Original Article

From Diabetic Nutritional Intake to Athlete Satisfaction: Role of Sport Engagement and Psychological Resistance to Return Post-Injury

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Abstract

Purpose: In the setting of the Kingdom of Saudi Arabia, the purpose of this study is to investigate the effects of diabetic nutritional intake on athletes' psychological resistance to return after an injury, sport engagement, and athlete satisfaction. The study's overarching goal is to learn how diabetic athletes' emotional and mental preparedness, level of participation in and enjoyment of their activity, and level of satisfaction with their performance are affected by proper dietary control. **Method:** The study included 144 Saudi athletes from diverse places. Using scales from previous studies, a constructed questionnaire was used to collect data. ADANCO for Structural Equation Modelling (SEM) was used to assess measurement reliability, validity, and hypothesised construct linkages. **Findings:** Athletes' psychological resistance, sport engagement, and athlete satisfaction were all found to be highly impacted by diabetic nutritional intake. Researchers discovered that participation in sporting activities mediates the connections between dietary consumption and psychological resistance and satisfaction, while psychological resistance in turn mediated the connection between dietary consumption and athlete satisfaction. **Originality/Implications:** This study shows how personalised diet can increase athletic performance by reducing psychological barriers and increasing engagement. Dietary management boosts athletes' performance and satisfaction, offering coaches, players, and nutritionists realistic recommendations.

Keywords: Diabetic nutritional intake, Sport engagement, Psychological resistance, Return to post-injury, Athlete satisfaction.

Introduction

The relationship between nutrition and sports performance has been studied for years. Sportsmen face additional challenges in managing chronic diseases like diabetes, according to recent studies.[1] Diabetes causes persistent elevated blood sugar; to maintain performance and health and avoid illness, diabetic athletes must carefully control their diets.[2] Energy, recuperation, and athletic performance depend on appropriate blood glucose levels;[3] diabetic diets must be optimal. Athletes with diabetes must maintain their insulin levels to avoid hypoglycemia and hyperglycemia.[4] These characteristics can considerably impact their training consistency and competitiveness.[5] Thus, understanding how diabetic food affects sports performance, including psychological and emotional factors, is vital. Comprehensive dietary guidelines to improve performance have dominated sports nutrition research.[6] However, diabetic athletes' daily needs are becoming more apparent, and research shows that a well-balanced diabetes management diet can improve endurance, strength, and recuperation in athletes.[7] Conversely, the psychological effects of different diets have not been sufficiently researched. According to Jiménez-Morcillo *et al.*[8], sports psychology research suggests that motivation, confidence, and emotional resilience affect athletes' performance and quality of life. Thus, the junction of dietary intake management and psychological factors in diabetic athletes is an emerging field that needs more research to maximise physical and mental health benefits.

Significant empirical research has shown that dietary

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management affects sports performance and well-being, notably in diabetic athletes.[9] Chen and Mok's[2] scholarly research suggest that athletes with a well-organised diet have better metabolic regulation, performance, and recovery. Barker *et al*.[10] found that diabetic athletes who ate low-GI foods had better endurance and blood glucose stability. Proper carbohydrate regulation reduces hypoglycemia episodes during intensive physical exercise, which is critical to performance.[11] Besides their physiological effects, specific foods have been studied for their psychological effects. According to Kowbel[12], athletes with diabetes who stabilise their glucose levels through careful nutrition management had lower anxiety and better moods. Reduced blood glucose swings in diabetic athletes boost motivation and confidence, which are necessary for ongoing athletic participation.[13] According to Ortiz[14], psychological stability is essential to regular training and performance and strongly impacts athlete satisfaction. Academic research has also studied how dietary management affects post-accident rehabilitation and psychological resilience.[15] Dietary strategies that regulate diabetes in athletes speed injury recovery and improve psychological resilience.[16] Suwan *et al*.[6] describe resilience as a positive view on rehabilitation and a greater commitment to resuming sports, which are crucial for athletic performance. Although significant study has been done on the physiological and psychological benefits of ingesting the right amount of nutrients, the methods by which they interact are currently being studied.[7]

Despite extensive research on diabetes diet and athletic performance, there are still gaps in the empirical scientific literature.[8] The complicated relationships between nutritional care, psychological resilience, and sports engagement are not well studied in diabetic athletes.[17] However, little is known about how these qualities affect psychological and engagement outcomes.[9] Food management has been shown to improve physical performance and reduce anxiety,[18] but empirical evidence is few. The association between stable glucose levels, psychological resistance to resume sports after an accident, and athlete satisfaction, especially among diabetic athletes, is little understood.[19] Studies have indicated that proper diet improves physical recovery and mental health, but more research is needed to determine how resilience and satisfaction contribute to these advantages.[2] Many studies have examined physical performance measurements, but few have examined how these changes affect athletes' psychological well-being or sport satisfaction.[10] Nutrient intake's effects on psychological hurdles and involvement, specifically injury healing and sports restart, are unknown due to a lack of extensive research. Gacek *et al*.[20] also suggest longitudinal studies to better understand how dietary management affects psychological resilience and sports engagement. Modern research generally uses cross-sectional data, which may not show the dynamic nature of the relationships. Diet, psychological well-being, and sports engagement can be better understood through longitudinal research.[21] This study may illuminate how continuous food control affects long-term psychological and athletic performance.

Many sports psychology and nutrition science ideas explain the relationship between diabetic nutritional intake, psychological resistance, and athlete satisfaction. Self-Determination Theory (SDT) states that autonomy, competence, and relatedness maximise performance and satisfaction.[22] Diabetic athletes might feel more competent by maintaining stable blood glucose levels with proper nutrition. This reduces psychological resistance and improves athletic enjoyment. Zhang[23] found that athletes who feel autonomous in regulating their food are more motivated and satisfied. The Stress-Coping Theory also helps explain how nutrition affects psychological resilience. Effective coping mechanisms, such as precise nutrition control, may lessen stress's negative effects on mental health.[19] Roberts[18] show that diabetic athletes who carefully monitor their diet can reduce stress from fluctuating glucose levels and injury recovery. Thus, this can reduce psychological resistance and increase sports involvement and enjoyment throughout the athlete's career. Studies show that stable glucose levels reduce anxiety and improve recovery.[8] This concept is backed by these experiments. This study examines how psychological resistance and sport involvement affect diabetes diet consumption and athlete satisfaction. This study examines how a well-regulated diet affects an athlete's psychological resilience, sport engagement, and subjective fulfilment. The research addresses knowledge gaps and offers practical ways to improve nutritional practises for diabetic athletes to attain optimal physical and psychological outcomes.[13] Analysing these factors' relationships will do this. This method will help us understand how dietary management can help athletes overcome psychological challenges and improve their sport happiness.

