations, performance indicators, and recovery patterns.

6. Consistent Monitoring and Adaptation:

Regular Assessment: Continuously monitor performance metrics, recovery status, and athlete feedback to adapt training plans accordingly.

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 31-35
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Flexibility in Programming: Be adaptable and willing to make adjustments based on individual athlete responses, performance trends, and changes in menstrual cycle characteristics.

Implementing these strategies requires a nuanced understanding of female physiology and ongoing collaboration between coaches, sports scientists, and athletes. By customizing training programs to align with women's physiology, sports performance can be optimized while promoting long-term health and well-being among female athletes.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 36-41
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

METABOLIC REACTIONS OF THE BODY OF HIGHLY QUALIFIED ATHLETES

Submission Date: December 14, 2023, Accepted Date: December 19, 2023,
Published Date: December 24, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-07

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ABSTRACT

This article investigates the intricate metabolic reactions within the bodies of highly qualified athletes, elucidating the dynamic interplay of biochemical processes underlying their exceptional performance. Delving into the multifaceted aspects of metabolism, including energy production, substrate utilization, and metabolic adaptations, this study unveils the unique metabolic profiles and pathways that distinguish elite athletes. Exploring the impact of training, nutrition, and genetic factors on metabolic efficiency, this examination offers insights into optimizing metabolic responses to support peak athletic performance and endurance.

KEYWORDS

Metabolic reactions, highly qualified athletes, metabolism, energy production, substrate utilization, metabolic adaptations, athletic performance, training, nutrition, genetic factors, metabolic efficiency, peak performance, endurance.

INTRODUCTION

Metabolism plays a crucial role in supporting exceptional athletic performance in highly qualified athletes. The efficient functioning of metabolism is essential for providing the energy, nutrients, and physiological adaptations necessary for elite athletic endeavors. Here are some key aspects of metabolism and its significance in highly qualified athletes:

Energy Production: Metabolism encompasses the processes by which the body converts nutrients into energy. For highly qualified athletes, who often engage

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 36-41
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

in intense training and competition, a robust and efficient energy production system is vital. This includes the breakdown of macronutrients such as carbohydrates, fats, and proteins to fuel the high demands of physical activity.

Nutrient Utilization: Metabolism regulates the utilization of nutrients for various physiological functions, including muscle repair and growth, oxygen transport, and immune system support. In elite athletes, optimizing the utilization of nutrients is essential for maintaining peak performance, enhancing recovery, and minimizing the risk of injury and illness.

Performance Optimization: Metabolism influences an athlete's capacity for power output, endurance, speed, and overall athletic performance. Highly qualified athletes require finely tuned metabolic processes to support their training adaptations and competitive goals. Efficient metabolism can contribute to improved strength, agility, and resilience during training and competition.

Recovery and Adaptation: Metabolism plays a critical role in post-exercise recovery and adaptation. The ability to efficiently replenish glycogen stores, repair muscle tissue, and modulate inflammation is essential for highly qualified athletes to recover from intense workouts and competitions and adapt to the demands of their sport.

Body Composition: Metabolism influences body composition by regulating fat metabolism, muscle protein synthesis, and overall energy balance. For elite athletes, maintaining an optimal body composition is crucial for maximizing power-to-weight ratio, agility, and overall athletic performance.

Endurance Capacity: Metabolism also impacts an athlete's endurance capacity by influencing oxygen utilization, mitochondrial function, and the utilization of fats as an energy source. Highly qualified endurance athletes rely on efficient metabolic pathways to sustain prolonged efforts and optimize their aerobic capacity.

Mental Focus and Cognitive Function: Metabolism influences brain function and cognitive performance, which are essential for decision-making, focus, and skill execution during competition. Optimizing metabolic processes can support mental resilience and concentration in highly qualified athletes.

Metabolism is a cornerstone of exceptional athletic performance in highly qualified athletes. Understanding the intricacies of energy production, nutrient utilization, recovery processes, and overall physiological adaptations driven by metabolism is essential for coaches, sports scientists, and athletes themselves to design effective training, nutrition, and recovery strategies that optimize metabolic health and support peak athletic performance.

Rigorous training regimens induce a myriad of metabolic adaptations that play a pivotal role in enhancing athletic performance. These adaptations encompass a wide array of physiological changes, including increased mitochondrial density, improved

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 36-41
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

substrate utilization, and enhanced energy efficiency. This essay seeks to explore the intricate mechanisms by which rigorous training regimens drive these metabolic adaptations and their profound implications for athletes' performance.

Mitochondrial Density: One of the hallmark adaptations induced by rigorous training regimens is the increase in mitochondrial density within skeletal muscle cells. Mitochondria are the powerhouses of the cell, responsible for producing adenosine triphosphate (ATP), the primary source of cellular energy. As athletes engage in intense and prolonged physical activity, their muscles require a greater capacity for ATP production to sustain the demands of exercise.

Rigorous training regimens, particularly those emphasizing endurance and aerobic activities, stimulate the upregulation of mitochondrial biogenesis. This process involves the synthesis of new mitochondria within muscle cells, leading to an overall increase in mitochondrial density. As a result, athletes develop a greater capacity for oxidative phosphorylation, the process by which mitochondria generate ATP from the oxidation of substrates such as carbohydrates and fats.

Improved Substrate Utilization: Another crucial metabolic adaptation induced by rigorous training regimens is the enhancement of substrate utilization. Athletes undergoing intense training experience shifts in their metabolic pathways, favoring the utilization of fats as a predominant fuel source during endurance activities. This phenomenon, known as increased fat oxidation, allows athletes to spare glycogen stores and prolong their endurance capacity during prolonged exercise.

Furthermore, rigorous training regimens also lead to improvements in carbohydrate metabolism. Enhanced glycogen storage and utilization, coupled with increased glucose uptake by muscle cells, contribute to improved energy availability during high-intensity efforts. The ability to efficiently utilize both fats and carbohydrates as substrates for energy production is a hallmark of metabolic flexibility, a key determinant of athletic performance across a spectrum of sports disciplines.

Enhanced Energy Efficiency: The metabolic adaptations induced by rigorous training regimens ultimately culminate in enhanced energy efficiency within the athlete's musculature. This heightened efficiency is characterized by a more economical use of oxygen and substrates to produce ATP, resulting in improved exercise economy and performance.

The increased mitochondrial density and improved substrate utilization contribute to this enhanced energy efficiency. Athletes exhibit a reduced reliance on anaerobic energy pathways, such as glycolysis, during submaximal efforts, thereby delaying the onset of fatigue and improving overall endurance capacity. Moreover, the optimization of metabolic processes allows athletes to maintain higher power outputs while

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 36-41
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

expending less energy, ultimately translating to superior athletic performance.

Implications for Athletic Performance: The metabolic adaptations induced by rigorous training regimens have profound implications for athletes across various sports disciplines. Endurance athletes, such as long-distance runners and cyclists, benefit from increased mitochondrial density and improved substrate utilization, enabling them to sustain prolonged efforts with greater efficiency. Meanwhile, athletes in power-based sports, such as weightlifting and sprinting, derive advantages from enhanced energy efficiency, translating to improved explosiveness and strength output.

Furthermore, these metabolic adaptations play a critical role in recovery and resilience. The ability to efficiently replenish glycogen stores, promote muscle repair, and modulate inflammation following intense training or competition is essential for athletes to recover effectively and adapt to the demands of their sport.

CONCLUSION

In conclusion, rigorous training regimens induce a cascade of metabolic adaptations that are fundamental to optimizing athletic performance. The interplay between increased mitochondrial density, improved substrate utilization, and enhanced energy efficiency empowers athletes to excel in their respective disciplines. Understanding and harnessing these metabolic adaptations through targeted training and nutrition strategies are essential for coaches, sports scientists, and athletes seeking to maximize their competitive potential.

Optimizing metabolic responses for peak performance involves tailoring training, nutrition, and recovery strategies to align with individual athlete profiles and specific sport demands. Here are some strategies to achieve this:

1. Individualized Training Programs:

- Assess the athlete's metabolic profile, including their aerobic and anaerobic capacities, substrate utilization, and energy efficiency, through metabolic testing.

- Design training programs that target the specific energy systems and metabolic pathways relevant to their sport. For example, endurance athletes may focus on developing mitochondrial density and fat oxidation, while power athletes may emphasize glycolytic capacity and explosive strength.

2. Periodized Nutrition Plans:

- Customize nutrition plans to support the metabolic demands of training and competition. For instance, endurance athletes may require higher carbohydrate intake to replenish glycogen stores, while power athletes may benefit from increased protein intake for muscle repair and recovery.

- Consider individual variations in nutrient metabolism and dietary preferences when designing meal plans to ensure optimal fueling for training and competition.

3. Metabolic Flexibility Training:

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 36-41
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

- Incorporate training sessions that challenge metabolic flexibility, such as alternating between low-intensity fat-burning workouts and high-intensity glycolytic efforts. This approach can enhance the athlete's ability to switch between energy substrates based on the demands of their sport.

4. Recovery Protocols:

- Implement personalized recovery protocols that address individual metabolic recovery needs. This may include post-exercise nutrition timing, supplementation, and modalities such as cold-water immersion or massage to optimize metabolic restoration and muscle repair.

5. Sport-Specific Adaptations:

- Tailor metabolic adaptations to the specific demands of the athlete's sport. For example, a triathlete may require a balanced focus on aerobic endurance, muscular endurance, and metabolic efficiency across multiple disciplines (swimming, cycling, running), whereas a sprinter may prioritize explosive power and rapid energy turnover.

6. Monitoring and Adjustments:

- Continuously monitor the athlete's metabolic responses to training and competition through regular assessments, such as lactate threshold testing, VO2 max measurements, and metabolic efficiency analysis.
- Use data-driven insights to make informed adjustments to training loads, nutrition plans, and recovery strategies based on the individual's metabolic adaptations and performance trends.

By integrating these strategies, coaches, sports scientists, and athletes can optimize metabolic responses to align with individual profiles and specific sport demands, ultimately enhancing athletic performance and competitive success.

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VOLUME 03 ISSUE 12 PAGES: 36-41
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 42-47
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

FEATURES OF FATIGUE AND RECOVERY OF ATHLETES

Submission Date: December 14, 2023, Accepted Date: December 19, 2023,
Published Date: December 24, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-08

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ABSTRACT

This article delves into the multifaceted features of fatigue and recovery in athletes, exploring the intricate mechanisms and patterns that characterize these physiological processes. Fatigue, an inevitable consequence of intense physical exertion, involves a complex interplay of central and peripheral factors impacting neuromuscular function, metabolic pathways, and hormonal responses. Conversely, recovery constitutes a dynamic restoration phase, encompassing neural, metabolic, and immune processes aimed at reinstating homeostasis. Understanding the features of fatigue and recovery in athletes is pivotal for optimizing training strategies, preventing overtraining, and enhancing performance. This review elucidates the distinctive characteristics, temporal patterns, and influential factors underlying fatigue and recovery in athletes across various sports disciplines.

