Amelioration of Obesity by Probiotic Fermented Milk in High-fat-diet Induced Obese Rat Model

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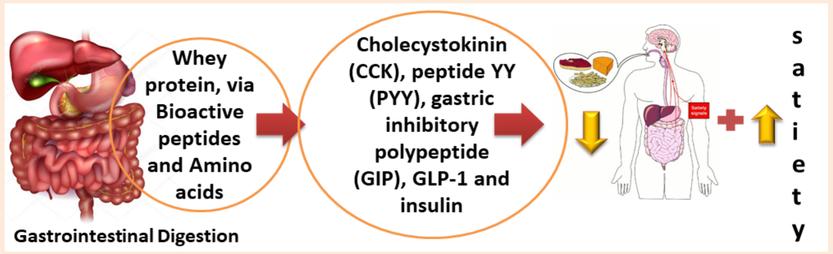
INTRODUCTION

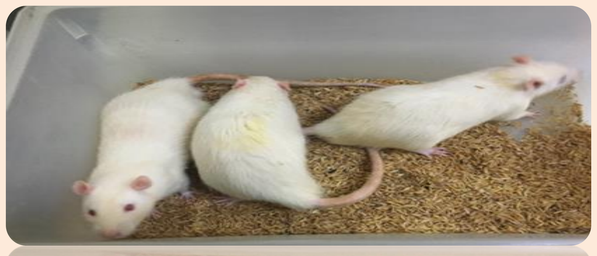
- Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health (WHO, 2016).
- Different food ingredients play significant role in better management of obesity.
- A variety of natural milk ingredients e.g., calcium, protein and functional fatty acids and other natural dietary compounds have been used in different anti-obesity products.
- The individual dairy proteins (whey and casein) may enhance satiety via increases in circulating appetite regulating hormones including glucagon-like peptide-1 (GLP-1).



- Soy protein is best used prior to and during exercise. Soy protein has an unique amino acid profile.
- The present study is planned to test the hypothesis that probiotic bacteria have a significant role to play in modulation of obesity.

Experimental animal and its maintenance

- Adult male Wistar rats weighing 200-250g were obtained from Zydus Research Centre, Changodar, Gujarat.
- The animals were housed in Polypropylene cages under standard controlled conditions (temperature: 23 ± 2°C, humidity: 50 ± 5% and 12 h light/dark cycle) and provided with free access to standard pellet diet and water *ad libitium*.



Wistar rats

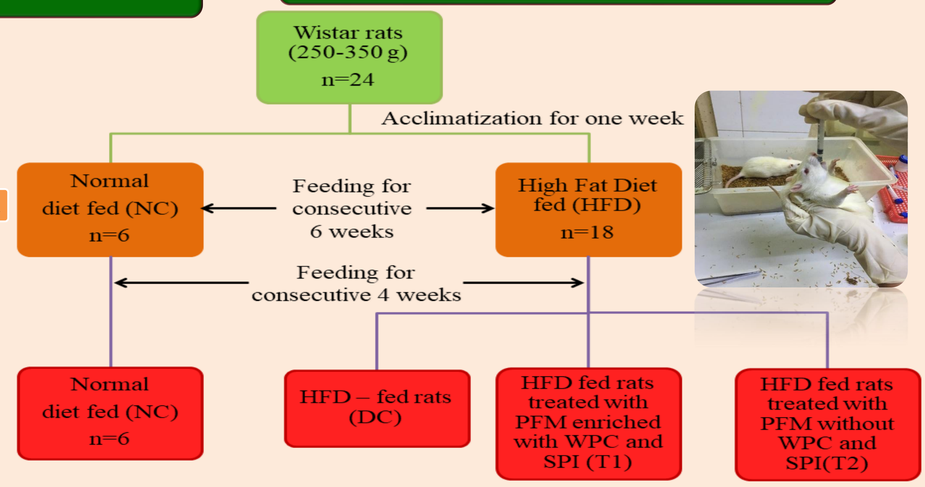
Induction of Obesity

- After acclimatization of one week, 24 animals were divided into two groups and fed normal pellet diet (NPD; n=6) or high-fat diet (HFD; n=18) for consecutive 6 weeks.
- Water and diet were provided *ad libitium* and body weight was recorded at regular time intervals.
- Obesity was established by feeding the animals (n=6) normal pellet diet (NPD) or high fat diet (n=18), which is prepared by mixing powdered NPD (37g/100g), vegetable ghee (25g/100g), casein (10g/100g), fructose (20g/100g), cholesterol (5g/100g), vitamins and minerals mix (3g/100g) for consecutive 6 weeks.