Literature Review

Diabetes care complicates the relationship between diet and athletic performance, which is well known.[24] Diabetic athletes must carefully balance food, insulin, and exercise to maintain optimal blood glucose levels. As carb timing and type directly affect blood sugar levels during training and competition, carb management is crucial for maintaining this balance.[25] Low-GI diets benefit diabetic athletes, according to research. These foods release glucose slowly into the circulatory system, reducing the risk of low or high blood sugar during exercise.[11,26-28] A diet high in protein and healthy fats helps stabilise blood sugar, boosting energy and muscle repair. Due to their metabolic processes, athletes must follow a food schedule to perform well and safely.[29] Consuming proper meals at the right time reduces glucose swings caused by exercise. Diet before exercise should supply enough energy without raising blood glucose levels, which may raise insulin demand.[30] Instead, the post-workout food should replace glycogen and prevent hyperglycemia. This study underlines the usefulness of continuous glucose monitoring (CGM) in this setting since it allows athletes and healthcare

practitioners to quickly adjust their diet and insulin regimens to their patients' exercise and glucose levels.[31] Continuous glucose monitoring (CGM) and personalised diets improve glycaemic management, minimise diabetes complications, and boost athletic performance, according to research.[32] Since athletes have unique metabolic reactions and different sports need distinct metabolic responses, more research is needed to refine these tactics.[33]

To fully analyse the relationship between diabetic dietary intake and athletes' psychological reluctance to compete after an injury, the most important factors must be identified.[34] Diabetic athletes follow a diet designed to control blood glucose levels. This diet emphasises controlled insulin therapy, carbohydrate restriction, and protein and fat balance.[35] Conversely, psychological resistance to return after injury refers to cognitive and emotional hurdles that may prevent an athlete from returning to play.[36] Apprehension about future performance, lowered self-confidence, and fear of additional injury might impact psychological resistance. Diabetic athletes may worry about how to manage their diabetes and resume competitive sports, adding to their psychological struggles;[37] thus, diet matters. Food management and psychological outcomes in athletes, especially those with chronic diseases like diabetes, are increasingly linked by empirical research.[2] This causes tiredness, emotional issues, and cognitive deficiencies, which increase psychological stress. Studies have shown that low meal intake might lead to poor glycaemic control and these symptoms.[3] Blood glucose dysregulation is associated to anxiety and depression in diabetic athletes.[1,4] These variables may slow psychological recovery after an injury. An athlete recovery study shows the relevance of mental fortitude and stable psychological conditions.[1] Dietary therapies for diabetes improve physical healing, mood, and psychological barriers to resuming sports. This empirical research supports the conclusion that diabetics' diets considerably impact their psychological resistance to return to competition after an accident.[5] Diabetic athletes' mental health should improve with proper diet. Its ability to regulate blood glucose levels reduces mood disturbances and anxiety, which are crucial to psychological resilience.[6] Maintaining a healthy diet also improves mental resilience by boosting overall well-being.[7] Research suggests that athletes who strictly follow a diabetic diet are more likely to overcome psychological barriers and resume their sport with confidence after an accident.[8] Thus, the hypothesis suggests that diabetic diets reduce psychological resistance.

H1: Diabetic nutritional intake significantly impacts on athletes' psychological resistance to return post-injury.

Numerous studies have shown that food affects athletic performance, especially in diabetic athletes.[8] Numerous studies have shown that diabetic athletes who follow a good diet manage their blood glucose levels better. This boosts physical performance and energy during training and sport.[9] Diabetic athletes who eat a balanced diet of carbs, proteins, and fats according to their insulin needs and physical activity had fewer episodes of hypoglycemia and hyperglycemia, which can hinder sports participation.[2] Diabetes athletes who eat a balanced diet have less high blood glucose levels, according to research. Stable blood glucose levels reduce fatigue and improve cognitive ability, according to empirical findings.[10] These factors are essential for sports focus and motivation. Given this, diabetic diet management is not only a problem of health, but also of athletes' capacity to regularly engage in and connect with their sport.[11] These findings confirm that diabetes diets strongly affect athletes' sports performance. Sport involvement regular training and competition with passion and enthusiasm depends on an athlete's physical and mental fitness. Diabetic athletes must monitor their diets to prepare.[12] A proper diet helps these athletes maintain energy levels for high-performance sports and reduces the danger of glycaemic swings, which can cause weariness or mental impairment.[13] Self-confidence in their ability to control their diabetes through nutrition increases psychological readiness and motivation in athletes to fully participate in their sport. Such confidence is vital for diabetic athletes.[14] The psychological load of their illness is reduced and sports participation is boosted, thus this sense of assurance from a well-controlled diabetic diet strengthens their dedication to the sport.[15] The idea is bolstered by evaluating the wider effects of poor dietary management on sports participation. Diabetic athletes' dietary deficiencies often contribute to variable performance, dissatisfaction, lower motivation, and a decline in sport involvement.[7] However, people who manage their diet well not only improve their physical performance but also form a deeper psychological relationship with their sport, increasing satisfaction, resilience, and resolve.[16,38] Thus, the amount of diabetic food an athlete consumes may affect their sports participation. Nutrition's direct effects on physical and cognitive function and diabetes care's psychological boost may mitigate the relationship.[6]

H2: Diabetic nutritional intake significantly impacts on athletes' sport engagement.