KEYWORDS

Fatigue, recovery, athletes, physiological mechanisms, neuromuscular fatigue, metabolic pathways, hormonal responses, overtraining, performance enhancement, training strategies, temporal patterns, homeostasis.

INTRODUCTION

Athletes endure rigorous physical and physiological demands both during training sessions and competitive events. These demands vary depending on the sport, individual conditioning, and the specific requirements of the event. Here's an overview of the significant aspects:

Physical Demands. Cardiovascular Endurance: Many sports demand exceptional cardiovascular fitness,

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 42-47
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

requiring athletes to sustain prolonged periods of exertion. Endurance athletes like marathon runners or cyclists need substantial aerobic capacity.

Strength and Power: Sports such as weightlifting, sprinting, and wrestling emphasize strength and explosive power. Athletes focus on building muscle strength and optimizing power-to-weight ratios.

Flexibility and Mobility: Gymnasts, dancers, and martial artists require excellent flexibility and mobility to perform intricate movements and maneuvers efficiently.

Speed and Agility: Sprinters, football players, and athletes in similar sports need high-speed capabilities and agility to react quickly to changes in their environment.

Physiological Demands. Energy Systems: Different sports prioritize specific energy systems. For instance, endurance sports rely heavily on aerobic metabolism, while sprinting or weightlifting utilizes anaerobic pathways for short bursts of intense activity.

Heat and Thermoregulation: Athletes competing in hot climates or during high-intensity activities must manage body temperature to prevent heat-related illnesses. This involves effective hydration strategies and acclimatization techniques.

Oxygen Uptake and Utilization: Oxygen consumption and utilization play a crucial role in an athlete's performance. Training often involves improving the body's capacity to take in and use oxygen efficiently (VO_2 max).

Recovery and Adaptation: Proper recovery between training sessions is vital for adaptation and improvement. Athletes focus on nutrition, sleep, and active recovery strategies to optimize performance and reduce the risk of injury.

During competition, athletes experience heightened physiological responses due to the stress of performance, increased adrenaline, and the pressure to excel. The body's systems undergo significant strain, requiring mental focus alongside physical prowess to sustain peak performance levels.

Coaches and sports scientists design training programs that progressively challenge these physical and physiological aspects to enhance an athlete's capabilities while minimizing the risk of overtraining and injuries. Individualized training plans tailored to an athlete's specific needs and goals are crucial for optimal performance while considering the balance between training stress and recovery.

Ultimately, managing the physical and physiological demands placed on athletes involves a holistic approach that includes training, nutrition, rest, and mental preparation to achieve peak performance during both training and competition.

Athletes, revered for their prowess and dedication, endure not only the physical demands of their sport but also encounter a myriad of fatigue types that extend beyond the realm of physical exhaustion. The rigors of training and competition often exact a toll on athletes, manifesting in various forms of fatigue—

American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
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physical, mental, and emotional—which collectively impact their performance, well-being, and overall athletic journey.

Physical fatigue stands as a prominent adversary faced by athletes. Muscular fatigue, a common occurrence, arises from the depletion of energy stores and the accumulation of metabolites during intense physical exertion. This fatigue might result in sensations of weakness, soreness, and reduced muscle performance. Concurrently, cardiorespiratory fatigue emerges due to the strain on the cardiovascular and respiratory systems, leading to increased heart rate, shortness of breath, and compromised oxygen delivery to muscles, particularly during prolonged bouts of exertion.

However, the scope of fatigue extends far beyond the confines of physicality. Mental fatigue, a formidable adversary, challenges athletes' cognitive capabilities. It emanates from prolonged periods of intense concentration, decision-making, and mental processing during training or competition. Athletes grappling with mental fatigue often experience reduced focus, slower reaction times, and a diminished capacity to assess situations effectively. Simultaneously, psychological fatigue, intimately intertwined with emotional elements, can induce emotional exhaustion, stress, and pressure. The emotional investment in their sport can leave athletes feeling drained, emotionally depleted, and overwhelmed by expectations and demands.

Emotional fatigue further encompasses burnout—a profound state of physical, emotional, and mental exhaustion caused by chronic stress and excessive training. Athletes experiencing burnout often find themselves disillusioned, detached, and lacking passion for their sport. This state not only impedes performance but also jeopardizes an athlete's long-term dedication and well-being.

Addressing these multifaceted forms of fatigue necessitates a comprehensive approach. Physical recovery strategies involving adequate rest, proper nutrition, and tailored post-exercise routines mitigate physical fatigue. Mental recuperation encompasses mindfulness, relaxation techniques, and mental training to bolster cognitive resilience and focus. Moreover, balancing training loads, incorporating rest periods, and seeking psychological support through sports psychologists or counselors are instrumental in managing the emotional toll of competition and training.

It is imperative for athletes, coaches, and support staff to acknowledge and address the diverse nature of fatigue. Implementing strategies that recognize and counteract physical, mental, and emotional exhaustion is pivotal to sustaining an athlete's performance, preserving their well-being, and cultivating a fulfilling athletic journey. Embracing this holistic approach to fatigue management empowers athletes to thrive not only in their sport but also in their overall lives, fostering resilience and long-term success.

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Publisher: Oscar Publishing Services

The intricate tapestry of fatigue types encountered by athletes underscores the necessity for a holistic approach to manage and mitigate its impact. By acknowledging and addressing physical, mental, and emotional fatigue, athletes can navigate the challenges posed by their sport, ensuring not just performance excellence but also sustained well-being throughout their athletic endeavors.

Athletes, in their pursuit of peak performance, undergo strenuous training regimens and competitive schedules that often lead to physical and mental fatigue. A pivotal aspect of optimizing their performance and ensuring long-term well-being involves the development and implementation of personalized recovery plans. Crafting such plans necessitates a meticulous, step-by-step approach tailored to the unique needs of individual athletes.

Step 1: Comprehensive Assessment and Evaluation

The cornerstone of designing a personalized recovery plan lies in understanding the athlete's holistic landscape. This begins with extensive interviews, physical assessments, and evaluations encompassing training routines, competition schedules, injury history, nutritional habits, sleep patterns, stress levels, and overall physical condition.

Step 2: Establishing Objectives and Goals

Collaborating closely with the athlete, set clear and realistic recovery objectives aligned with their performance aspirations, injury prevention, and overall well-being. Prioritize areas requiring attention based on the assessment findings to streamline the recovery plan effectively.

Step 3: Tailored Recovery Plan Development

Using the gathered information, construct an individualized recovery blueprint. This plan should integrate diverse elements such as sleep optimization strategies, personalized nutrition guidance, active and passive recovery techniques, stress management protocols, and specific recovery modalities customized to the athlete's needs.

Step 4: Nutrition and Hydration Strategies

Engage with sports nutritionists to devise a nutrition plan tailored to the athlete's energy demands and recovery requirements. Incorporate hydration strategies essential for maintaining optimal performance and aiding in post-exercise recovery.

Step 5: Sleep Optimization

Highlight the significance of quality sleep and assist the athlete in adopting practices to enhance sleep quality and duration. Educate them on sleep hygiene and relaxation techniques conducive to improved recovery.

Step 6: Recovery Modalities and Techniques

Integrate a spectrum of active and passive recovery methods into the plan. This includes activities such as foam rolling, stretching, yoga, alongside modalities like massage therapy, contrast baths, compression garments, or technological aids to expedite recovery and reduce muscular fatigue.

Step 7: Monitoring and Adjustment

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Regularly assess the athlete's response to the recovery plan. Monitor performance metrics, fatigue levels, injury occurrences, and overall well-being to fine-tune and adapt the recovery strategies as needed. This iterative process ensures continuous optimization of the plan's effectiveness.

Step 8: Education and Communication

Empower athletes with comprehensive knowledge about the rationale behind each recovery strategy. Foster open communication channels among athletes, coaches, and support staff to ensure adherence to the plan and prompt addressing of concerns or modifications.

Step 9: Documentation and Record-Keeping

Maintain detailed records documenting the recovery plan, interventions utilized, athlete responses, and any modifications made. This comprehensive record aids in informed decision-making and serves as a reference for future adjustments.

Step 10: Continuous Support and Guidance

Provide unwavering support and guidance, emphasizing the long-term benefits of adhering to the recovery plan. Foster a collaborative environment that encourages ongoing commitment and participation from the athlete.

CONCLUSION

In conclusion, the development and implementation of personalized recovery plans for athletes require a systematic and tailored approach that integrates various elements crucial for performance enhancement and injury prevention. By meticulously following these steps, sports practitioners can craft effective recovery plans that cater to an athlete's individual needs, fostering optimal performance and well-being throughout their athletic journey.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
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American Journal Of Biomedical Science & Pharmaceutical Innovation
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

INFLUENCE OF MODIFIED PEPTIDES FROM THE FETAL THYMUS ON THE ACTIVITY OF T-LYMPHOCYTES AND NATURAL KILLERS IN EXPERIMENTAL VIRAL HEPATITIS

Submission Date: December 15, 2023, **Accepted Date:** December 20, 2023,
Published Date: December 25, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-09

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ABSTRACT

The results showed that immunomodulin has a moderate regulatory effect on the spontaneous blast transformation of lymphocytes in the in vitro system. The costimulatory effect of immunomodulin in the reaction of PHA-induced blast transformation of T-lymphocytes was revealed. The data we obtained on the rather pronounced interferon-inducing properties of Sanogen developed by us and its combinations with well-known inductors - Cycloferon and Betaleukin, can be of practical use in the treatment of infectious pathology, especially viral hepatitis, when the combination of hepatoprotective, anti-inflammatory, antiviral, immunomodulatory and detoxification mechanisms of action, in the absence of toxicity and side effects, will ensure the development of sanogenetic processes in the patient's body.

KEYWORDS

Toxicity, side effects, treatment of cancer, cells.

INTRODUCTION

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Thymus extracts, incl. thymosin is used in the treatment of cancer, autoimmune diseases, many chronic infectious processes, etc. [1,2,10, 28, 37]. The most important mechanism of action of thymic peptides is the enhancement of the functional activity of T-lymphocytes, however, the multi-stage process of developing an immune response includes the activation of not only cellular but also humoral immunity factors, contributing to an increase in the production of specific antibodies, cytokines, inflammatory factors, etc. [7, 16, 22]. Natural immunity is largely determined by killer cells (NK), which play a decisive protective role in the early stages of viral aggression [26]. Among the known thymic peptides, a drug obtained from fetal sheep thymus is particularly interesting. It consists of 15 peptides. Its immunocorrective effect was shown in experiments and clinical observations, in connection with which it received the name "Immunomodulin". It is mass-produced in the state of emergency "Immunomed" (Tashkent) and approved for medical use in Uzbekistan and Kazakhstan [2].