Method of Probiotic Fermented Milk

Toned Milk (3.0% Fat, 8.5% SNF)
↓
Addition of WPC and SPI @ 2%
↓
Heating of milk to 90˚C/10 min
↓
Cooling of milk to 40˚C
↓
Inoculation of milk with starter cultures @ 2% and mix it well
↓
Incubation (37 ± 2˚C) acidity reaches to 0.7% LA
↓
Cooling (5 ± 2˚C)
↓
Add 10 % water and breaking of the curd to get smooth homogenous product
↓
Fill in HDPE bottles
↓
Storage at refrigerated temperature 7 ± 1˚C

EXPERIMENTAL DESIGN



Analysis for body weight, organ weight, serum biochemical parameters and histopathology of liver

RESULTS & DISCUSSION

Effect of probiotic fermented milk products on body weight (g) of experimental animals

NC

DC

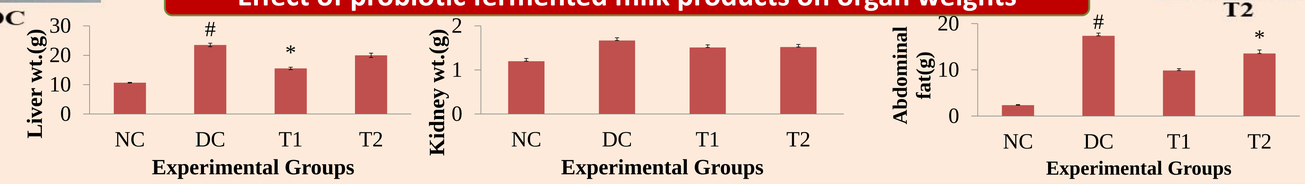
Experimental group	Body weight (g) of rats			
	At the start of experiment	After 10 weeks	Average increase in body wt. in 10 weeks	% increase in body wt. in 10 weeks
NC	266.1 ± 19.20	374.1 ± 10.48	108.0	40.50
DC	323.1 ± 05.60	551.9 ± 18.09#	228.8	70.81
T1	304.1 ± 10.60	445.3 ± 25.40*	141.2	46.43
T2	320.6 ± 14.86	496.1 ± 40.77*	175.5	55.03

Values are expressed as mean ± SD (n = 6)

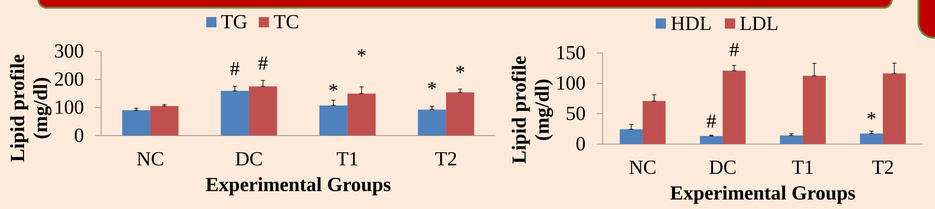
T1

T2

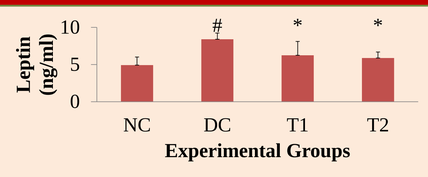
Effect of probiotic fermented milk products on organ weights



Effect of Probiotic Fermented Milk Products on Lipid Profile

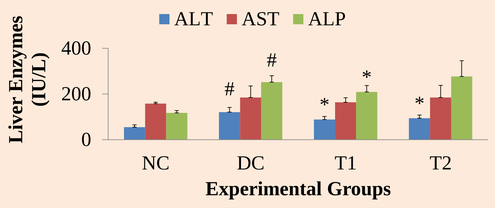


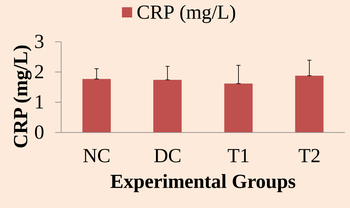
Effect of Probiotic Fermented Milk Products on Serum Leptin Level



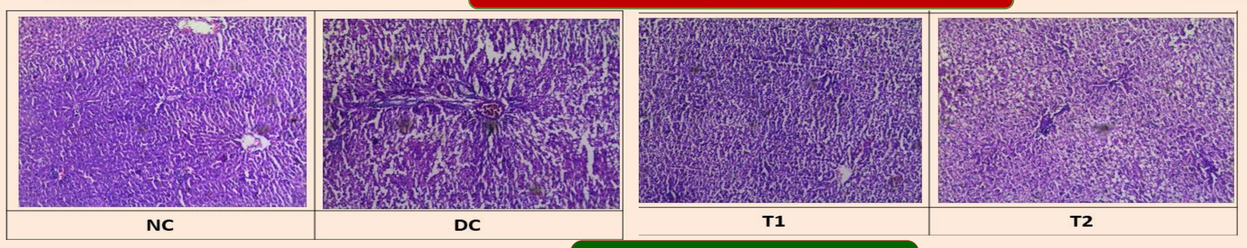
Effect of probiotic treatment on liver enzymes

(Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) and Alkaline phosphatase (ALP), C-reactive protein (CRP))





Histopathological Study of Liver



- The histology of the liver appeared normal in animals of NC group
- Liver from the DC group showed widespread lipid vacuoles deposited inside the parenchyma cells.
- Product T2 showed lesser micro vesicular fatty changes and the appearance of T2 was better than T1

CONCLUSIONS

Overall, the *in vivo* study results indicated that, oral administration of probiotic fermented products with and with out WPC and SPI for 10 weeks exerted beneficial effect against HFD induced obesity in rats by improving the organ weights and serum biochemical markers. Probiotic fermented milk enriched with WPC and SPI exerted better anti-obesity activity compared to probiotic fermented milk without WPC and SPI.