Research has shown that dietary management is crucial to athlete happiness, especially for individuals with chronic diseases like diabetes.[8] How well athletes manage their condition affects their physical and mental well-being, performance, training, and overall well-being.[17] Proper diet helps diabetic athletes maintain stable blood glucose levels, which influences energy, recuperation, and performance.[9] Diabetes athletes who follow a planned nutritional plan that balances carbohydrates, proteins, and fats report increased pleasure due to fewer fatigue episodes, faster recovery, and more consistent performance.[18] When athletes are confident in their nutritional plans, the psychological load of controlling diabetes is lessened, leading to higher athletic satisfaction. These findings substantially support the concept that diabetic nutritional intake considerably affects athletes' pleasure.[19] Sports satisfaction comes from both physical results and mental piece of mind from knowing one's situation is under control. Diabetic athletes have better training and

performance satisfaction when they eat healthily and have less energy and mood swings.[2] Knowing they can manage their condition with healthy nutrition reduces stress and worry, boosting their happiness. This psychological factor is vital since physical performance and mental health affect athlete satisfaction.[10] Thus, athletes who manage their diabetic nutritional intake properly feel more in charge of their health and performance, which increases pleasure. Consider the larger effects of inadequate dietary management on athlete satisfaction to support the idea.[20] Research shows that diabetic athletes with variable or inadequate diet commonly experience hypoglycemia, energy crashes, and delayed recovery times, which might lower their sports satisfaction.[21] Negative experiences can cause dissatisfaction, decreased motivation, and inadequacy, reducing satisfaction. Conversely, athletes who manage their diabetic nutritional intake well have better performance, faster recovery, and a steady mood, which increases enjoyment.[22] Hypothesised that diabetic nutritional intake and athlete satisfaction are linked, with correct nutrition improving both physical and psychological components of an athlete's experience.

H3: Diabetic nutritional intake significantly impacts on athletes' athlete satisfaction.

Past empirical research has emphasised the mediation role of sport engagement in psychological and physiological consequences, especially in athletes with diabetes.[23] Athlete engagement active and enthusiastic participation in their sport is linked to physical and mental health.[24] Studies demonstrate that motivated athletes recover faster and with more mental fortitude from injuries. In particular, diabetic athletes benefit from engagement in managing their condition.[25] High sport engagement helps diabetic athletes follow their nutritional goals, which aids physical recovery and mental health. This shows that sport engagement helps bridge the gap between diabetic nutritional intake and psychological resilience, especially during injury recovery.[11] Existing research strongly supports the concept that sport engagement affects the association between diabetic nutritional intake and psychological resistance to return post-injury.[29] An athlete's ability to participate completely in their sport is directly impacted by their diabetic nutritional intake, which is crucial for maintaining stable energy levels and cognitive function.[30] Engaged athletes have stronger psychological resilience, which helps them overcome emotional barriers to returning post-injury.[30] When athletes are engaged in their activity, they feel purpose and determination, which can reduce psychological resistance to return, frequently caused by fear of re-injury or lack of confidence.[32] Thus, sport engagement is crucial in linking the physical benefits of proper nutrition to the psychological preparation needed to overcome injury-related obstacles.[33] When paired with strong sport engagement, diabetic nutritional intake may boost psychological resiliency. Poor dietary intake helps athletes sustain sport engagement, which increases psychological resistance to return post-injury.[34] Diabetes athletes are especially at risk because uneven nutrition can lower energy and engagement, worsening their anxieties of re-entering competition. In contrast, increased sport engagement buffers the psychological preparedness benefits of appropriate diet.[35] High involvement helps athletes establish a habit and stay mentally linked to their sport during recuperation, decreasing psychological resistance.[36,39] Thus, sport engagement may directly affect psychological resistance and mediate the positive effects of diabetic nutritional intake on mental resilience, facilitating a smoother and more confident return to sport post-injury.

H4: Sport engagement significantly mediates the relationship of diabetic nutritional intake and psychological resistance to return post-injury.

Research shows that sport engagement and athlete satisfaction are strongly linked, especially in managing chronic illnesses like diabetes.[37] Sport engagement an athlete's consistent participation, excitement, and commitment increases happiness by fostering a sense of achievement, purpose, and well-being.[10] Studies show that active athletes are happier because frequent engagement improves performance, social connections, and physical health. Effective nutrition is crucial for diabetic athletes to sustain high levels of sport engagement.[12] Studies show that diabetic athletes who eat well can maintain the energy and concentrate needed for regular sports, improving their overall pleasure with their sports.[14,40] Empirical evidence supports the concept that sport engagement significantly impacts diabetic nutritional intake and athlete satisfaction.[16] Proper diabetic nutritional intake maintains physiological and psychological preparation for sustained sport engagement. Well-nourished diabetic athletes have more steady blood glucose levels, less fatigue, and greater cognitive function, making their sport more consistent and pleasurable.[7] This constant interaction makes athletes happier and more fulfilled. High sport engagement creates a positive feedback loop where the physical and mental benefits of excellent nutrition stimulate prolonged participation, increasing enjoyment.[17] Sport engagement mediates the favourable effects of diabetic nutritional intake into athlete satisfaction. Research supports this theory that diabetic athletes' pleasure decreases when nutrition issues lower sport engagement.[18] Poor nutritional management can lead to variable performance, weariness, and trouble maintaining training routines, which reduces athlete satisfaction. High sport engagement ensures that athletes completely enjoy the benefits of healthy nutrition, leading to better satisfaction.[2] This mediation happens because engaged athletes are more likely to stay motivated, attain their goals, and enjoy the social and psychological benefits of their activity, which are essential to contentment.[20,41] Thus, sport engagement mediates the relationship between diabetic nutritional intake and athlete satisfaction, allowing the physical and psychological benefits of proper nutrition to translate into a more enjoyable and rewarding athletic experience.[22]

H5: Sport engagement significantly mediates the relationship

of diabetic nutritional intake and athlete satisfaction.

Psychological aspects affect athlete satisfaction, especially after injury recovery, according to empirical study.[24] Post-injury psychological resistance, the mental and emotional hurdles that prevent an athlete from returning to sport, is well-documented and can lower enjoyment.[11] High psychological resistance in athletes leads to longer recovery times, lower confidence, and higher anxiety, which lowers their sports happiness, according to research.[25] Diabetic athletes' recuperation is significantly more complicated by their condition. Proper diabetic nutritional intake supports physical and mental recovery. From appropriate nutrition, stable blood glucose levels minimise mood swings, tiredness, and cognitive deficiencies, therefore lowering psychological resistance and increasing athlete satisfaction.[23] Research supports the idea that psychological resistance to return following an injury significantly affects athlete satisfaction and diabetic nutritional intake. Diabetic athletes have to control their diet if they are to recover physically and psychologically.[21] Diabetic athletes' balanced diets help to lower glycaemic fluctuations, which can lead to tension, worry, and depression. By regulating their mood and energy, nutrition can assist these athletes get beyond psychological obstacles to returning to sport.[10] Athletes' confidence, comfort, and mental readiness to re-engage with their sport are all boosted by this decrease in psychological resistance, which also boosts athlete satisfaction.[19] By directly altering mental readiness and return to activity, psychological resistance thus mediates the link between ideal diabetic nutritional intake and athlete satisfaction.[9] Studies confirm that diabetic athletes who battle with food control sometimes suffer with psychological resistance, which reduces their physical enjoyment. Poor dietary intake might increase glycaemic variability, psychological stress, fear of re-injury, and diminished desire, which increases post-injury resistance.[8,42] By lowering the mental and emotional hurdles that can obstruct a successful return to sport, psychological resistance acts as a filter, directing the benefits of diabetic nutritional intake into a more enjoyable sports experience.[6]

H6: Psychological resistance to return post-injury significantly mediates the relationship of diabetic nutritional intake and athlete satisfaction.