To increase the immunobiological activity of thymic peptides, we attempted to combine them with metal ions, as is the case in thymulin, which circulates in the bloodstream as a nanopeptide combined with zinc.

The aim of the work is to study the effect of zinc-modified thymus peptides on the functional activity of T-lymphocytes and human natural killer cells in the in vitro system and to evaluate the effectiveness of interferonogenesis and antiviral action under the influence of Sanogen, Betaleukin, Cycloferon and their combinations in the experiment.

METHODS

Determination of the effect of drugs on the proliferative response of T-lymphocytes. The material for the study of lymphocyte blastogenesis was peripheral blood mononuclear cells of 32 patients with chronic viral hepatitis B aged 20-49 years.

Phytohemagglutinin (PHA) (Sigma) and concanavalin A (Con A) (Pharmacia) at suboptimal concentrations (10 µg/mL) were used as RBTL activators. Modified and unmodified peptides were added to the lymphocytes (1 million/ml) at a final concentration of 0.01 µg/ml in the test samples. The tablet was incubated at 37°C for 1 hour, after which the corresponding mitogen was added to the wells. Only mitogen was added to control lymphocyte samples. Mitogen was not used in the study of spontaneous blast transformation of lymphocytes. After 48 hours, 3H-thymidine was added to the samples at a concentration of 1 µCi/ml. The results of the reaction were taken into account 72 hours after the start of cultivation.

To quantify the effect of immunomodulin on the proliferative response of T-lymphocytes, the impact index (IV) was used, which was calculated by the formula:

$$IV = (Io – Ik)/Ik \bullet 100\%,$$

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where: Io - the number of pulses per minute (imp/min) in the experiment;

Ik - the number of pulses/min in the control.

RESULTS AND DISCUSSION

It was found that the average value of spontaneous RBTL in patients with hepatitis in control group 1 (without incubation with mitogen and immunomodulin) was 280±14 imp/min with a range of individual fluctuations from 153 to 404 imp/min (Fig. 1). In the presence of immunomodulin (control 2), the indicators of spontaneous blastogenesis significantly increased on average in the group up to 351 ± 26 imp/min with a range of individual fluctuations from 207 to 673 imp/min. The index of drug effect on spontaneous RBTL was +25.3% (P<0.05). The introduction of the zinc-modified peptide into the culture increased the rates of spontaneous transformation of T-lymphocytes to an average of 415±36 pulses/min. With a range of individual fluctuations from 248 to 650 imp/min. The index of drug effect on spontaneous RBTL was +48% (P<0.05 with control 2 and P<0.001 with control 1).

We also studied the functional activity of T-lymphocytes in terms of their ability to enter the mitotic cycle under the influence of PHA. It was established that under the influence of lectin, the blast transformation of lymphocytes in general in the control group 1 is (51.4±3.3) x 103 imp/min with individual fluctuations in indicators from 41 to 74 thousand imp/min.

In control group 2, the mean value of this indicator did not differ significantly from control 1 and amounted to 57.0 ± 2.4 thousand imp/min with individual values from 42 to 77 thousand imp/min. The impact index of immunomodulin on average for the group was +11%.

In the main group, the average value of this indicator significantly differed from control 1 and control 2 and amounted to 65.0 ± 2.4 thousand imp/min with individual values from 48 to 86 thousand imp/min. The impact index of modified immunomodulin averaged +27% per group (P<0.05 with control 2 and P<0.001 with control 1).

In the experiment with pre-treatment with the drug only mononuclear cells, similar results were obtained. Thus, the incubation of effector cells with immunomodulin (without target cells) showed a significant stimulation of the membrane toxic activity of natural killer cells in all studied groups. In this group of experiments, 2 controls were used: preliminary parallel incubation of effector cells only in a nutrient medium (control 1) and with a peptide (control 2). In the experimental group, the metallopeptide was evaluated. Thus, in healthy donors, the EC cytotoxicity index was 51.2±1.9%; incubation with the modified peptide increases these values to 65.7±1.6%; preincubation with immunomodulin activates them up to 58.3±1.7%. The difference between the experimental

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values and controls was significant (P<0.05 with control 2 and P<0.001 with control 1).

Quantitative assessment of the induction of 1PM by Sanogen, Betaleukin and Cycloferon with separate and combined administration to experimental animals.

It has been established that Betaleukin induces IFN production within 96 hours (observation period); the maximum titer was noted after 12 hours and reached 512 units. The average titer was 118±16 units. (Fig.1, 3). Sanogen also had quite pronounced interferonogenic properties - the maximum titer was 128 units. after 24 hours with an average value of 47 ± 4 units (Fig. 1, 3).

When using monopreparations, Cycloferon was the most effective - the maximum IFN was 1024 units. after 48 hours. Under his influence, the average titer during a 120-hour observation was 295 ± 35 units. (fig.3)

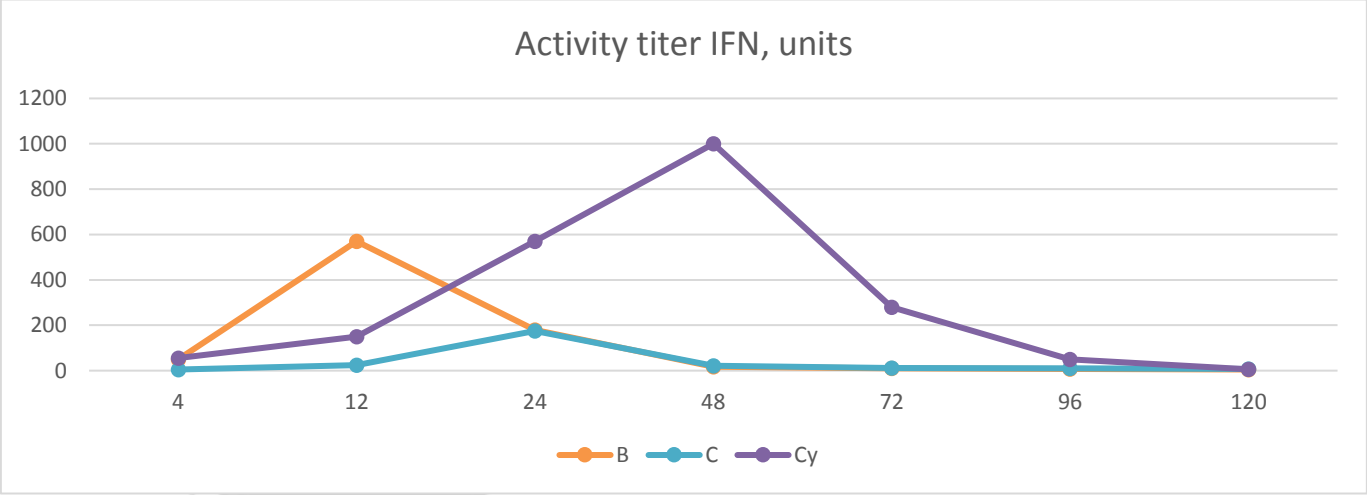

Fig.1. Dynamics of serum interferon activity in mice after a single separate intraperitoneal injection of Sanogen (C), Betaleukin (B) and Cycloferon (Cy) in effective doses: 2 μg/kg; 10 ng/kg and 4 μg/kg, respectively.

The introduction of Betaleukin with Cycloferon sharply increased the activity of serum IFN to an average of 1060 ± 80 units. The expected increase was to be 395 units. (100 units of Betaleukin + 295 units of Cycloferon), i.e. it turned out to be 2.7 times higher than the additive value. Synergy was also manifested in the accumulation of the maximum titer up to 2048 units, which is 1.3 times higher than expected (512 units + 1024 units = 1536 units). There was also a shift in the peak of IFN production for a period of 48 hours. Even 4 hours after the combined administration of inducers, the IFN activity was high and amounted to 256 units, while the serum activity remained significant and after 120 hours was 512 units. The synergistic effect for this period was 32 times higher than the additive one.

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The simultaneous administration of Sanogen and Cycloferon sharply increased the activity of serum IFN to an average of 805 ± 75 units, since the expected average increase was to be 323 units. (28 Sanogen units + 295 Cycloferon units), it turned out to be 2.5 times higher than the additive value (Fig. 3). Synergy also manifested itself in the accumulation of the maximum IFN titer up to 2048 units, which is 1.8 times higher than expected (128 units + 1024 units). The peak of IFN production was recorded for a period of 48 hours, which corresponded to the period of maximum serum activity with the introduction of Cycloferon. It should be noted that already 4 hours after the combined administration of these inducers, the IFN activity was the highest - 256 units. (Fig. 2). Despite the early and very pronounced induction, serum activity remained significant throughout the entire observation period, and even after 120 hours it was 256 units. (Fig. 2), whereas with the separate administration of Sanogen or Cycloferon, the titers were only 2 units each. and 16 units. (Fig. 1), i.e. the synergistic effect was 14 times higher than the additive one.

Therefore, with the simultaneous administration of Sanogen and Cycloferon, a pronounced synergism was found in the induction of endogenous IFN, since IFN synthesis was noted, the high activity of which is recorded in the circulating blood from 4 to 120 hours with a maximum of 2048 units 48 hours after injection, 1.8 times higher than additive action when used separately.

To quantify the activity of interferonogenesis under the influence of monodrugs and their combinations, we calculated the average values for the duration of the study for 5 days for each option (Fig. 3). It has been established that Cycloferon (295±36 units) is the most active among monopreparations. All used combinations of drugs were more powerful interferonogens compared to it. Under the influence of Sanogen with Betaleukin, the average activity of interferonogenesis was 457±45 units, Sanogen with Cycloferon - 805±56 units, and Betaleukin with Cycloferon -1060±52 units.

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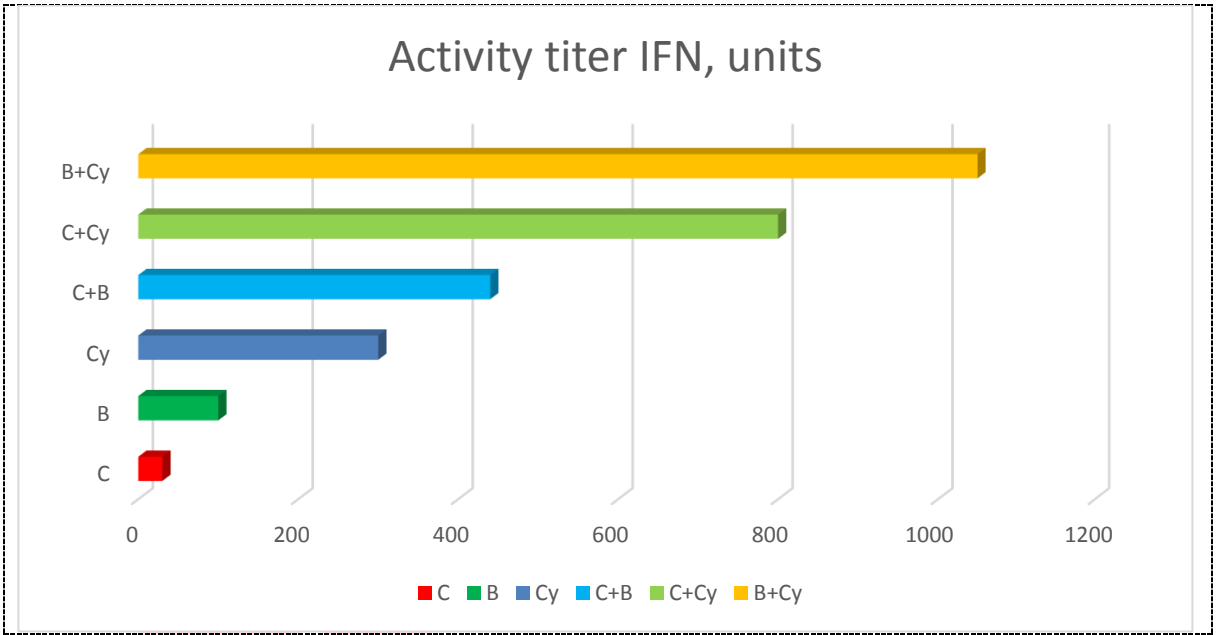

Fig. 3. Average values of serum interferon titers for 5 days after separate and combined administration of Sanogen (C), Betaleukin (B), and Cycloferon (Cy) to mice.

CONCLUSIONS

The fundamental feature of the action of fetal thymus peptides is the dependence of the severity and direction of their effects on the initial state of regulated cells, which contributes to the normalization of processes that are out of balance.

-thymic peptides combined with zinc have a regulatory effect on the proliferative activity of T-lymphocytes through the interaction of their cell receptors with mitogen and thymus peptides, which ultimately leads to a cascade synthesis of cytokines, which in turn modulates the proliferation of T-cells and cytotoxic activity of natural killers.

- pronounced interferon-inducing properties of Sanogen developed by us and its combinations with well-known inductors - Cycloferon and Betaleukin, can have practical application in the treatment of infectious pathology, especially viral hepatitis, when the combination of hepatoprotective, anti-inflammatory, antiviral, immunomodulatory and detoxification mechanisms of action

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American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
Publisher: Oscar Publishing Services

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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 56-63
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

PHENOLOGY AND INHERITANCE OF MORPHOLOGICAL HARACTERS IN INTERSPECIFIC HYBRID PLANTS OF COTTON AND THIN-FIBER COTTON VARIETIES (IN CLIMATE CONDITIONS OF SIRDARYA REGION)

Submission Date: December 15, 2023, Accepted Date: December 20, 2023,
Published Date: December 25, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-10

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ABSTRACT

Cotton Gossypium L. in the soil and climatic conditions of the Syr Darya is a cultural tetraploid from the family of G.Barbados L. The phenology of flowering in varieties belonging to the genus has been studied. According to it, of the selected research objects, the varieties Surkhan-18, Termez-202 and Surkhan-103 have a high possibility of continuing genetic and breeding processes in the conditions of the Syrdarya region and using these varieties to create hybrid organisms.

It is important to study the morphological characteristics of the hybrids obtained on the basis of cross-breeding of different types of cotton, and to scientifically substantiate aspects such as the order in which the laws are passed. Because each variety has its own morpho-biological characteristics, and in most cases, morpho-biological

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 56-63
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

characteristics (type of branching, leaf shape, shape and color of pods, the presence of anthocyanin spots on the petals, color of pollen, etc.) are taken into account when evaluating the variety. Also, on the basis of phenotypic analysis of the hybrids obtained by hybridization of varieties and species that are sharply different from each other in terms of morphological characteristics, it is possible to make a clear conclusion about the manifestation of morphological characteristics of one or another variety in hybrid plants. In order to successfully carry out breeding and create new hybrid plants that incorporate the best characteristics of the initial varieties, it is necessary to know the laws of passing morphological characteristics from one generation to the next, along with the valuable economic characteristics of cotton.

KEYWORDS

Fiber, cultural, type of branching, hybrid plants.

INTRODUCTION

Fine -fiber variety of cotton, long-fiber variety of cotton and the cotton that gives a fiber of 37-42 mm or more. Fine - fiber cotton mainly includes varieties of Gossipium barbadense L type. In the world production of cotton wool, fine-fiber gauze ranks second after gauze with medium fibers. Fine-fiber cotton is grown on large areas in many countries, including Uzbekistan, Tajikistan, Turkmenistan, Egypt, Sudan, Peru, Northern Brazil, Nigeria, and the USA.

In the Republic of Uzbekistan, fine-fiber cotton varieties are grown mainly in the southern regions (Surkhandarya, Kashkadarya, Bukhara, Andijan, Namangan regions).

In order to introduce a mechanism to stimulate the development of agrotechnologies for the creation of high-yielding, disease- and pest-resistant, fast-growing, high-yielding varieties of fine-fiber cotton, taking into account the soil and climatic conditions of the regions, expanding their acreage, reproduction and cultivation of seeds of new and promising varieties, the Cabinet of Ministers of the Republic of Uzbekistan No. 47 dated January 30, 2020 "On Amendments and additions in the resolution of the Cabinet of Ministers of the Republic of Uzbekistan on the efficient organization of the production of fine-fiber cotton, on the introduction of the mechanism of reproduction and stimulation of new varieties" .

These measures have been approved by the Government, and a number of important tasks have been assigned to responsible ministries and departments. The tasks of harvesting a sufficient amount of seed material from fine-fiber cotton varieties suitable for the soil and climatic conditions of

American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
Publisher: Oscar Publishing Services

the regions of the republic, precocious, with high yield and fiber quality have been set.

The weather in the Syrdarya region is sharply changeable and dry. The average annual temperature is 14 °C. Summers are dry and hot. The average temperature in July is 27-29 °C. In summer, the temperature rises to 32-45 ° C. Often a warm wind (garmsel) dries the soil and has a bad effect on the development of plants. The growing season is 218 days. In summer, due to strong evaporation, groundwater salines the soils of surface areas (Sharaf Rashidov, Akaltyn, Gulistan districts).

The soils are mainly weakly sod-podzolic with a light shade, less often and moderately saline, according to the mechanical order-loamy and sandy loam. Saline and saline soils are found on the plains. Underground water pipe. 5-6 meters [1,2,3].

At the same time, it is worth noting that fine-fiber cotton varieties are resistant to very hot weather conditions, dehydration, harmsel insecticides and pests, as well as fiber length, its elasticity and textile. The economic efficiency of their cultivation is 60 percent higher than that of other varieties [4,5].

From this point of view, the experiment is aimed at carrying out in the conditions of the Syrdarya region, i.e. testing of fine-fiber cotton varieties in the conditions of the Syrdarya.

METHODS

The area of the fabric is 25 m in length and consists of 30 rows. So that the length of each row is 2 m, and the distance between the rows is 76 cm. The experimental field was being prepared for sowing seeds. The order of sowing seeds was as follows, that is, each variety was planted in 6 rows, in each row 6 nests, in each nest 5-7 dry seeds with an interval of 25-30 cm. The object of the experiment was a cultural tetraploid of G.barbadense L. type created on the basis of fine-fiber varieties Surkhan-16, Surkhan-18, Termez-202, Surkhan-103 and Surkhan-104.

RESULTS AND DISCUSSIONS

Phenological observations of the flowering process in varieties were carried out research (14.06.2021, 23.06.2021). The study of the flowering process in cotton was carried out daily for 10 days, in the morning.

In our study, the intensity of the flowering process was high in the period from June 19 to June 23, relatively low in the period from June 16 to June 18, and in the period from June 14 to June 15, the intensity of the flowering process was low (Table 1).

The obtained 10-day flowering process according to the results of phenological observations shows that the cotton varieties Surkhan-18, Termez-202 and Surkhan-103 have a higher flowering time than the varieties Surkhan-104 and Surkhan-16, especially high flowering intensity is observed in the variety Termez-202 (Fig.1).

American Journal Of Biomedical Science & Pharmaceutical Innovation
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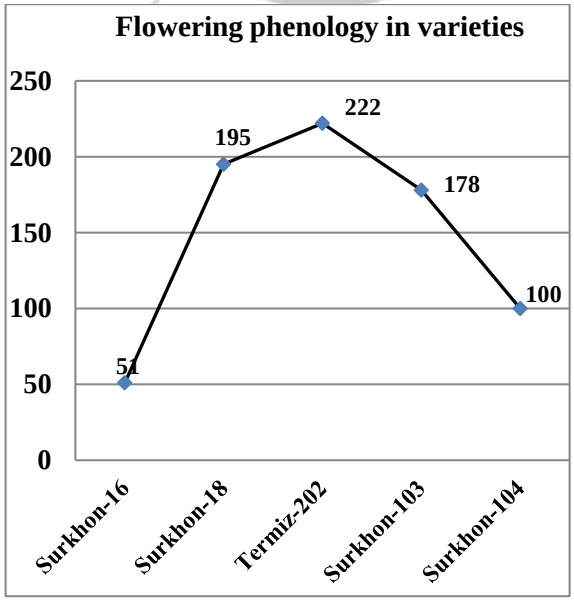
OCLC – 1121105677
Publisher: Oscar Publishing Services

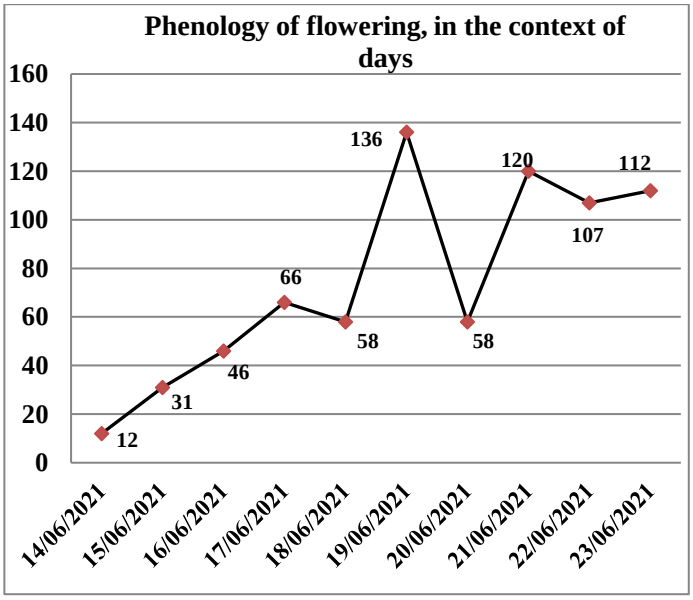
Table 1
Phenology of the flowering process in fine-fiber cotton varieties

№	Varieties	Flowering phenology									
		14.06.2021	15.06.2021	16.06.2021	17.06.2021	18.06.2021	19.06.2021	20.06.2021	21.06.2021	22.06.2021	23.06.2021
1	Surkhan-16	-	-	-	1	7	7	1	14	7	14
2	Surkhan-18	2	10	11	27	14	34	12	32	27	26
3	Termez-202	-	1	10	15	19	46	28	33	38	32
4	Surkhan-103	9	16	22	19	8	37	11	18	20	18
5	Surkhan-104	1	4	3	4	10	12	5	22	12	20

Analyzing the phenology of flowering in the context of varieties, it can be seen that the Termez-202 variety has a higher flowering intensity compared to other varieties, from the moment of sowing seeds until June 23, that is, 222 flowers were opened with an interval of 48 days.