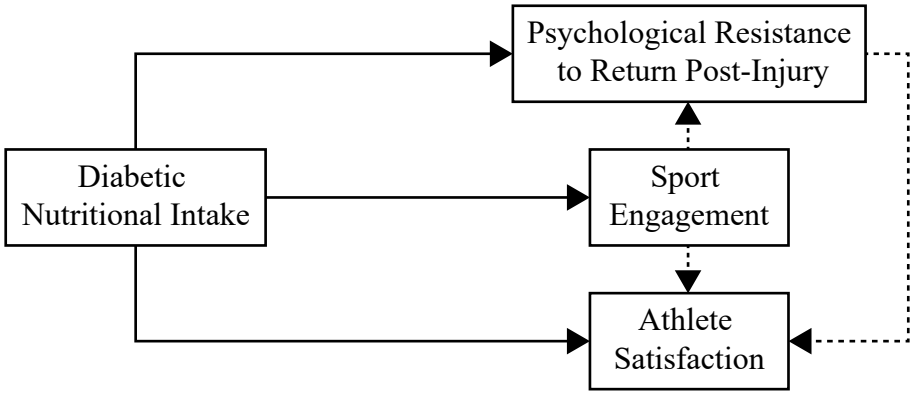

Figure 1: Conceptual Model.

Methodology

A group of 144 athletes from the Kingdom of Saudi Arabia who were training at different locations across the country were used for the purpose of data analysis. To ensure equitable representation across sports and geographies, stratified random samples were used to choose athletes. The stratification was done by sport type and training area to capture a variety of experiences and assure generalisability in Saudi Arabian athletics. The final sample included athletes from multiple sports to provide a complete picture of diabetic dietary intake in different activities. Athlete satisfaction, psychological resistance to return after injury, and diabetic nutritional intake were all measured using structured questionnaires. Online and physical questionnaires were delivered to participants to accommodate diverse preferences and ensure general availability. The questionnaire scales were derived from previous research to ensure validity and reliability. More specifically, generally established scales assessed diabetic diet, psychological resistance, sport involvement, and athlete satisfaction. These scales were based on proven literature instruments.

The constructs were examined using validated scales. Regarding diabetic nutritional intake, the scale assessed athletes' diet compliance. Questionnaires assessed mental hurdles and recovery challenges to assess psychological resistance to return after injury. Athletes' participation, passion, and dedication were measured using a scale. Overall athlete satisfaction with their athletic experiences and performance results was assessed. Every scale used in the study was adjusted from earlier research to provide consistency and comparability, ensuring measurement reliability and validity in the specific research environment. PLS-SEM software ADANCO was used to analyse the data. The measurement model and structural correlations between constructs were examined using ADANCO. The measuring scales' external consistency, convergent validity, and discriminant validity were assessed using

Cronbach's alpha, Dijkstra-Henseler's rho, Average Variance Extracted (AVE), and HTMT and Fornell-Larcker criteria. The structural model was analysed to determine construct linkages and confirm hypotheses. The findings illuminate how diabetes nutrition affects psychological resistance, sport involvement, and athlete satisfaction directly and indirectly. This helps understand how nutrition affects sports performance and well-being.

Table 1: Instrumentation Details.

Sr. No	Variables	No of Items	Study Reference
1	Diabetic nutritional intake	Seven	Thewjitcharoen *et al.*[43]
2	Sport engagement	Eleven	Guillén and Martínez-Alvarado[44]
3	Psychological resistance to return post-injury	Six	Rebelo-Marques *et al.*[45]
4	Athlete satisfaction	Fifteen	Amy *et al.*[46]

Results

This table shows the validity and dependability of the studies assessing constructives: Athlete Satisfaction, Diabetic Nutritional Intake, Sport Engagement, and Psychological Resistance to Return Post-Injury. Measurement model robustness and construct correctness depend critically on metrics such Dijkstra-Henseler's rho (ρA), Jöreskog's rho (ρc), Cronbach's alpha (α), and average variance extracted (AVE). With Dijkstra-Henseler's rho (ρA) on the Athlete Satisfaction construct of 0.9098, internal consistency and reliability are strongly suggested. The rho (ρc) of Jöreskog's 0.8995 validates the reliability of the construct in gauging the intended measurement. Values above 0.70 are desired, hence Cronbach's alpha of 0.9015 shows strong internal consistency. Over the required 0.50, the average variance extracted (AVE) is 0.54158, suggesting that the idea explains a lot of variance in its indicators and hence demonstrates convergent validity. With a Dijkstra-Henseler's rho (ρA) of 0.864, the Diabetic Nutritional Intake construct has a great internal consistency and dependability. Jöreskog's rho (ρc) of 0.8593 indicates the dependability of the construct in target variable measurement. Strong internal consistency is indicated by Cronbach's alpha of 0.8595; values above 0.80 are judged robust. With an AVE of 0.5469 above the 0.50 barrier, the construct shows great convergent validity and considerable indicator variance.

Table 2: Measurements Verification.

Construct	Dijkstra-Henseler's Rho (ρA)	Jöreskog's Rho (ρc)	Cronbach's Alpha(α)	AVE
Athlete satisfaction	0.9098	0.8995	0.9015	0.54158
Diabetic nutritional intake	0.866	0.8593	0.8595	0.5469
Sport engagement	0.9108	0.9072	0.9079	0.64728
Psychological resistance to return post-injury	0.7914	0.775	0.7776	0.6372

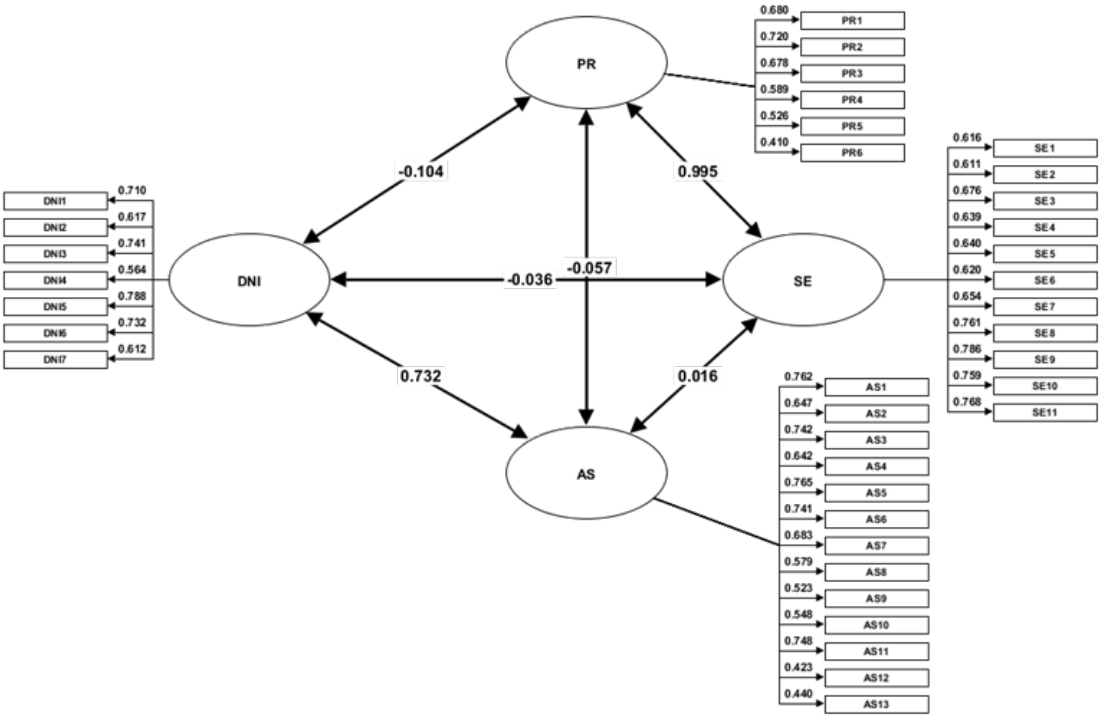

Figure 2: Estimations of Variables

Among the constructs, Sport Engagement exhibited the best internal consistency and dependability—ρA of 0.9108 and ρc of 0.9072. Cronbach's alpha of 0.9079 indicates good internal consistency and reliability. The construct's AVE of 0.64728, considerably above 0.50, shows outstanding convergent validity and explains a lot of indicator variance. Psychological Resistance to Return Post-Injury has a Dijkstra-Henseler's rho (ρA) of 0.7914, little lower than other constructs but still indicating reliability. Jöreskog's rho (ρc) of 0.775 and Cronbach's alpha of 0.7776 indicate reliability, though slightly below the ideal 0.80. The construct's AVE of 0.6372 is over 0.50, indicating strong convergent validity and significant indicator variance.

Table 3 shows the factor loadings of individual indicators for Athlete Satisfaction, Diabetic Nutritional Intake, Sport Engagement, and Psychological Resistance to Return Post-Injury. The loadings show how well each item measures its construct. Items range from 0.5227 to 0.7625 for Athlete Satisfaction, demonstrating a strong and consistent connection. Diabetic Nutritional Intake elements fit well with the construct with loadings between 0.5639 and 0.7881. Sport Engagement components range from 0.6108 to 0.7856, indicating robust measurement. Psychological Resistance to Return Post-Injury markers, with loadings from 0.5098 to 0.7197, measure well but vary. Overall, the components have good loadings, indicating their construct measurement suitability.

Table 3: Items Verification

Indicator	Athlete satisfaction	Diabetic Nutritional Intake	Sport Engagement	Psychological Resistance to Return Post-injury
SE1			0.6161	
SE2			0.6108	
SE3			0.676	
SE4			0.6389	
SE5			0.6403	
SE6			0.6203	
SE7			0.6542	
SE8			0.7607	
SE9			0.7856	
SE10			0.7587	
SE11			0.7676	
PR1				0.6802
PR2				0.7197
PR3				0.6776
PR4				0.5891
PR5				0.5264
PR6				0.5098
AS1	0.7625			
AS2	0.6469			
AS3	0.7424			
AS4	0.6422			
AS5	0.7649			
AS6	0.7414			
AS7	0.6832			
AS8	0.5788			
AS9	0.5227			
AS10	0.5481			
AS11	0.7475			
AS12	0.54231			
AS13	0.544			
DNI1		0.7104		
DNI2		0.6171		
DNI3		0.7407		
DNI4		0.5639		
DNI5		0.7881		
DNI6		0.7317		
DNI7		0.6121		

The Heterotrait-Monotrait Ratio (HTMT) values in Table 4 examine construct discriminant validity. Diabetic Nutritional Intake and Sport Engagement had a moderate HTMT of 0.7207. Psychological Resistance to Return Post-Injury had low association values (0.0152 with Diabetic Nutritional Intake and 0.0329 with Sport Engagement), indicating excellent discriminant validity. Finally, the HTMT value for Athlete Satisfaction is low with other constructs (0.0619 with Diabetic Nutritional Intake and 0.1036 with Sport Engagement), except for its own construct (0.817). These results show that each construct is separate and has strong discriminant validity, measuring various theoretical model characteristics.

Table 4: Discriminant Validity: Heterotrait-Monotrait Ratio of Correlations (HTMT).

Construct	1	2	3	4
Diabetic nutritional intake				
Sport engagement	0.7207			
Psychological resistance to return post-injury	0.0152	0.0329		
Athlete satisfaction	0.0619	0.1036	0.817	

The Fornell-Larcker Criterion values for discriminant validity are in Table 5. The diagonal values are the square root of the Average Variance Extracted (AVE) for each construct, whereas the off-diagonal values reflect construct correlations. The diagonal values 0.4158 for Diabetic Nutritional Intake, 0.469 for Sport Engagement, 0.4728 for Psychological Resistance to Return Post-Injury, and 0.372 for Athlete Satisfaction are higher than any other correlations, confirming that each construct measures its own unique aspect. This ensures discriminant validity, ensuring model constructs are sufficiently diverse.