In the remaining varieties, that is, in the varieties Surkhan-103, Surkhan-18, Surkhan-195, Surkhan-104, 100 and Surkhan-16, more than 51 flowers were revealed. As can be seen from the results of the table, the lowest rate of flowering intensity was observed in the variety Surkhan-16 (Figure 1).





American Journal Of Biomedical Science & Pharmaceutical Innovation
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
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Figure 1. Phenology of flowering in varieties

Figure 2. Phenology of flowering by day

When analyzing the phenology of flowering in the context of days, the following indicators appeared. According to the results of the analysis, based on 10-day (June 14 - June 23) phenological observations, starting from the date of sowing seeds (05.05.2021), the indicator of flowering intensity on June 14 (38 days) is the lowest of 12, and the highest indicator of flowering intensity is observed on June 19 (43 days) and is 136 we can see that the flower has opened (Fig. 2).

The intensity of flowering in 46-48 days (from June 21 to 23) was determined in experiments that 107 flowers were opened, and up to 120 flowers. From June 14 to 16 (with an interval of 38-40 days), the indicator was low, and it was noticed that from 12 to 46 flowers were opened.

In the course of the research, varieties specific to the species G. hirsutum L. and G. barbadense L. were crossed. New hybrids were obtained, and seeds of hybrid combinations were planted in field conditions with the parent forms and maintained under the same conditions. Phenological observations and analysis were carried out. If we pay attention, there is a big difference between the medium and thin fiber varieties involved in hybridization, and among them it is necessary to include the type of branching. G. hirsutum L. cultivars participating in the maternal form belong to SP-1303, Baraka, ATM-1 and T-91/21 ridges of the I-II branching type, while G. barbadense L. cultivars participating in paternity belong to Surkhan-14 and Surkhan- 9 varieties are varieties with a limited branching type, and the crop elements are attached to the main stem. This was also confirmed in the conducted experiments.

Another important morphological indicator is the shape and color of pods. In hybrid plants, the inheritance of G. hirsutum L. varieties with intermediate or high indicator of pod size was determined, but in some combinations, the superiority of G. barbadense L. varieties in pod structure was noticed. In some combinations, the dominance of G. hirsutum L. varieties was observed. In other words, it was observed that in hybrid plants, the shape of pods was relatively elongated or pointed, corresponding to that of Surkhan-14 and Surkhan-9 varieties, while in some hybrids, it was found that there are plants with a pod shape close to the maternal shape or relatively different. In addition, it was determined that the surface of the pods was relatively rough, and the color of the pods was dark green, which indicated the superiority of G. barbadense L. varieties. In Baraka x Surkhan-9 hybrid combination, it was found out that the pods are relatively smooth and the color is lighter green. Also, in this hybrid combination, it was found

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VOLUME 03 ISSUE 12 PAGES: 56-63
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

that in the F2 generation there are plants with a different shape of the pods from the parental forms (Figure 3).

So, in the inheritance of pod shape and color, in the F1 hybrid combinations involving G. hirsutum L. and G. barbadense L. species, the dominance of the parental form with more intermediate and high indices in pod size was determined, and the superiority of G. barbadense L. varieties in the inheritance of pod shape and color were observed.

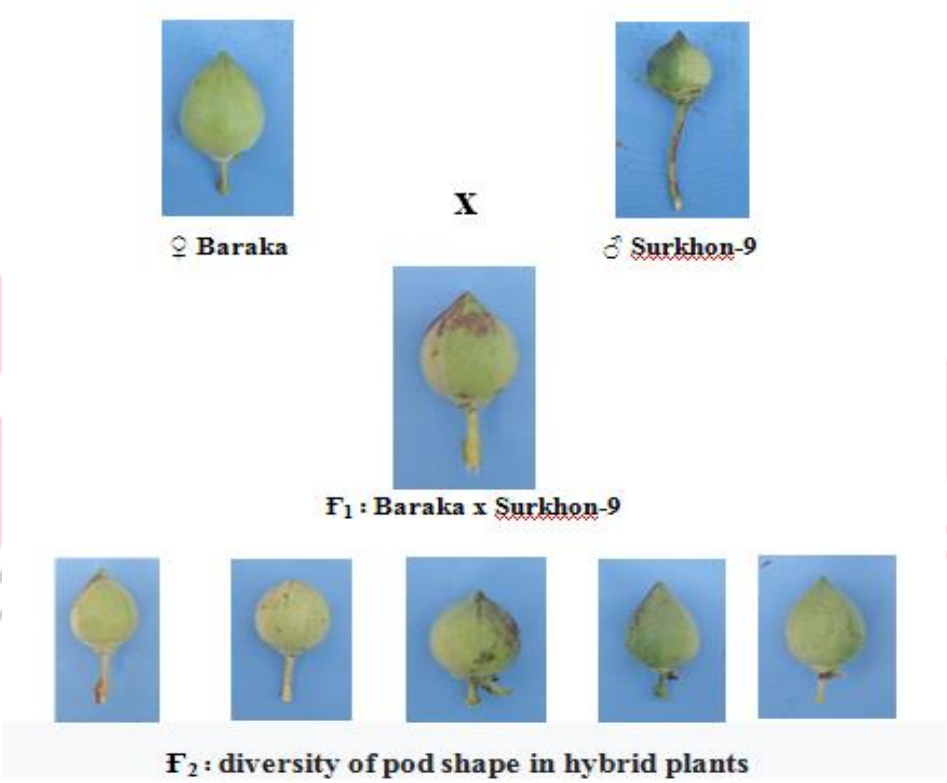

Figure 3. Inheritance of pod shape in parental and F_1, F_2 generation plants

Another distinguishing feature is the color of the petals, pollen color and the presence of anthocyanin spots on the petals. It was found that the varieties belonging to the G. hirsutum L. species involved in hybridization have white and pale yellow petals and yellow pollen, while the varieties of G. barbadense L. have yellow petals and orange pollen. The yellow petals of the hybrid combinations with their participation were large and relatively yellow, corresponding to the varieties of G. barbadense L.

American Journal Of Biomedical Science & Pharmaceutical Innovation
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
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Furthermore, in the Baraka x Surkhan-9 hybrid combination, it was found that the color of petals and pollen, the absence of anthocyanin spots on petals, is based on the dominance of the maternal form (Figure 4).

Figure 2. On the left is a flower of the maternal plant, on the right is a flower of the paternal plant, and in the middle is a flower of the F_1 hybrid plant.

In the hybrid plants obtained with the presence of other varieties of the G. hirsutum L. species that participated in the hybridization, it was observed that the color of the pollen is light yellow or orange, and the absence or partial presence of anthocyanin spots on petals.

CONCLUSIONS

In conclusion, we can say that one of the signs that affect the indicators of valuable agricultural traits in cotton is the intensity of flowering. Based on the obtained result, in the varieties Surkhan-18, Termez-202 and Surkhan-103 there is an opportunity to continue genetic and breeding processes in the conditions of the Syrdarya region and use these varieties to create hybrid organisms.

Based on the experiment, intermediate inheritance was observed in the F1 generation obtained from interspecies hybridization in terms of the shape of the pod, while F2 hybrid plants showed that a plant with a different shape can be formed, according to Mendel's law of independent assortment. Also, depending on the combinations, it was determined that the trait is inherited based on the superiority of the Baraka variety, which is the maternal form, in the combination of F1 Baraka x Surkhan-9 hybrid in the colour of petals and pollen, the absence of anthocyanin spots on petals.

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(ISSN – 2771-2753)
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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 64-72
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

RUST FUNGI OF PLANT SPECIES BELONGING TO THE LAMIACEAE FAMILY, COMMON IN THE NORTH-EASTERN REGIONS OF UZBEKISTAN

Submission Date: December 15, 2023, Accepted Date: December 20, 2023,
Published Date: December 25, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-11

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ABSTRACT

The article presents scientific information about fungi of the genus Puccinia, found in plants of the Lamiaceae family, widespread in the north-east of Uzbekistan. According to the results of scientific research, 3 species of Puccinia were found in 10 species of plants of the Lamiaceae family: Puccinia menthae Pers., Puccinia phlomidis Thum., Puccinia ziziphorae P. Syd. and Syd. In addition, brief descriptions and summaries of the morphology and disease symptoms of some fungi are given.

KEYWORDS

Lamiaceae, Puccinia, Puccinia menthae, host plant, fungi.

INTRODUCTION

Zaprometov and Gaponenko were the first to conduct research on the microbiota of higher plants found in Central Asia. Their data includes information on 396 species of fungi found on 263 plant species [21, 42, 43]. In 1944-1960, Golovin and other scientists conducted research on micromycetes in higher plants [5, 6, 22, 23,

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

24, 25, 26, 33]. In the period 1970-1990, information about fungi found in plants common on the territory of the Republic can be seen in the scientific works of scientists from the Botanical Institute at the Academy of Sciences of the Republic of Uzbekistan [27, 36, 38, 39, 40]. So far, in the course of scientific work and research carried out by Uzbek scientists, new species of fungi and new species of host plants have been identified on the territory of the Republic. The morphological characteristics of the identified fungi and their summaries are also formed [1, 2, 3, 4, 7, 9, 10, 11,12, 13, 14, 15, 16, 17, 18, 19, 28, 31, 32].

Scientists provided information on more than 3,500 species belonging to 200 genera of plants in the family Lamiaceae. In Central Asia there are more than 460 plant species of the Lamiaceae family, belonging to 53 families, and in Uzbekistan - 214 species, belonging to 38 families. The stem of plants of the Lamiaceae family is tetrahedral, the leaves on the stem are opposite, and a simple leaf. The petals of representatives of this family are bilabial, the lower lip consists of 3 petals, the upper lip - of 2 petals. Sometimes there are 2 skiers, and more often than not there are 4 skiers. There are 2 carpels. The fruit looks like a nut. The genera Ziziphora, Mentha, Origanum are widely used in the perfumery, confectionery, food industries, as well as in medicine [34,35].