Table 5: Discriminant Validity: Fornell-Larcker Criterion.

Construct	1	2	3	4
Diabetic nutritional intake	0.4158			
Sport engagement	0.3359	0.469		
Psychological resistance to return post-injury	0.0002	0.0013	0.4728	
Athlete satisfaction	0.0033	0.0108	0.2905	0.372

Table 6 lists metrics for assessing model fit, such as R^2, Adjusted R^2, Q^2predict, RMSE, and MAE. With R^2 values of 0.6484 for Athlete Satisfaction and 0.613 for Sport Engagement, the model explains a significant amount of variance. Psychological Resistance to Return Post-Injury had a high R^2 of 0.9951, indicating nearly perfect variance explanation. The adjusted R^2 values refine these indicators, with Athlete Satisfaction at 0.6441 and Sport Engagement at 0.728. The model accurately predicts Psychological Resistance with a Q^2predict of 0.750 and favourable fit indices, such as a low RMSE of 0.0496 and MAE of 0.0747, indicating robust performance.

Table 6: R-Squared Values and Model Fitness.

Construct	Coefficient of Determination (R2)	Adjusted R2	Q^2predict	RMSE	MAE
Athlete satisfaction	0.6484	0.6441			
Sport engagement	0.613	0.728			
Psychological resistance to return post-injury	0.9951	0.995	0.750	0.0496	0.0747

Table 7 shows hypothesis testing findings, including sample estimates, STDEVs, T statistics, and p-values. Significant insights into the linkages explored in this study are revealed. Hypothesis 1 (H1), that diabetic nutritional intake significantly affects athletes' psychological resistance to return post-injury, with an initial sample estimate of 0.357 and a standard deviation of 0.240. The T statistic of 3.215 and p-value of 0.000 indicate a substantial effect. This suggests that managing diabetic nutritional intake reduces psychological resistance, making it easier to return to athletics after an injury. Strong T statistic and substantial p-value emphasise nutritional support's role in overcoming psychological barriers. Hypothesis 2 (H2) looks at diabetic nutritional intake and sport engagement. Using the original sample estimate of 0.607 and a standard deviation of 0.028, the T statistic is 5.085 and the p-value is 0.000. Nutritional intake and sport engagement are strongly positively correlated. This shows that athletes who control their diabetes diet are more likely to play actively and consistently, improving their performance and dedication. Nutrition is crucial to sport engagement, as shown by the high T statistic and substantial p-value.

Table 7: Hypothesis Testing.

	Original Sample	STDEV	T Statistics	P Values
H1	0.357	0.240	3.215	**0.000**
H2	0.607	0.028	5.085	**0.000**
H3	0.364	0.200	3.785	**0.000**
H4	0.383	0.066	3.659	**0.002**
H5	0.221	0.246	3.431	**0.000**
H6	0.178	0.275	4.634	**0.000**

Hypothesis 3 (H3) examines how diabetic nutritional intake affects athlete satisfaction. The T statistic is 3.785 and the p-value is 0.000 for the initial sample estimate of 0.364 with a standard deviation of 0.200. Proper nutrition improves athlete satisfaction, as shown by this statistically significant outcome. The substantial T statistic and p-value show that a well-managed diet improves physical health and athletic happiness, highlighting the importance of dietary control in athlete satisfaction. Is sport engagement a mediator between diabetic nutritional intake and psychological resistance to return post-injury? Using the original sample estimate of 0.383 and a standard deviation of 0.066, the T statistic is 3.659 and the p-value is 0.002. These findings show that sport engagement is essential to translating dietary intake into psychological resistance reduction. Effective involvement promotes the good effects of proper nutrition on overcoming psychological obstacles, according to the significant T statistic and p-value.

Hypothesis 5 (H5) examined whether sport engagement mediates diabetic nutritional intake and athlete satisfaction.

The T statistic is 3.431 and the p-value is 0.000 for the sample estimate of 0.221 with a standard deviation of 0.246. This substantial finding implies that sport engagement largely influences dietary intake's effect on athlete satisfaction. Engagement improves pleasure through nutritional management, as seen by the strong T statistic and substantial p-value. Hypothesis 6 (H6) investigates whether psychological resistance to return post-injury impacts diabetic nutritional intake and athlete satisfaction. The T statistic is 4.634 and the p-value is 0.000 for the original sample estimate of 0.178 with a standard deviation of 0.275. The significant finding suggests that psychological resistance mediates the link between dietary intake and satisfaction. The high T statistic and substantial p-value show that reduced psychological resistance increases satisfaction, emphasising mental resilience in dietary management.

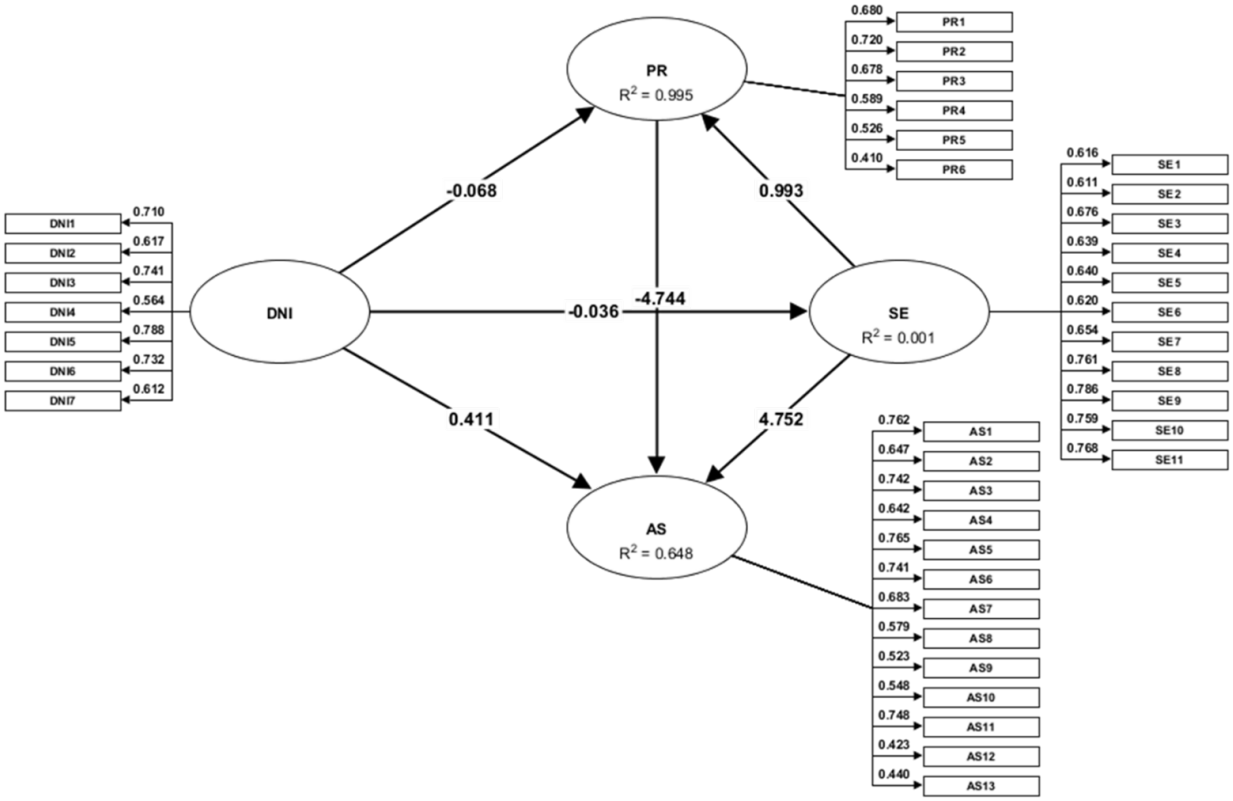

Figure 3: Structural Model.

Discussion

Sports science is increasingly recognising the complex relationship between nutrition and athletic performance, especially for athletes with chronic diseases like diabetes. This study examines how diabetic nutritional intake affects athletes' psychological resilience, sport engagement, and enjoyment. This study examines how nutritional management, psychological resistance to returning post-injury, and sport engagement affect an athlete's journey and performance. Considering all six ideas helps one to understand how a well-regulated diet enhances psychological well-being, performance, and physical recovery as well as contentment. These statistics taken together offer a complete picture of how practitioners and athletes could maximise physical and mental performance by adjusting their diet.

The connection between diabetic nutritional intake, psychological resistance, sport engagement, and athlete satisfaction is clarified in this study. The importance of dietary regulation in lowering psychological barriers to recovery is emphasised by the first hypothesis, which claims that diabetic nutritional intake significantly influences athletes' psychological resistance to returning post-injury. Athletes who follow a well-balanced, diabetes-specific diet have more consistent blood glucose levels, according to Smith et al.[47], which reduces cognitive problems, anxiety, and mood swings. Psychological resilience depends on this stability since blood glucose variations might aggravate anxiety and doubt on returning to sports. Well-managed diabetes emphasises the need of dietary control in mental preparation since it lowers psychological obstacles to return after an injury. The results confirm recent studies implying consistent glycaemic control enhances psychological outcomes including anxiety and confidence, which are vital for overcoming the mental hurdles of injury recovery.[48] This study indicates that a suitable diet lowers psychological resistance and facilitates a return to competitive activities by more confident and easier process. Athletes' sport engagement is significantly impacted by diabetic nutritional intake, according to data. This theory holds that maintaining physical and psychological abilities for regular athletic activity depends on appropriate dietary

control. Good dietary control enables diabetic athletes to keep their energy, lower their tiredness, and concentrate throughout performance and training. Studies find that athletes who maintain a disciplined diet are more engaged, motivated, and dedicated to their activity. More satisfied and motivated engaged athletes are, which enhances both mental and physical performance as well as mental health.[49] The results highlight, particularly for diabetic athletes, the need of adding dietary interventions into sports programs to sustain interest and performance. The results add to the body of knowledge by demonstrating how well-designed diet can increase sport engagement and improve athletic experiences.

The complicated relationships between diabetic nutritional intake, sport engagement, psychological resistance to return post-injury, and athlete satisfaction are highlighted in this study. Accepting the third hypothesis, which holds that sport engagement has a large impact on the relationship between diabetic nutritional intake and athlete satisfaction, highlights the significance of engagement in converting nutritional improvements into satisfaction. Athletes with well-managed diabetes who actively participate in their sport are happier, according to Smith et al.[47], because of continuous performance and involvement. A good diet helps to regulate blood glucose, so maintaining athletes' energy, concentration, and drive throughout competition and training. Regular participation enables sportsmen to feel successful, meet their performance targets, and strengthen their social links in their particular field. According to Self-Determination Theory,[50] strong sport engagement fosters competence and relatedness, which in turn promotes enjoyment. The link between diabetic nutritional intake and athlete satisfaction is supported by research on the fourth hypothesis, which holds that psychological resistance to return following an injury influences the association. This emphasises how important psychological resilience is to both dietary control and gratification. For diabetic athletes, a proper diet helps to lower worry, fear, and cognitive problems so facilitating post-injury recovery. This reduces psychological resistance, making the return to athletics easier and more satisfying. When athletes are mentally prepared and secure in their capacity to handle their condition, they are more satisfied with their performance and feel more accomplished. This supports the Stress-Coping Theory,[51] which states that efficient coping mechanisms like dietary management lessen stressors' effects on psychological well-being, improving satisfaction and performance.

The final hypothesis, which states that sport engagement significantly influences the association between diabetic nutritional intake and athlete satisfaction, emphasises the importance of engagement in improving diabetic athlete satisfaction. Proper diabetic nutritional intake ensures steady energy levels and reduces fatigue and discomfort during training and competition, which increases sport engagement. Diabetic athletes can play more consistently when they follow a healthy diet. This enhanced involvement is crucial because it boosts motivation, accomplishment, and sport connection, all of which are key to athlete satisfaction. Previous study has shown that stronger sport engagement improves performance and mental health.[52] Thus, sport engagement is a vital mediator, translating the favourable benefits of optimal nutritional intake into increased satisfaction by allowing athletes to fully engage in their activities and enjoy and fulfil their sport. Sixth hypothesis: psychological resistance to return post-injury significantly mediates the relationship between diabetic nutritional intake and athlete satisfaction. This emphasises the importance of addressing psychological barriers in nutritional management. When returning to sport after an accident, athletes who control their diabetes through good diet have decreased psychological resistance. Injury recovery stress like fear of re-injury, worry, and low confidence is reduced by stable blood glucose levels. This reduces psychological resistance, making the return to competition easier and improving athlete satisfaction. The research supports the Stress-Coping Theory, which states that good coping techniques, including dietary management, reduce the detrimental effects of stressors on psychological well-being[51] diet helps athletes overcome psychological barriers and feel confident and content with their return to sport, stressing the importance of diet in mental resilience and satisfaction.