METHODS

In 2023, field research was organized in the form of planned route monitoring of natural landscapes, crop fields and gardens in various regions of the Republic. Mycological methodological programs, various identifiers and scientific articles were used to determine the morphological characteristics of fungal species. The time and place of collection of plant samples taken for the study were also determined. The study of herbarium samples of fungi was carried out using trinocular microscopes N – MBI – 15 Biolam and 300M (HDCE-X5). A Canon IXUS 1260 digital camera was used to photograph mushrooms in natural conditions. The current systematic nomenclature of identified fungi is given based on the site indexfungorum.org [29] and the names of host plants powo.science.kew.org [30] (Fig. 1).

RESULTS AND DISCUSSION

As a result of the study of scientific sources, re-examination of samples of rust fungi stored in the Tashkent Mycological Herbarium, morphological study of newly collected materials and their taxonomic analysis, it was established that Puccinia menthae Pers is found in the majority of Puccinia fungi of 6 species Mentha aquatica L., Mentha arvensis L., Mentha longifolia L., Nepeta mariae Rege, Nepeta olgae Regel, Origanum tyttanthum Gontsch., Puccinia phlomidis Thüm. and 3 species Phlomoides hissarica (Regel) Adylov, Kamelin & Makhm., Phlomoides speciosa (Rupr.) Adylov, Kamelin & Makhm., Stachyopsis

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oblongata (Schrenk) Popov & Vved., [Eriophyton oblongatum (Schrenk) Bendiksby], Puccinia ziziphorae P Syd. & Syd.: Ziziphora pedicellata Pazij & Vved. Studies have shown that the species Puccinia menthae Pers., belonging to the Puccinia family, infect the largest number of plants of the Lamiaceae family (Diagram 1).

Table 1

Taxonomic analysis of Puccinia species found on plants of the Lamiaceae family in the north-eastern region of Uzbekistan

№	Species	Substrate/host plants	Quantity	Plant family
1	*P. menthae*	*Mentha longifolia* L.	6	**Lamiaceae**
2		*Mentha aquatica* L.		
3		*Nepeta mariae* Rege		
4		*Nepeta olgae* Regel		
5		*Origanum tyttanthum* Gontsch., [*Origanum vulgare* subsp. gracile (K.Koch) letsw.]		
6		*Mentha arvensis* L.		
7	*P. phlomidis*	*Phlomoides hissarica* (Regel) Adylov, Kamelin & Makhm.	3	
8		*Phlomoides speciosa* (Rupr.) Adylov, Kamelin & Makhm.		
9		*Stachyopsis oblongata* (Schrenk) Popov & Vved., [*Eriophyton oblongatum* (Schrenk) Bendiksby]		
10	*P. ziziphorae*	*Ziziphora pedicellata* Pazij & Vved.	1	

As can be seen from the table, 3 species of fungi belonging to the genus Puccinia were found in 10 plant species of the Lamiaceae family in the study area, and it was also found that the fungus P. menthae infects 6 plant species.

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
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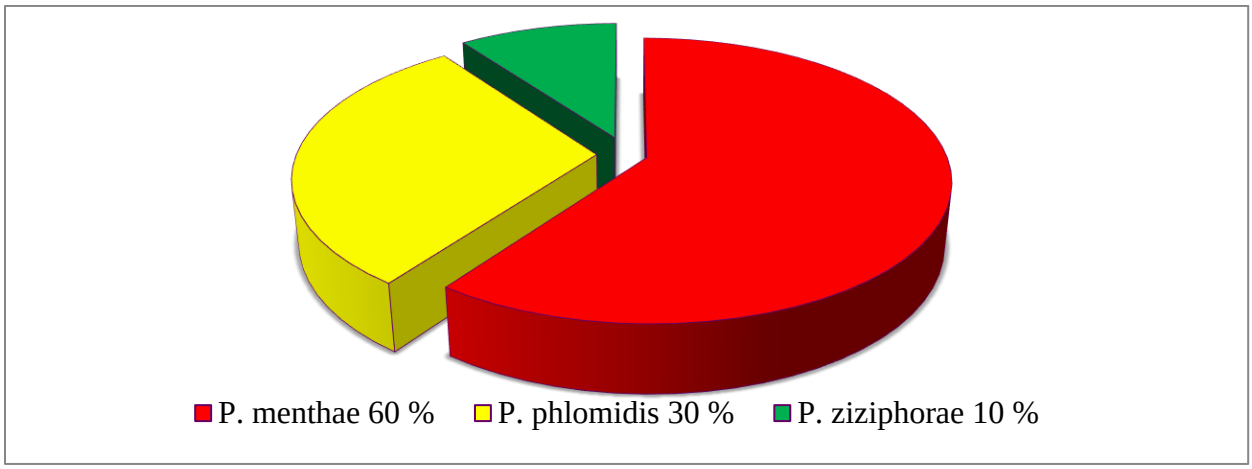
Diagram1



The conducted studies show that the species *Puccinia menthae Pers.*, belonging to the family Puccinia, affects the 6 most common plant species of the family Lamiaceae.

Brief morphological description of Puccinia species distributed among plants of the family Lamiaceae

Puccinia menthae Pers. – is the host plant of Mentha longifolia L. Spermogonia are scattered or in small groups on the underside of plant leaves, between the aecidia, with a diameter of 130-170 µm, light yellow or brown. Aecidiospores are oval, elliptical, oblong, with a diameter of 19-29×15-21 microns, the shell is pale yellow or colorless, thickness is 1-2 microns.

The mushrooms, located in the lower part of the leaves, are densely located on the surface of the leaves, fused, round, with a diameter of 0.2-0.6 mm, brown or dark brown. Uredenospores are round, elliptical, ovoid, 20-28×16-21 microns in diameter, the shell is pale yellow, 1.5-2 microns thick, spiny, with 2-3 poorly visible pores. Teliospores are broadly elliptical, with a diameter of 22-35×21-28 microns, the tip is rounded, the lower part is compressed or not narrowed, the shell is brown, 1.5-2.5 microns thick, not thickened at the tip, spiny, stalk. weak, equal to the length of the spore [44].

Puccinia menthae Pers. – is the host plant of Mentha longifolia L. Spermogonia are scattered or in small groups on the underside of plant leaves, between the aecidia, 130-170 µm in diameter, light yellow or brown. Aecidiospores are oval, elliptical, oblong, 19-29×15-21 µm in diameter, the shell is pale yellow or colorless, 1-2 µm thick. The mushrooms, located in the lower part of the leaves, are densely located on the surface of the leaves, fused, round, 0.2-0.6 mm in diameter, brown or dark brown. Uredenospores are round, elliptical, ovoid, 20-28×16-21 µm in diameter, the shell is pale yellow, 1.5-2 µm thick, spiny, with 2-3 poorly visible pores. Teliospores are broadly elliptical, with a diameter of 22-35×21-28 microns, the tip is rounded, the

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(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 64-72
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

lower part is compressed or not narrowed, the shell is brown, 1.5-2.5 microns thick, not thickened at the tip, spiny, the stalk is weak, equal to the length of the spore [44].

Puccinia phlomidis Thüm. – is the host plant of Phlomoides tuberosa L. The spermogonia of the fungus are located on the underside of the leaves. Numerous, scattered or forming a small group, round in shape, 150-170 mm in diameter, pale yellow in color. Aecidiospores are spherical, oval, multifaceted, ovoid, diameter 21-25×16-19 microns, skin colorless or pale yellow, up to 1 micron thick, almost smooth or partially spiny, orange in color. There are no uredospores. Teleutococci on the upper side of the leaf, scattered or located around a ring, the body is larger, round or irregular in shape, up to 1 mm in diameter, brown in color. Teliospores are elliptical or broadly oval, 24-34×19-22 µm in diameter, the tip and base are round, the shell is brown, smooth, the stalk is colorless, very short, sometimes absent [44].

Puccinia ziziphorae P. Syd. & Syd. – is the host plant of Ziziphora pedicellata Pazij & Vved. The fungus is most often found on both sides of the plant's leaves. It also damages the branches and stems of the plant. It has the shape of round spots and is pale yellow in color. The etiospores of the fungus are pear-shaped, elliptical, round in shape, with a diameter of 19.8-21.1×18.2-22.5 microns, a shell of 1 micron, colorless. Uredospores are located mainly in the lower part of the plant leaf, sometimes in the upper part, have an ovoid, round, elliptical shape, diameter 21.6-26.0 × 16.5-23.2 microns. Teliospore diameter 26.4-33.0×19.8-23.1 µm, elliptical, slightly elongated, colorless stalk, thickness 39-45 µm. [37].

Summary of Puccinia species belonging to plants of the family Lamiaceae, distributed in the northeastern region of Uzbekistan

Basidiomycota	Phylum
Pucciniomycetes	Class
Pucciniales	Order
Pucciniaceae	Family
Puccinia	Genus

***Puccinia menthae* Pers.**

Mentha aquatica L. – Tashkent region, Parkent district, Bashkizilsoy, 07/19/1951, Bostanlyk district, Kainarsoy, 1949-1950. [37].

Mentha arvensis L. – Tashkent region, Parkent district, Bashkizilsay, 1949-1950 [37].

American Journal Of Biomedical Science & Pharmaceutical Innovation
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Mentha longifolia L. – Namangan region, Popsky district, near Kandagan, 07/18/2000, Dubog village, 07/17/2000, Chartak district, Iskavat village, 07/23/2000, Uychinsky district, Kyzylrovot 07/24/2000, 06/29/2001, Chust, from the camp "Dustlik", 07/10/2001, 07/23/2002, Namangan district, Shor village 08/05/2000, Chartak district, Peshkurgan village, 05/26/2002 (Gaffarov-2005). Tashkent region, Parkent district, Bashkizilsay, Soyok, Gisarak, 1949-1950, Akhangaran district, 10/06/1953-1955, Angren district, 09/26/1953 [37]. Angren city, Ertoshsay village, N=41°11'0.03", E=70°18'11.93",^{h}– 1598 m, 06/26/2023.

Nepeta mariae Rege – Tashken region, Angren district, 10/06/1953-1955, Bustanlyk district, large Maydantal 07/06/1955 [37].

Nepeta olgae Regel – Tashken region, Parkent district, Bashkizilsay, 07/23/1953 [37].

Origanum tyttanthum Gontsch., – Fergana region, Fergana district, Shakhimardon, 07/10/1950. Tashken region, Parkenst district, Bashkizilsay, 04-06.1950, Sukak, 1953, Reserve, 08.13.1953, Angren district, 06-10.1953-1955 [37]. Angren city, Ertashsay village, Ertash street, N=41°11'06.03", E=70°18'11.93",^{h}– 1598 m.

Puccinia phlomidis Thüm.

Stachyopsis oblongata (Schrenk) Popov & Vved. – Fergana region, Fergana district, 07/06/1950. Tashkent region, Bustanlyk district, Alaudinsay, Maidantal, 07/22/1955 [37].