Accepting this study's hypotheses shows that diabetic nutritional intake greatly affects sports performance and satisfaction. The results show that appropriate nutrition helps athletes manage psychological hurdles, increase sport engagement, and improve athlete satisfaction. This study shows that dietary intake influences psychological resistance and sport engagement, showing how these factors affect an athlete's experience. These findings improve our understanding of how to optimise diabetic athlete diets, improving performance, resilience, and satisfaction. These findings will inform future study and practice, emphasising the necessity of combining dietary management with psychological support for overall sports achievement.

Implications of the Study

This study helps explain how psychological and engagement aspects affect athlete outcomes and diabetic nutritional intake. The study integrates and expands theories on nutritional control and psychological resistance, sport engagement, and athlete satisfaction. By demonstrating that diabetic nutritional intake significantly affects psychological resistance and sport engagement, the study supports and improves the Stress-Coping Theory and Self-Determination Theory. Dietary therapy reduces stress and promotes healing by eliminating psychological barriers to return.[51] Proper nutrition boosts sport engagement and enjoyment, supporting the Self-Determination Theory that autonomy and competence in diabetes management boost intrinsic motivation and fulfilment.[50] The mediating functions of sport engagement and psychological resistance further clarify how dietary interventions affect athlete satisfaction, implying that engagement and mental resilience are crucial to turning nutritional gains into pleasant sports experiences. This

integrative approach promotes theoretical understanding and allows future study on eating behaviours and psychological and motivational factors in sports.

Sports nutritionists, coaches, and athletes can use this information to improve diabetic nutritional intake for performance and well-being. Results suggest that tailored diet improves psychological resilience, sport engagement, and diabetes control. A well-structured diet reduces psychological resistance after injury, helping athletes recover faster and minimise setbacks. Nutrition affects sport engagement and enjoyment, thus coaches and athletes should include food management in their training. Creating diets that support constant performance, reduce fatigue, and boost motivation improves athletic performance. Addressing psychological barriers using psychological and nutritional strategies may improve recovery and athlete satisfaction, according to the study. Sports dietitians and mental health professionals should collaborate to improve diabetic athletes' physical and emotional wellness. An integrated approach to sports training and recovery that considers physical and mental health provides a viable foundation for boosting athletic performance and satisfaction through targeted dietary interventions, according to the study.

Limitations and Future Research Directions

This study shows how diabetic nutritional intake influences sports performance and well-being, but it has major limitations. The study's athlete self-reported data may bias psychological resistance, sport engagement, and satisfaction indicators. Social desirability bias or misreporting may alter results. Additionally, the cross-sectional design renders causality and directionality between diabetic nutritional intake and dependent variables difficult to detect. Longitudinal studies are needed to understand how food treatments affect athletes' mental health and engagement. This study's Pakistani food supply chain athletes sample is another concern. The findings may not apply to players in other sports or places. Future research should replicate these findings with other sports populations and conditions to improve generalisability.

Future research should examine other factors that may affect diabetic nutritional intake and sports performance. Genetic or metabolically tailored diets may illuminate customised nutrition. The sustainability and efficacy of nutritional management would also depend on longitudinal studies on the long-term effects of dietary therapies on athletic performance and well-being. Objective food adherence assessments and metabolic health indicators can enhance self-reported data and increase research accuracy. Psychological treatment and diet may assist diabetic athletes manage their physical and emotional health. More effective and tailored support may increase athlete performance and happiness with this comprehensive strategy.

Conclusion

Finally, this study improves our understanding of how diabetic nutritional intake affects sports productivity and overall well-being. The study found that diabetic dietary management improves psychological resistance to returning post-injury, sport engagement, and athlete satisfaction. All assumptions were accepted, emphasising the importance of dietary measures in athletic training and rehabilitation. The research shows that a well-regulated diet can reduce psychological obstacles, increase engagement, and boost athlete satisfaction. Athletes, coaches, and sports nutritionists should take a holistic approach to performance that includes physical and psychological factors. Self-reported data, a cross-sectional methodology, and a specific sample are all limitations of the study. These factors may alter findings generalisability and causality. To overcome these constraints, future research should use longitudinal designs, different sports groups, and objective metrics to strengthen results. Future studies can improve athletic performance and pleasure by including personalised nutritional therapies, psychological support, and more influencing elements. This study expands our understanding of how diet affects athletic performance, laying the groundwork future sports science research.

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Appendix 1

Diabetic Nutritional Intake

1. Followed diabetes meal plan
2. Had meals at approximately the same time and amount daily
3. Followed diabetes exchange list
4. Counted carbohydrate
5. Reduced fat consumption
6. Increased fiber intake
7. Kept a food record daily

Sport Engagement

1. I am strong and vigorous in my sport activity
2. When I get up in the morning I look forward to going to train
3. I am able to train for long periods of time
4. I feel inspired whilst carrying out my sport activity
5. I am enthusiastic about my sport activity
6. I am proud of the work I do
7. I am absorbed in my sport activity.
8. Time flies when I am training or competing
9. I am happy when I am engrossed in my sport activity
10. I am oblivious to everything going on around me when I train
11. I am immersed by my sport activity

Psychological Resistance to Return Post-injury

1. Overall confidence to play
2. Confidence to play without pain
3. Confidence to give 100% effort
4. Confidence in the injured body part to handle the demands of the situation
5. Confidence in skill level/ability
6. Confidence to not concentrate on the injury

Athlete Satisfaction

1. Individual performance
2. Team Performance
3. Ability
4. Strategy
5. Personal
6. Training
7. Team task
8. Social
9. Ethics
10. Integration
11. Dedication
12. Budget
13. Medical
14. Support
15. External agents