Phlomoides speciosa (Rupr.) Adylov, Kamelin & Makhm. – Tashkent region, Parkent district, Bashkizilsay reserve, 04-05.1950, Akhangaran district, Ohangaron tumani, lower Kainar hills, Yangi village, upper hills, 06/04/1953, Bustanlyk district, Maydantal, 07/22/1957 [37].

Phlomoides hissarica (Regel) Adylov, Kamelin & Makhm. – Tashkent region, Bustanlyk district, Khoramzadasay, 07/20/1961 [37].

Puccinia ziziphorae P. Syd. & Syd.

Ziziphora pedicellata Pazij & Vved. – Namangan region, Pap district, from the mountains of the eastern part of the village of Kandagan, 07/18/2000, 07/17/2002 [9]. Tashkent region, Parkent district, Shavvazsay, Bashkizilsay, 07.1949. Akhangaran district, Abiyasov, 06/26/1954, 10/02/1954. Orta-Chirchik district, Parlisoy village, upper hills, 06/08/1953. Bustanlyk district, large and small Maydontol, 08/06/1955 [37]. Bustanlyk district, Amirsay, N=41°29'10.42", E=69°56'43.1", altitude above sea level: 1611 m., 07/04/2023 [32].

CONCLUSION

Mycological studies of rust fungi found in plants of the Lamiaceae family, distributed in the North-Eastern region of Uzbekistan, showed that fungi of the Puccinia family were found in 3 species, such as Puccinia menthae Pers., Puccinia phlomidis Thüm., Puccinia ziziphorae P. Syd. & Syd.; Mentha aquatica L., Mentha arvensis L., Mentha longifolia L., Nepeta mariae Rege, Nepeta olgae Regel, Origanum tyttanthum Gontsch., Phlomoides hissarica (Regel) Adylov, Kamelin & Makhm., Phlomoides speciosa

American Journal Of Biomedical Science & Pharmaceutical Innovation
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OCLC – 1121105677
Publisher: Oscar Publishing Services

(Rupr.) Adylov, Kamelin & Makhm., Stachyopsis oblongata (Schrenk) Popov & Vved., [Eriophyton oblongatum (Schrenk) Bendiksby], Ziziphora pedicellata Pazij & Vved. found in 10 plant species of the Lamiaceae family. Observations have shown that these fungi are found in hilly, mountainous and foothill regions of the temperate zone. It has been observed that rust fungi develop from the second half of spring until the last months of summer and cause plant disease.

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(ISSN – 2771-2753)
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(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 73-78
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

PHYSIOLOGICAL AND BIOCHEMICAL BASES AND PEDAGOGICAL TECHNOLOGIES OF ADAPTATION TO PHYSICAL LOAD OF DIFFERENT SIZE IN ATHLETES

Submission Date: December 18, 2023, **Accepted Date:** December 23, 2023,
Published Date: December 28, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-12

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ABSTRACT

This study investigates the physiological and biochemical foundations underlying the adaptation of athletes to varying degrees of physical load. It explores the intricate mechanisms involved in the adaptive responses of athletes to different intensities of exercise and their implications for performance enhancement. The research delves into the intricate interplay of physiological systems, biochemical markers, and pedagogical technologies employed to optimize athlete's adaptation to diverse levels of physical exertion. By examining these aspects, this study aims to provide comprehensive insights into the strategies and interventions that facilitate efficient adaptation, thereby aiding in the development of tailored training regimens for athletes across different disciplines.

KEYWORDS

Physiological adaptation, Biochemical markers, Physical load, Athletes, Exercise intensity, Performance enhancement, Pedagogical technologies, Training regimens, Adaptation strategies.

The Significance of Studying Adaptation to Physical Load

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 73-78
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

INTRODUCTION

Adaptation to physical load is a fundamental aspect of human physiology, particularly relevant in the context of athletes, fitness enthusiasts, and individuals engaged in regular physical activity. Understanding how the body responds and adapts to various forms of physical stress is of paramount importance for optimizing performance, preventing injuries, and promoting overall health and well-being. This essay explores the significance of studying adaptation to physical load and its implications for athletic performance, injury prevention, personalized training programs, recovery optimization, health and well-being, and scientific advancements.

Performance Enhancement

One of the primary reasons for studying adaptation to physical load is its direct impact on athletic performance. By comprehending the physiological responses to different training stimuli, athletes and coaches can design training programs that strategically manipulate variables such as intensity, volume, and frequency to elicit specific adaptations. This understanding allows for the optimization of training regimens to promote favorable changes in muscular strength, endurance, power, and aerobic capacity, ultimately leading to enhanced athletic performance.

Injury Prevention

Studying adaptation to physical load is crucial for designing training programs that minimize the risk of injuries. By gradually increasing the intensity and volume of training in a structured manner, individuals can allow their bodies to adapt and become more resilient. This approach reduces the likelihood of overuse injuries and musculoskeletal imbalances, thus promoting long-term athletic development and sustainability in physical activity.

Personalized Training Programs

The significance of studying adaptation to physical load lies in its ability to inform the development of personalized training programs. Every individual responds differently to training stimuli due to variations in genetics, training history, and physiological characteristics. By understanding how individuals adapt to physical stress, coaches and sports scientists can tailor training programs to suit an individual's specific needs, optimizing training effectiveness while minimizing the risk of overtraining or undertraining.

Recovery Optimization

Understanding the adaptive responses to physical load is essential for optimizing recovery strategies. Effective recovery is crucial for facilitating the adaptation process and minimizing the risk of overreaching or overtraining syndrome. By recognizing the time course of adaptation and recovery, athletes can implement targeted recovery interventions such as nutrition, sleep, and active recovery techniques to

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 73-78
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
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enhance the body's adaptive response and overall readiness for subsequent training sessions.

Health and Well-being

Studying adaptation to physical load extends beyond athletic performance and has significant implications for overall health and well-being. Regular physical activity is associated with numerous health benefits, including improved cardiovascular health, metabolic function, mental well-being, and resilience to chronic diseases. Understanding how the body adapts to physical stress provides insights into the mechanisms underlying these health benefits, thereby emphasizing the importance of regular exercise for maintaining optimal health.

Scientific Advancements

Research on adaptation to physical load contributes to advancements in exercise science, sports medicine, and rehabilitation practices. By elucidating the physiological mechanisms underlying muscular, cardiovascular, and metabolic adaptations, scientific research in this field informs evidence-based practices for optimizing training and rehabilitation protocols. This knowledge also has implications for developing innovative strategies for enhancing athletic performance, preventing injuries, and promoting overall health and well-being.

Studying adaptation to physical load is of paramount significance for athletes, fitness enthusiasts, and researchers alike. The understanding of how the body responds and adapts to physical stress informs the development of effective training programs, injury prevention strategies, personalized approaches to exercise prescription, recovery optimization techniques, and advancements in scientific knowledge. Ultimately, this knowledge contributes not only to enhanced athletic performance but also to the promotion of overall health and well-being in individuals engaging in regular physical activity. Therefore, continued research and education in this area are essential for maximizing the benefits of physical activity while minimizing the risks associated with training and exercise.

Mechanisms of Physiological Adaptation in Athletes

Physiological adaptation is a complex process through which the human body responds to the demands imposed by physical activity, leading to various structural, functional, and biochemical changes. In the context of athletes, understanding the mechanisms of physiological adaptation is crucial for optimizing training programs, enhancing performance, and preventing injuries. This essay explores the key mechanisms underlying physiological adaptation in athletes, including muscular adaptations, cardiovascular adaptations, metabolic adaptations, and neuroendocrine adaptations.

Muscular Adaptations

One of the primary mechanisms of physiological adaptation in athletes is the development of muscular strength, power, and endurance. Resistance training and high-intensity activities stimulate muscle fibers to

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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OCLC – 1121105677
Publisher: Oscar Publishing Services

undergo hypertrophy, resulting in an increase in cross-sectional area and force-generating capacity. Additionally, regular physical activity promotes improvements in neuromuscular coordination and motor unit recruitment, leading to enhanced motor skills and movement efficiency. These adaptations are mediated by molecular signaling pathways such as mTOR (mechanistic target of rapamycin) and AMPK (adenosine monophosphate-activated protein kinase), which regulate protein synthesis and mitochondrial biogenesis, respectively.

Cardiovascular Adaptations

Athletes also undergo significant cardiovascular adaptations in response to endurance training and aerobic activities. Prolonged exercise leads to increased cardiac output, stroke volume, and capillarization of skeletal muscle, facilitating greater oxygen delivery to working muscles. This is accompanied by structural changes in the heart, such as eccentric hypertrophy of the left ventricle and enhanced myocardial contractility. These adaptations are mediated by physiological stimuli such as shear stress, hypoxia, and sympathetic activation, which trigger molecular pathways involving nitric oxide, vascular endothelial growth factor (VEGF), and endothelin-1.

Metabolic Adaptations

Another critical mechanism of physiological adaptation in athletes involves metabolic changes that optimize energy production and utilization. Endurance training induces mitochondrial biogenesis and oxidative enzyme upregulation in skeletal muscle, enhancing the capacity for aerobic metabolism and fatty acid oxidation. Concurrently, anaerobic activities promote adaptations such as increased glycolytic enzyme activity and improved buffering capacity to sustain high-intensity efforts. These metabolic adaptations are regulated by transcriptional coactivators like PGC-1α (peroxisome proliferator-activated receptor gamma coactivator 1-alpha) and metabolic sensors such as AMPK, which coordinate cellular energy homeostasis and substrate utilization.

Neuroendocrine Adaptations

The neuroendocrine system plays a pivotal role in mediating physiological adaptations to exercise in athletes. Intense training stimulates the release of anabolic hormones such as testosterone, growth hormone, and insulin-like growth factor-1 (IGF-1), promoting muscle protein synthesis and tissue repair. Conversely, endurance exercise elicits the secretion of cortisol and catecholamines, which mobilize energy substrates and facilitate cardiovascular function. These hormonal responses are modulated by the hypothalamic-pituitary-adrenal (HPA) axis and the hypothalamic-pituitary-gonadal (HPG) axis, orchestrating adaptive changes in metabolism, tissue remodeling, and stress resilience.

In essence, the mechanisms of physiological adaptation in athletes encompass a wide array of structural, functional, and biochemical responses that

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(ISSN – 2771-2753)
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OCLC – 1121105677
Publisher: Oscar Publishing Services

enable the human body to cope with the demands of physical activity. Muscular adaptations involve hypertrophy and neuromuscular improvements, cardiovascular adaptations enhance oxygen delivery and cardiac function, metabolic adaptations optimize energy production and substrate utilization, and neuroendocrine adaptations regulate anabolic and catabolic processes. Understanding these mechanisms is essential for designing effective training programs, promoting athletic performance, and safeguarding the health and well-being of athletes. Furthermore, continued research into the intricacies of physiological adaptation holds promise for advancing sports science, exercise physiology, and personalized approaches to athletic development.

Continued investigation plays a pivotal role in advancing athletic performance in several crucial ways: Optimization of Training Methods: Ongoing research allows for the refinement and development of training methodologies. Understanding the latest scientific insights helps coaches and trainers tailor training programs to better suit individual athletes, considering their physiological differences, specific needs, and sport demands.

Innovation in Equipment and Technology: Research drives the creation of cutting-edge equipment and technological advancements that can enhance athletic performance. This includes wearable technology, improved gear, and training apparatus designed to optimize training, improve technique, and reduce the risk of injury.

Improved Recovery Strategies: Investigating various recovery methods and their impact on athletic performance aids in developing more effective strategies to enhance recovery, reduce fatigue, and promote quicker recuperation between training sessions or competitions.

Injury Prevention and Rehabilitation: Continued investigation contributes to a better understanding of injury mechanisms and risk factors. This knowledge helps in developing preventive strategies and effective rehabilitation protocols to minimize the occurrence of injuries and ensure athletes recover swiftly and safely.

Nutritional Advancements: Research in sports nutrition allows for the identification of optimal dietary practices that can maximize performance, aid recovery, and promote overall health in athletes. Understanding the role of specific nutrients and their timing can significantly impact an athlete's endurance, strength, and recovery.

Performance Monitoring and Analysis: Advancements in sports science enable the collection of more precise data on athletes' performance metrics, including biomechanical analysis, physiological markers, and psychological factors. This data-driven approach facilitates more accurate assessment and improvement of an athlete's strengths and weaknesses.

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 73-78
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Psychological and Mental Preparation: Investigating mental aspects such as focus, stress management, and motivation is vital. Continued research in sports psychology aids in developing techniques to optimize mental preparedness, resilience, and overall psychological well-being, essential for peak athletic performance.

Adaptation to Changing Environments and Challenges: As sports evolve and encounter new challenges, continued investigation enables athletes and coaches to adapt to changes efficiently. This includes adjustments in training approaches, mental strategies, and physiological adaptations required for various environments or emerging sports trends.

In conclusion, continued investigation and research are indispensable for the ongoing advancement of athletic performance. It not only fosters improvements in training methods and equipment but also enhances our understanding of the complex interplay between physical, mental, and environmental factors that contribute to athletic excellence. This knowledge empowers athletes and their support teams to push boundaries, achieve new milestones, and maintain a competitive edge in the ever-evolving world of sports.

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American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 79-83
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

RELEVANCE OF THE DEVELOPMENT OF SPORTS PHYSIOLOGY

Submission Date: December 18, 2023, Accepted Date: December 23, 2023,
Published Date: December 28, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue12-13

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ABSTRACT

The development of sports physiology stands as a crucial cornerstone in comprehending the intricate mechanisms governing human performance in athletic endeavors. This article delves into the profound relevance and significance of sports physiology in deciphering the physiological, biomechanical, and psychological facets underpinning athletes' abilities. It outlines the historical progression of sports physiology, highlighting its pivotal role in optimizing training methodologies, preventing injuries, enhancing performance, and fostering overall athlete well-being. By elucidating the significance of sports physiology, this study emphasizes its contribution to advancing athletic excellence and shaping the future landscape of sports.

KEYWORDS

Sports physiology, Athletic performance, Training optimization, Biomechanics, Injury prevention, Athlete well-being, Performance enhancement, Historical progression, Training methodologies, Human performance.

INTRODUCTION

Sports physiology is a branch of exercise science that focuses on understanding the body's response to physical activity and exercise. It encompasses the study of how the body functions during exercise, the effects of different types of exercise on the body, and how to optimize athletic performance through training and nutrition. In essence, sports physiology seeks to understand the physiological changes that occur in the body during exercise and how these changes can be manipulated to improve athletic performance.

The scope of sports physiology is broad and encompasses various aspects of human physiology,

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 12 PAGES: 79-83
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

including cardiovascular, respiratory, muscular, and metabolic systems. It also involves the study of biomechanics, nutrition, and the psychological aspects of sports performance. Sports physiologists work with athletes to develop training programs that enhance their physical capabilities, improve their endurance, strength, speed, and agility, and reduce the risk of injury.

One of the key areas of focus in sports physiology is understanding the body's energy systems and how they are utilized during different types of exercise. This includes the study of aerobic and anaerobic metabolism, which play a crucial role in determining an athlete's endurance and performance. Understanding these energy systems allows sports physiologists to design training programs that target specific energy pathways, helping athletes perform at their best.

Another important aspect of sports physiology is the study of muscle function and adaptation to exercise. This includes understanding how muscles contract, produce force, and adapt to different types of training. Sports physiologists also study the effects of resistance training, stretching, and other forms of exercise on muscle strength, power, and flexibility.

Nutrition is another critical component of sports physiology. Sports physiologists study how different nutrients affect athletic performance, recovery, and overall health. They work with athletes to develop personalized nutrition plans that support their training and competition goals.

In addition to the physiological aspects of sports performance, sports physiologists also consider the psychological factors that influence athletic success. They study the mental aspects of sports performance, including motivation, stress management, and mental toughness, and work with athletes to develop strategies for improving their mental resilience and focus during competition.

Sports physiology is a multidisciplinary field that encompasses the study of human physiology, biomechanics, nutrition, and psychology as they relate to athletic performance. Its scope is broad and includes understanding how the body responds to exercise, optimizing training programs to improve athletic performance, and addressing the physical and mental aspects of sports performance. Sports physiologists play a crucial role in helping athletes achieve their full potential and excel in their chosen sport.

Understanding human performance in athletics is a complex and multifaceted topic that encompasses various physiological, biomechanical, nutritional, and psychological aspects. The study of human performance in athletics is crucial for athletes, coaches, and sports scientists to optimize training programs, enhance athletic capabilities, and achieve peak performance. This essay will explore the key components of understanding human performance in athletics and its implications for athletes and sports professionals.

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OCLC – 1121105677
Publisher: Oscar Publishing Services

One of the fundamental aspects of understanding human performance in athletics is the study of exercise physiology. Exercise physiology delves into how the body responds to physical activity and exercise, encompassing the cardiovascular, respiratory, muscular, and metabolic systems. By understanding the physiological changes that occur during exercise, sports scientists can design training programs that target specific energy systems, improve endurance, and enhance overall performance.

Furthermore, the study of biomechanics plays a crucial role in understanding human performance in athletics. Biomechanics involves the analysis of movement patterns, forces, and mechanical aspects of the human body during athletic activities. By examining factors such as running gait, jumping mechanics, and throwing techniques, sports scientists can identify optimal movement patterns and develop training strategies to improve athletic performance while reducing the risk of injury.

Nutrition is another essential component of understanding human performance in athletics. The role of nutrition in athletic performance cannot be overstated, as it directly impacts energy levels, recovery, and overall health. Sports scientists study how different nutrients affect athletic performance and work with athletes to develop personalized nutrition plans that support their training and competition goals.

In addition to the physiological and biomechanical aspects, the psychological factors influencing human performance in athletics are equally important. Sports psychologists delve into the mental aspects of sports performance, including motivation, stress management, and mental toughness. Understanding the psychological factors that impact athletic success enables athletes to develop strategies for improving their mental resilience and focus during competition.

Moreover, understanding human performance in athletics involves recognizing the individual differences among athletes. Each athlete has unique physiological characteristics, biomechanical traits, nutritional needs, and psychological profiles. Therefore, personalized training programs tailored to an athlete's specific strengths and weaknesses are essential for optimizing performance.

The implications of understanding human performance in athletics are far-reaching. For athletes, this knowledge enables them to maximize their potential, improve their competitive edge, and reduce the risk of injury. Coaches can use this information to design effective training programs that target specific areas for improvement and enhance overall performance. Furthermore, sports scientists can contribute to the development of evidence-based training methods and nutritional strategies that benefit athletes across various sports disciplines.

Understanding human performance in athletics is a multidisciplinary endeavor that encompasses exercise

American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
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physiology, biomechanics, nutrition, and psychology. By integrating these various components, athletes and sports professionals can gain insights into how the body responds to exercise, optimize training programs, and address the physical and mental aspects of sports performance. Ultimately, this understanding plays a pivotal role in helping athletes achieve their full potential and excel in their chosen sport.

The potential contributions of sports physiology to the future of sports and athlete development are vast and impactful:

Tailored Training Programs: Sports physiology research allows for the customization of training regimens based on individual athlete profiles. Future advancements will further refine these programs, considering athletes' unique physiological responses, genetic predispositions, and specific sport demands.

Performance Optimization: Advancements in sports physiology will lead to a deeper understanding of the body's adaptive responses to training stimuli. This knowledge will help maximize performance gains while minimizing the risk of overtraining and injury, leading to more effective and sustainable athletic performances.

Injury Prevention and Rehabilitation: Future developments in sports physiology will offer innovative approaches to prevent injuries by identifying risk factors and implementing targeted training interventions. Enhanced rehabilitation protocols based on physiological principles will facilitate faster and safer recovery, ensuring athletes return to competition at their best.

Technology Integration: The integration of cutting-edge technologies in sports physiology, such as wearable devices, sensors, and real-time monitoring systems, will revolutionize athlete assessment and training. These innovations will provide coaches and athletes with immediate feedback on physiological parameters, enabling real-time adjustments for optimal performance.

Nutritional Advancements: Continued research in sports nutrition, a subset of sports physiology, will lead to more precise dietary strategies tailored to individual athletes. Understanding how nutrition influences performance, recovery, and overall health will be pivotal in maximizing athletes' potential.

Psychological Support: Sports physiology will further delve into the psychological aspects of performance, aiding in the development of mental training techniques and interventions. This holistic approach will strengthen athletes' mental resilience, focus, and overall well-being.

Youth Development: Advances in sports physiology will contribute to optimized training methods for youth athletes, emphasizing age-appropriate exercises that consider growth, development, and injury prevention. This will lay a robust foundation for future elite athletes.

Ethical Performance Enhancement: Continued research will help distinguish between legal and ethical

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methods of performance enhancement from unethical practices. This will uphold the integrity of sports while enabling athletes to excel through legitimate means.

Data-Driven Decision-Making: The accumulation of physiological data will lead to more sophisticated analytics and modeling, aiding coaches and sports scientists in making informed decisions regarding training, recovery, and performance enhancement strategies.

Global Impact: Advances in sports physiology will not only benefit elite athletes but also filter down to grassroots and amateur levels, promoting health, fitness, and performance across all levels of sports participation.

CONCLUSION

In conclusion, the ongoing advancements in sports physiology will be pivotal in shaping the future of sports and athlete development, fostering safer, more efficient, and scientifically-driven approaches to training, performance enhancement, and overall athlete well-being.

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